

Mastering  
Skills &  
Concepts:

**Course V**

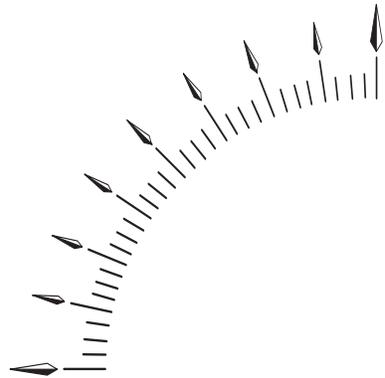
**Print Activities**



DESTINATION  
Math®



Riverdeep



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# Notes to the Teacher

Welcome to *Destination Math*. The student materials in this packet are designed to help students as they progress through the course. These materials, which remain consistent with the philosophy of *Destination Math*, are specifically intended to:

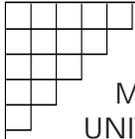
- keep students focused on the instruction.
- provide students an opportunity to take notes, record information from the program, and reflect on the tutorials.
- allow students an opportunity for additional practice of the instruction in each session.
- provide a more open-ended assessment of the concepts in each session.
- use real-world examples and situations that students can identify with.

There is a set of materials designed to support each session. Each set consists of:

- **Student Logbook:** This sheet is designed for student use while viewing the tutorials. It consists of a one-page worksheet where students can record information from the tutorial, take notes, and reinforce their understanding.
- **Your Turn:** This is a one-page worksheet that provides additional practice for each session. It is designed for students to complete away from the computer to reinforce the concepts they have studied. It may also serve as a guide to what students need to review to complete their mastery of the skills and concepts.

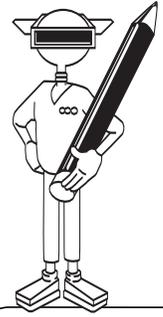
In addition, two sets of materials are provided to cover all the concepts presented in each unit.

- **Unit Review:** The Unit Review problems are organized by session, with a fourth section integrating and extending the skills and concepts presented in the unit.
- **Unit Assessment:** Two pages of traditional practice covering all the skills and concepts in the unit.



COURSE: **MSC V**  
 MODULE 1: **Essentials of Algebra**  
 UNIT 1: **Algebra Fundamentals**

# Student Logbook



## Introducing Variables

**As you work through the tutorial, complete the following statements and questions.**

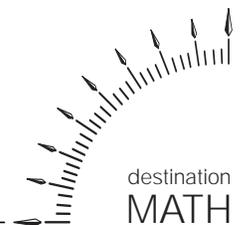
1. What is the maximum weight the helicopter can lift? \_\_\_\_\_
2. What is the weight of a concrete section with a volume of  $1 \text{ m}^3$ ?  
\_\_\_\_\_
3. Volume is measured in \_\_\_\_\_ units.
4. What is the formula for finding the volume of a rectangular prism?  
\_\_\_\_\_
5. What is the shape of the concrete section delivered by the helicopter?  
\_\_\_\_\_
6. What dimension of the concrete section is known? \_\_\_\_\_  
What is the value of this dimension? \_\_\_\_\_
7. Write an expression for the width of the concrete section in terms of its height. \_\_\_\_\_
8. Write an expression for the height of the concrete section in terms of its length. \_\_\_\_\_
9. In algebra, letters that represent unknowns are called \_\_\_\_\_.
10. Using variables to represent unknowns, write the equation for the volume of the concrete section. \_\_\_\_\_

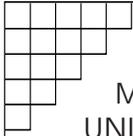
### Key Words:

Volume  
 Rectangular prism  
 Algebra  
 Variable

### Learning Objectives:

- Rewriting the formula for the volume of a rectangular prism by substituting expressions for each term
- Using variables to represent the terms in the formula for the volume of a rectangular prism





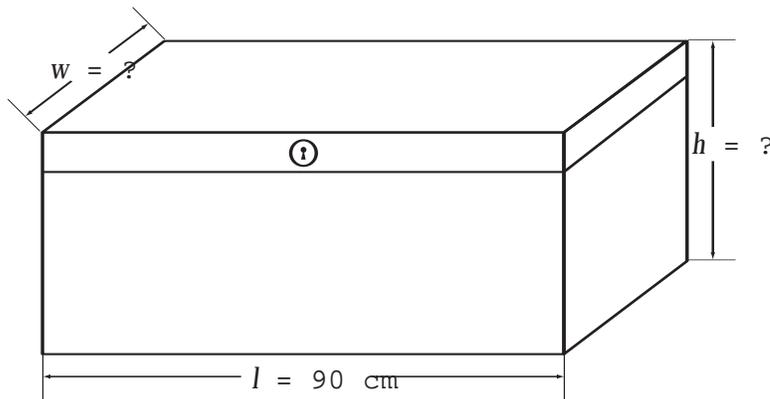
## Your Turn

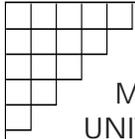


### Introducing Variables

A furniture store is advertising a chest that holds 24 small boxes. The length of the chest is 90 cm. The height is 15 cm less than  $\frac{1}{2}$  the length. The width is  $\frac{4}{5}$  of the height.

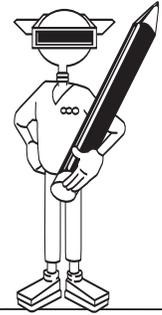
1. What is the shape of the storage chest? \_\_\_\_\_
2. What dimensions of the chest are used to determine the volume of the chest? \_\_\_\_\_
3. What dimension of the chest is known? \_\_\_\_\_
4. What dimensions of the chest are unknown? \_\_\_\_\_
5. Assign variables to each dimension you listed in Question 4.  
\_\_\_\_\_
6. Write an expression for the height of the chest in terms of its length.  
\_\_\_\_\_
7. Write an expression for the width of the chest in terms of its height.  
\_\_\_\_\_
8. Write an equation for the volume  $v$  of the chest. \_\_\_\_\_





COURSE: **MSC V**  
 MODULE 1: **Essentials of Algebra**  
 UNIT 1: **Algebra Fundamentals**

# Student Logbook



## Identifying Components of Algebraic Expressions

As you work through the tutorial, complete the following statements and questions.

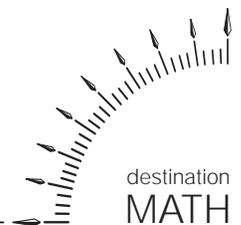
- The expression  $8(h) + 0.5$  describes the \_\_\_\_\_.
- In your own words, define the word *coefficient*. \_\_\_\_\_  
\_\_\_\_\_
- In the expression  $8(h) + 0.5$ , the coefficient of the variable is \_\_\_\_\_.
- What coefficient does every variable have? \_\_\_\_\_ Explain your answer. \_\_\_\_\_
- In your own words, define the word *constant*. \_\_\_\_\_
- Rewrite  $8h$  in three other algebraic forms. \_\_\_\_\_ ,  
\_\_\_\_\_ , \_\_\_\_\_
- In your own words, define *algebraic term*. \_\_\_\_\_
- In your own words, define the term *algebraic expression*. \_\_\_\_\_  
\_\_\_\_\_
- Can an algebraic expression contain other algebraic expressions? \_\_\_\_\_
- A term is a number or a \_\_\_\_\_ , or the product or quotient of one or more \_\_\_\_\_ and \_\_\_\_\_ .

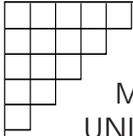
### Key Words:

Coefficient  
 Constant  
 Term  
 Expression

### Learning Objectives:

- Identifying the coefficient in a variable expression
- Identifying the constant in an expression
- Identifying an algebraic term
- Identifying an algebraic expression





COURSE: **MSC V**  
 MODULE 1: **Essentials of Algebra**  
 UNIT 1: **Algebra Fundamentals**

Your  
Turn



## Identifying Components of Algebraic Expressions

1. Identify the parts of each expression.

a.  $3m^4 + 18m^2 - 21$

Coefficients of the variables: \_\_\_\_\_ Constants: \_\_\_\_\_ Number of terms: \_\_\_\_\_

b.  $-2m^4 - 7p^2q^3 + pqr$

Coefficients of the variables: \_\_\_\_\_ Constants: \_\_\_\_\_ Number of terms: \_\_\_\_\_

c.  $m^4n^5p^2$

Coefficients of the variables: \_\_\_\_\_ Constants: \_\_\_\_\_ Number of terms: \_\_\_\_\_

Katie De Silva needs to determine how much fencing is needed to enclose a small circular area in Lone Wolf National Park to protect fragile plants. The formula for the circumference of a circle is:  $Circumference = \pi \times diameter$ .

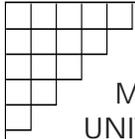
2. Use 3.14 as an approximation for  $\pi$  and write an algebraic expression to represent the circumference of the circular area. \_\_\_\_\_

3. List the coefficient in your expression. \_\_\_\_\_

4. If the diameter,  $d$ , of the enclosure is 5 m, write an equation for the circumference of the garden. \_\_\_\_\_

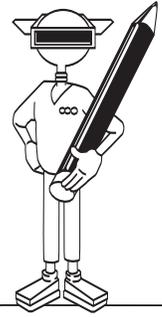
5. What is the circumference of the enclosed area? \_\_\_\_\_





COURSE: **MSC V**  
 MODULE 1: **Essentials of Algebra**  
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# Student Logbook



## Replacing Variables in a Formula

As you work through the tutorial, complete the following statements and questions.

1. Rewrite the expression for height ( $h$ ) substituting the value for length ( $l$ ).

\_\_\_\_\_

2. Find the value of  $h$ . \_\_\_\_\_

3. Substitute the known value for height ( $h$ ) into the expression for width ( $w$ ).

\_\_\_\_\_

4. Find the value of  $w$ . \_\_\_\_\_

5. Use the values for length ( $l$ ), width ( $w$ ), and height ( $h$ ) to write a numerical expression for volume ( $v$ ). \_\_\_\_\_

6. What is the value of  $v$ ? \_\_\_\_\_

7. What units are needed to describe the volume? \_\_\_\_\_

8. What is the weight of the section of concrete? \_\_\_\_\_

9. Can the helicopter carry the section? \_\_\_\_\_ Explain your answer.

\_\_\_\_\_

10. Describe how an algebraic formula can be worked out. \_\_\_\_\_

11. Explain why Dijit had to find the volume of the concrete section in order to determine whether the helicopter could carry it. \_\_\_\_\_

\_\_\_\_\_

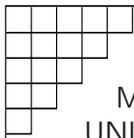
### Key Words:

Volume  
 Rectangular prism

### Learning Objectives:

- Substituting known values for the variables in an expression
- Calculating the volume of a rectangular prism given the value of its dimensions





# Your Turn



## Replacing Variables in a Formula

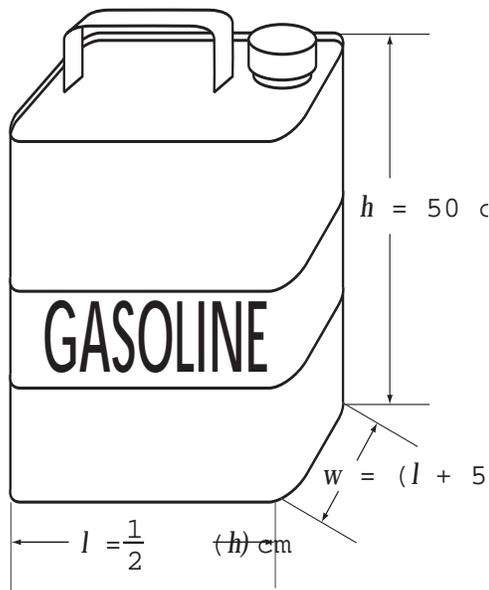
1. Write an equation for the volume of a can of gasoline like the one shown here. \_\_\_\_\_

2. Use the drawing to write an expression for the length ( $l$ ) of the can. \_\_\_\_\_

3. Write an expression for the width ( $w$ ) of the can. \_\_\_\_\_

4. Write an expression for the height ( $h$ ) of the can. \_\_\_\_\_

5. Using the expressions for length, width, and height, write an expression for the volume ( $v$ ) of the can. \_\_\_\_\_



6. Use substitution to rewrite the expression for the length ( $l$ ). \_\_\_\_\_

7. What is the value of the length ( $l$ )? \_\_\_\_\_

8. Use substitution to rewrite the expression for the width ( $w$ ). \_\_\_\_\_

9. What is the value of the width ( $w$ )? \_\_\_\_\_

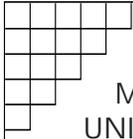
10. Substituting the values for the variables, write the expression for the volume ( $v$ ) of one gasoline can. \_\_\_\_\_

11. What is the volume ( $v$ ) of one can? \_\_\_\_\_ cc

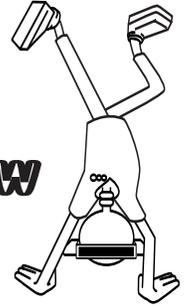
12. What is the volume in liters (L)? (*Hint: 1 L = 1,000 cc*) \_\_\_\_\_

13. Write a formula to find out how many cans you need. \_\_\_\_\_





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# Unit Review

## Introducing Variables

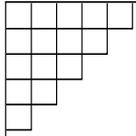
1. A local wading pool has the shape of a rectangular prism. The pool has the following dimensions:  $h = 2(w) - 318$  cm,  $w = 180$  cm,  $l = 2w$  cm.
- What dimension of the pool is known? \_\_\_\_\_
  - What dimensions of the pool are unknown? \_\_\_\_\_
  - Write a formula to find the volume of the swimming pool. \_\_\_\_\_  
\_\_\_\_\_
  - List all the variables in the formula. \_\_\_\_\_

## Identifying Components of Algebraic Expressions

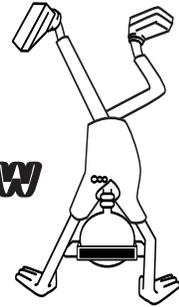
2. The perimeter  $p$  of a rectangle can be calculated using the formula  $P = 2(l + w)$  where  $l$  and  $w$  represent its length and width.
- What are the coefficients of  $l$  and  $w$  in the formula? \_\_\_\_\_
  - What are the constants in the formula? \_\_\_\_\_
  - If  $l = 10$  in and  $w = 8$  in, what is  $P$ ? \_\_\_\_\_

## Replacing Variables in a Formula

3. Refer to the wading pool in Question 1, which has dimensions:  
 $h = 2(w) - 318$  cm,  $w = 180$  cm, and  $l = 2w$  cm.
- Rewrite the expression for the length ( $l$ ), substituting the known values.  
\_\_\_\_\_
  - Rewrite the expression for the height ( $h$ ), substituting known values.  
\_\_\_\_\_



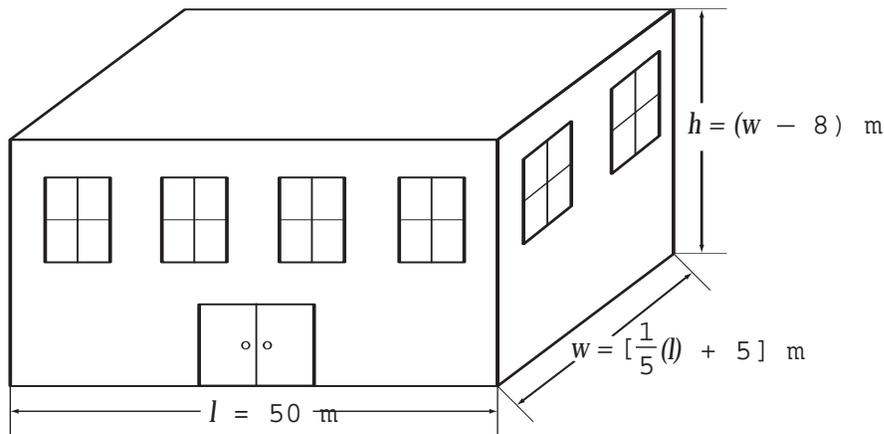
# Unit Review

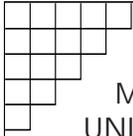


- c. Use the known values for length, width, and height to rewrite the formula for the volume of the wading pool. \_\_\_\_\_
- d. Find the volume of the pool. \_\_\_\_\_

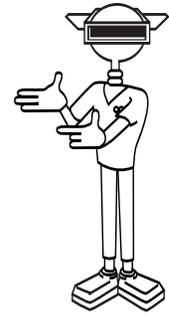
## Putting It All Together

4. Engineers have designed a warehouse in the shape of a rectangular prism. The drawing below shows the plan for the warehouse.
- a. Write an equation to find the volume of the warehouse. \_\_\_\_\_  
\_\_\_\_\_
- b. List the variables in the equation. \_\_\_\_\_
- c. What is the expression for the width ( $w$ )? \_\_\_\_\_
- d. What is the expression for the height ( $h$ )? \_\_\_\_\_
- e. What is the numerical value of the width ( $w$ )? \_\_\_\_\_
- f. What is the value of the height ( $h$ )? \_\_\_\_\_
- g. What is the volume of the warehouse? \_\_\_\_\_





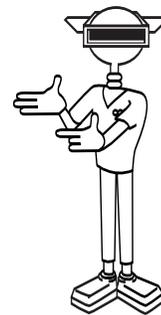
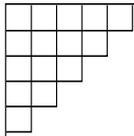
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 UNIT 1: **Algebra Fundamentals**



## Unit Assessment

1. Andre has asked Dijit to help him prepare a manual to be included with his invention. The length of the manual is 3.5 cm longer than its width. The thickness of the manual is  $\frac{1}{2}$  the width.
  - a. If  $w$  represents the width of the manual, what is the length of the manual in terms of  $w$ ? \_\_\_\_\_
  - b. What is an expression for the thickness of the manual in terms of  $w$ ? \_\_\_\_\_
  - c. The volume of a rectangular solid can be found by multiplying its length, width, and height. What is an expression for the volume of the manual in terms of  $w$ ? \_\_\_\_\_
  - d. The cost of mailing each manual depends on its volume. Each cubic centimeter costs \$0.18. Write an expression in terms of  $w$  that represents the cost of mailing the manual. \_\_\_\_\_
  
2. Earth is roughly a sphere with a radius ( $r$ ) of about 6,380 km. The expression for the surface area of a sphere is  $4\pi r^2$ . The expression for the volume of a sphere is  $\frac{4}{3}\pi r^3$ .
  - a. What are the coefficients of the variable in the expression for surface area? \_\_\_\_\_
  - b. What are the coefficients of the variable in the expression for the volume of a sphere? \_\_\_\_\_
  - c. Write an expression for the surface area  $A$  of Earth, substituting values for each symbol. \_\_\_\_\_
  - d. What is the approximate surface area of Earth? \_\_\_\_\_
  - e. Write an expression for the volume of Earth, substituting values for each symbol. \_\_\_\_\_
  - f. What is the approximate volume of Earth, rounded to the nearest hundred thousand? \_\_\_\_\_

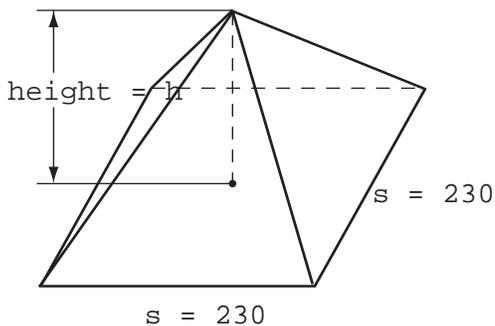




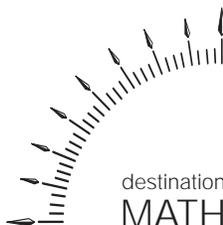
# Unit Assessment

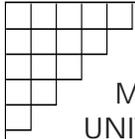
3. You have 8 racks of classic rock CDs, 11 racks of pop CDs, and 3 racks of opera CDs. Each rack holds the same number of CDs. Let  $x$  = the number of CDs each rack holds.
- Write an expression for the number of classic rock and pop CDs you have. \_\_\_\_\_
  - Write an expression for the total number of CDs you have. \_\_\_\_\_
  - Your friend is having a party. She asks to borrow one third of your classic rock CDs and one fourth of your pop CDs, but none of your opera CDs. Write an expression for how many CDs your friend will borrow. \_\_\_\_\_
  - What additional information do you need to be able to calculate the numerical values for parts a–c? \_\_\_\_\_

4. The drawing shows some of the original dimensions of the largest pyramid ever built, the 4,600-year-old Great Pyramid of Cheops in Egypt. The volume of a pyramid equals  $\frac{1}{3}$  times the area of the base  $A$  times the height  $h$  of the pyramid.



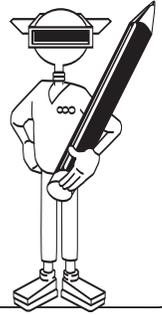
- Use the values in the diagram to write a formula for the volume of the Great Pyramid. \_\_\_\_\_  
 Volume = 2,592,100 m  
 Base is a square, 230 m on e
- Write an expression to find the height of this pyramid. \_\_\_\_\_
- Use a calculator and find the height of this pyramid. \_\_\_\_\_





COURSE: **MSC V**  
 MODULE 1: **Essentials of Algebra**  
 UNIT 2: **Evaluating an Algebraic Expression**

# Student Logbook



## Representing the Dimensions & Area of a Rectangle

**As you work through the tutorial, complete the following statements and questions.**

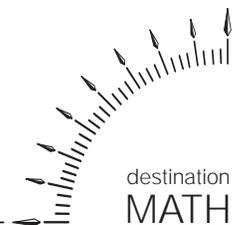
1. James Blackfeather has forgotten the width of the rectangle, so he lets the variable \_\_\_\_\_ represent the number of meters in the width.
2. What is the expression for the length in terms of the width  $w$  of the landing pad for the Micro helicopter? \_\_\_\_\_
3. Write the expression for the width of the pad needed for the SkyKing helicopter using symbols and numerals. \_\_\_\_\_
4. In order for the SkyKing to land safely, it needs a \_\_\_\_\_ clearance area.
5. To find the area of a rectangle, express its dimensions in terms of \_\_\_\_\_ and \_\_\_\_\_.

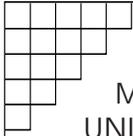
**Key Words:**

Variable  
Expression

**Learning Objectives:**

- Representing the dimensions of a rectangle in terms of  $l$  and  $w$
- Representing the areas of rectangles using variable expressions





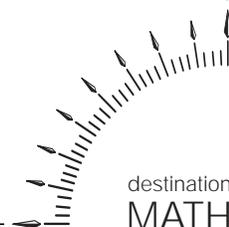
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 MODULE 1: **Essentials of Algebra**  
 UNIT 2: **Evaluating an Algebraic Expression**

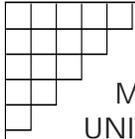
Your  
Turn



## Representing the Dimensions & Area of a Rectangle

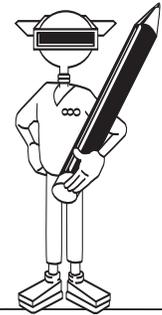
- Now that they have a larger helicopter, the Coney Valley Mountain Rescue Team can carry more supplies. The old rectangular supply case had a width of  $w$  and a length of  $w + \frac{2}{3}$ . Write an expression for the area of the bottom of the old supply case. \_\_\_\_\_
- The new supply case will have a width of  $w + 5$  and a length that is equal to  $\frac{4}{3}$  more than twice its width.
  - Write an expression in terms of  $w$  to represent the length of the new case.  
\_\_\_\_\_
  - Write an expression in terms of  $w$  to show the area of the bottom of the new case.  
\_\_\_\_\_
- Compare the new case and the old case.
  - Write an expression to show the difference between the width of the new case and the width of the old case. \_\_\_\_\_
  - Write an expression to show the difference between the length of the new case and the length of the old case. \_\_\_\_\_
- The length of a football field is 100 yards, and its width is  $53\frac{1}{3}$  yards. The length and width of a soccer field are 120 yards and 75 yards.
  - Using the variable  $l$  to represent the length of a football field, and write an algebraic expression to represent the length of a soccer field in terms of  $l$ . \_\_\_\_\_
  - Use the variable  $w$  to represent the width of a soccer field, and write an algebraic expression to represent the width of a football field in terms of  $w$ . \_\_\_\_\_





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# Student Logbook



## Combining Like Terms

**As you work through the tutorial, complete the following statements and questions.**

1. Complete the following statement for the area of a rectangle:

$$A = \underline{\hspace{2cm}} \times \underline{\hspace{2cm}}$$

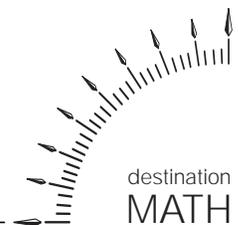
2. What expression represents the area of the landing pad for the Micro helicopter? \_\_\_\_\_
3. Express the area of the landing pad in two other ways in terms of  $w$ . \_\_\_\_\_, \_\_\_\_\_
4. What expression represents the area  $A$  of the clearance needed for the SkyKing? \_\_\_\_\_
5. Write the expression for the length of the landing pad needed for the SkyKing in its simplest form. \_\_\_\_\_
6. What is the first step in simplifying the expression for the width of the landing pad needed for the SkyKing? \_\_\_\_\_
7. Write the expression for the width of the landing pad needed for the SkyKing in its simplest form. \_\_\_\_\_
8. The algebraic expression for the area of the new landing pad was simplified by applying the \_\_\_\_\_ property.
9. Write the algebraic expression, in simplest form, for the area needed to land the SkyKing safely. \_\_\_\_\_
10. In simplifying algebraic expressions, it is always necessary to combine \_\_\_\_\_ terms and use the \_\_\_\_\_ of \_\_\_\_\_.

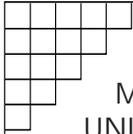
### Key Words:

Variable  
 Expression  
 Commutative property  
 Distributive property  
 Simplify  
 Like terms  
 Order of operations

### Learning Objectives:

- Applying the commutative property of multiplication
- Applying the distributive property of multiplication over addition
- Simplifying expressions by combining like terms
- Simplifying expressions by using the order of operations





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Your  
Turn



## Combining Like Terms

1. Simplify the expression  $(2w - 3) + (w + 2) + (w + 4)$ .

\_\_\_\_\_

2. Simplify the expression  $7(3x - 4)$ . \_\_\_\_\_

3. What property did you use to simplify the expression in Question 2?

\_\_\_\_\_

4. Use the distributive property to simplify each of the following.

a.  $5(x + 2)$  \_\_\_\_\_

b.  $x(x + 1)$  \_\_\_\_\_

c.  $2x(2x + 3)$  \_\_\_\_\_

5. Simplify the expression  $5x - 2(7x + 9) - x$ . \_\_\_\_\_

6. Simplify the expression  $2(x + 4) + x$ . \_\_\_\_\_

7. Simplify the expression  $3t - 3(2t + 2) - (t + 1)$ . \_\_\_\_\_

8. Simplify the expression  $x(3 + x) + x^2 + x(x + 2x)$ . \_\_\_\_\_

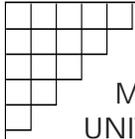
9. The length of a soccer field is  $2\frac{1}{4}$  times the width  $w$  of a football field. The width of a soccer field is  $1\frac{2}{5}$  times the width  $w$  of a football field.

a. Write an expression to represent the length of a soccer field in terms of  $w$ . \_\_\_\_\_

b. Write an expression to represent the width of a soccer field.  
 \_\_\_\_\_

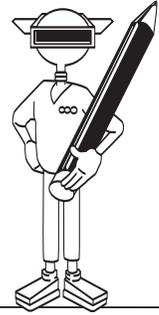
c. Write the formula for determining the area  $A$  of a soccer field in terms of  $w$ , and simplify.  
 \_\_\_\_\_





COURSE: **MSC V**  
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# Student Logbook



## Evaluating Expressions Using Substitution

As you work through the tutorial, complete the following statements and questions.

- Write the algebraic expression that describes the area to be cut back.  
\_\_\_\_\_
- Dijit writes  $-(w^2 + 5w)$  as \_\_\_\_\_ and then writes this as \_\_\_\_\_.
- After collecting the like terms, the expression in terms of  $w$  for the area to be cut back is \_\_\_\_\_.
- What value does Dijit substitute for  $w^2$ ? \_\_\_\_\_
- What value does Dijit substitute for  $w$ ? \_\_\_\_\_
- The value for the expression is \_\_\_\_\_, and the area to be cut back is \_\_\_\_\_.
- What does this value represent? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
- When subtracting one algebraic expression from another, what must be done to all terms in the expression that is being subtracted? \_\_\_\_\_  
\_\_\_\_\_

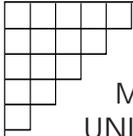
### Key Words:

Variable  
 Expression  
 Like terms  
 Substitute  
 Evaluate

### Learning Objectives:

- Subtracting polynomial expressions
- Substituting values of known quantities for variables in expressions





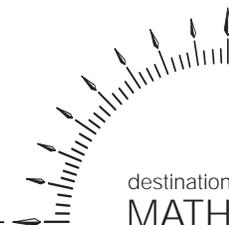
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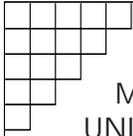
Your  
Turn



## Evaluating Expressions Using Substitution

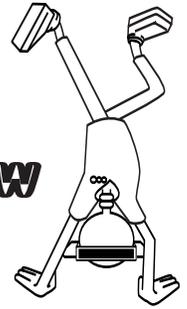
- Simplify the expression  $(\frac{3}{4}x^2 + \frac{1}{2}x) - (\frac{1}{4}x^2 + \frac{1}{4}x)$ . \_\_\_\_\_
- Find the value of  $\frac{1}{2}x^2 + 2x$  for each of the following values of  $x$ .
  - $x = 2$  \_\_\_\_\_
  - $x = 3$  \_\_\_\_\_
  - $x = 4$  \_\_\_\_\_
  - $x = \frac{1}{2}$  \_\_\_\_\_
- Chip wants to increase the size of the base a small rectangular tool shed he wants to build. The width of the base of the old shed is  $w$  and its length is  $2w + \frac{3}{8}$ . Chip wants to increase the width by  $w$  and increase the length by  $\frac{5}{8}$ .
  - Write an expression for the area of the base of the original shed. \_\_\_\_\_
  - Write an expression for the area of the base of the new shed. \_\_\_\_\_
  - Write an expression showing the difference between the areas of the bases of the new shed and of the old shed. \_\_\_\_\_
  - Simplify the expression in Part C. \_\_\_\_\_
  - Let the width of the base of the original shed be 25 ft. Evaluate the expression in part d and find the difference in the areas between the bases of the new and old shed. \_\_\_\_\_





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 UNIT 2: **Evaluating an Algebraic Expression**

## Unit Review



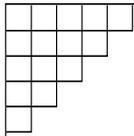
### Representing the Dimensions & Area of a Rectangle

- A baker uses two rectangular baking pans to make cookies. One pan has a width of  $w$  and a length of  $l$ . The width of the second pan was increased by  $\frac{1}{80}$  and its length was increased by  $\frac{1}{120}$ .
  - Write an expression for the width of the second pan in terms of  $w$ . \_\_\_\_\_
  - Write an expression for the length of the second pan in terms of  $l$ . \_\_\_\_\_
  - Write an expression for the area of the second pan in terms of  $l$  and  $w$ .  
\_\_\_\_\_

### Combining Like Terms

- Simplify the expression  $2w + 3w + (w - 3)$ . \_\_\_\_\_
- Simplify the expression  $6(w + 2) - 3w + 2$ . \_\_\_\_\_
- The length of a neighborhood playground is represented by the expression  $4 \times [(3w + 5) + 4w + (2w - 6)]$ .
  - Explain the first step you would take to simplify the expression inside the brackets. \_\_\_\_\_
  - Perform the first step, and show your work.
  - Show the next step you would take.
  - What property did you use to simplify the expression in part c?  
\_\_\_\_\_





# Unit Review



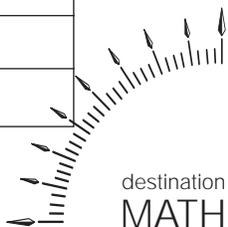
## Evaluating Expressions Using Substitution

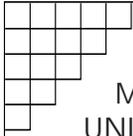
5. a. A gardener wants to dig a rectangular flower bed to plant 6 rows of begonias. Each row should have a width of  $w$  and a length of  $10w$ . Write an expression in terms of  $w$  for the area of the flower bed.  
\_\_\_\_\_
- b. The gardener decides to add a space between the rows so that the new width of the rows is  $w + \frac{1}{5}w$ . Write an expression in terms of  $w$  for the area of the new flower bed. \_\_\_\_\_
- c. Write an expression in terms of  $w$  to find the difference between the areas of the original flower bed and the new flower bed and then simplify the expression. \_\_\_\_\_
- d. If the difference between the widths of the two flower beds in part c is 20 cm, what is the difference between the areas of the two beds?  
\_\_\_\_\_

## Putting It All Together

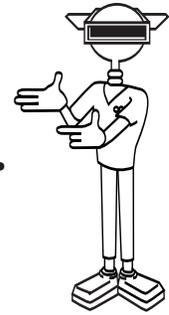
6. a. Evaluate  $5x^2y^3 + 2x^3y^2$  if  $x = -1$  and  $y = -2$ . \_\_\_\_\_
- b. Write the expression  $-y \times y \times y \times z \times z \times z + 3y \times y \times y \times z \times z$  in simplest form. \_\_\_\_\_
7. The widths of two rectangles are equal. The table below gives the lengths of two rectangles, in terms of their widths,  $w$ . Complete the table and then find the value of the area when the width is 11 m.

Rectangle	Length	Simplify length	Length $\times$ width	Expression for area	Area(m <sup>2</sup> ) ( $w = 11$ )
1	$\frac{1}{2}(w + 26)$				
2	$14 \times (\frac{3}{7}w - 4)$				



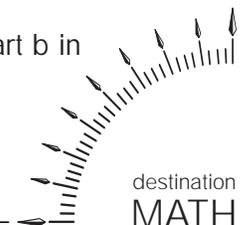


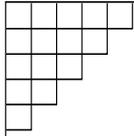
COURSE: **MSC V**  
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## Unit Assessment

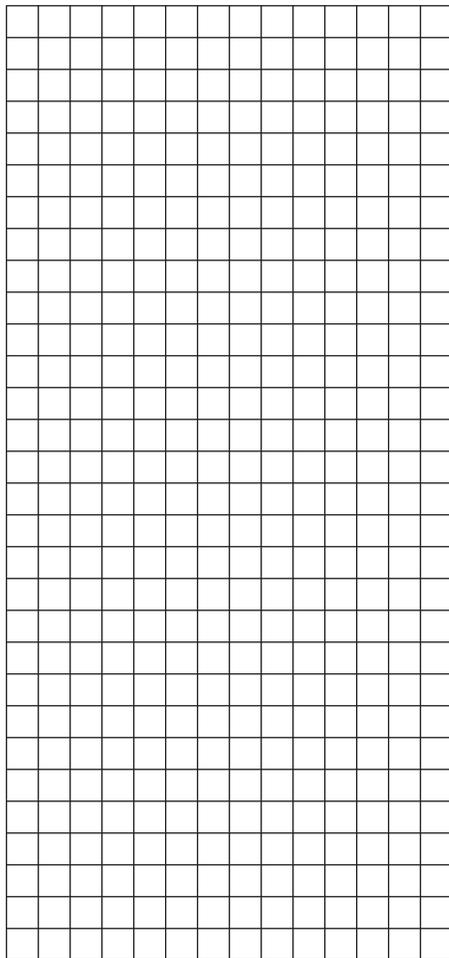
- A rectangular Olympic-sized swimming pool has an area of  $1,050 \text{ m}^2$ .
  - If its length is 50 m, what is its width? \_\_\_\_\_
  - Write an expression for the length of the pool in terms of its width ( $w$ ).  
\_\_\_\_\_
- The area of a Canadian football field is  $1,817 \text{ yd}^2$  larger than the area of a U.S. football field. Using the symbols  $l_U$  and  $w_U$  for the dimensions of a U.S. football field, and  $l_C$  and  $w_C$  for the dimensions of a Canadian football field, write an expression in terms of  $l_U$ ,  $w_U$ ,  $l_C$ , and  $w_C$  that represents the difference in their areas. \_\_\_\_\_
- The length of a Canadian football field is  $1\frac{69}{100}$  times longer than its width,  $w$ .
  - Write an expression for the length of the football field in terms of  $w$ . \_\_\_\_\_
  - Write an expression for the area of the football field in terms of  $w$ . \_\_\_\_\_
  - If  $w = 65$  yards, what is the area in square yards of the football field to the nearest whole number? \_\_\_\_\_
  - What is the length in yards of a Canadian football field to the nearest whole number? \_\_\_\_\_
- Under a microscope, the inside surface of the intestines have many hills and valleys. The total surface area of the average person's intestines, including these hills and valleys, is about  $200,000 \text{ cm}^2$ .
  - Assume that all the hills and valleys could be flattened. Write an expression that would describe how long, in centimeters, the length of a person's intestines if they formed a rectangle that was  $12\frac{1}{2} \text{ cm}$  wide? \_\_\_\_\_
  - Use the expression in part a to find the length of the intestines? \_\_\_\_\_
  - Write an expression that would express the number of centimeters in part b in inches. ( $1 \text{ cm} \approx \frac{2}{5} \text{ in.}$ ) \_\_\_\_\_

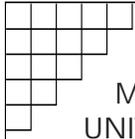




# Unit Assessment

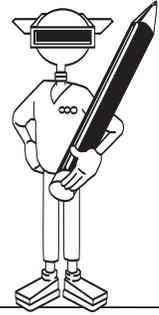
5. The grid below is divided into square units, each of which has an area of 4.
- Draw a rectangle whose width  $w$  is 28, and whose length  $l$  is 12 less than twice its width.
  - Write an expression that describes the length of the rectangle in terms of  $w$ .  
\_\_\_\_\_
  - Find the value of the length. \_\_\_\_\_
  - Write an expression for the area of this rectangle. \_\_\_\_\_
  - What is the area of the rectangle? \_\_\_\_\_





COURSE: **MSC V**  
 MODULE 1: **Essentials of Algebra**  
 UNIT 3: **Simple Equations**

# Student Logbook



## Using Variables to Express Relationships

As you work through the tutorial, complete the following statements and questions.

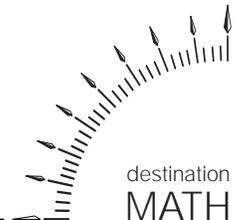
1. What is the weight in tons of the crates in the ship's cargo space? \_\_\_\_\_
2. What is the weight in tons of the dredger, the two bulldozers, and the two trucks?  
 \_\_\_\_\_ Explain your answer. \_\_\_\_\_
3. What are the symbols for the weight of a truck, the weight of a bulldozer, and the weight of a dredger? \_\_\_\_\_
4. In the problem, which symbols represent quantities that cannot be known from the information given? \_\_\_\_\_
5. What expression represents the weight of one truck in terms of the weight of a bulldozer? \_\_\_\_\_
6. What expression represents the weight of a bulldozer? \_\_\_\_\_
7. What expression results from substituting the expression for the weight of a bulldozer in the expression for the weight of a truck? \_\_\_\_\_
8. Which of the following expressions is equal to the weight of the two trucks,  $2t$ ? \_\_\_\_\_
  - a.  $2 - [\frac{1}{2}(2.5t - 1) - 2]$
  - b.  $2 + [\frac{1}{2}(2.5t - 1) - 2]$
  - c.  $2 \times [\frac{1}{2}(2.5t - 1) - 2]$
  - d.  $2 \times [(2.5t - 1) - 2]$
9. Variables can be used to express \_\_\_\_\_ quantities.

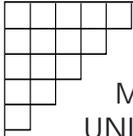
### Key Words:

Variable  
Expression

### Learning Objectives:

- Choosing variables to represent each of the unknown quantities in a problem
- Using algebraic expressions to show the relationship between variables
- Substituting one variable for another and writing an equation containing only one variable term





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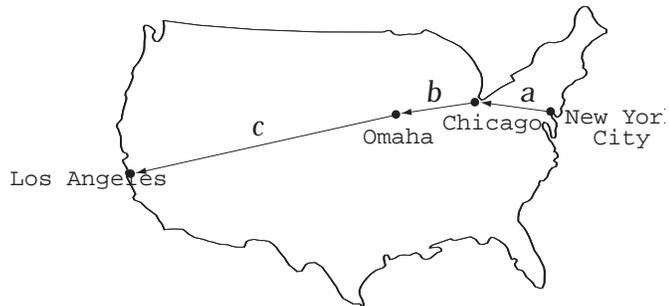
Your  
Turn



## Using Variables to Express Relationships

Dijit is planning a car trip across the United States. The trip will start in New York City and end in Los Angeles, stopping off at Chicago and Omaha in between. To plan the trip properly, Dijit needs to know the distances between these cities.

- Let  $a$  equal the distance between New York City and Chicago,  $b$  the distance between Chicago and Omaha, and  $c$  the distance between Omaha and Los Angeles.



- Using  $a$ ,  $b$ , and  $c$ , write an expression for the total distance of the trip.  
\_\_\_\_\_

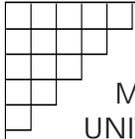
- The actual total distance is 2,856 miles. Write an equation in terms of  $a$ ,  $b$ , and  $c$  that represents the trip. \_\_\_\_\_

- The distance between Chicago and Omaha equals one half of the distance between New York City and Chicago, plus 58 miles. Write an equation in terms of  $a$ ,  $b$ , and  $c$  that represents this relationship.  
\_\_\_\_\_

- The distance between Omaha and Los Angeles equals four times the distance between Chicago and Omaha, less 241 miles. Write an equation in terms of  $b$  and  $c$  that represents this relationship.  
\_\_\_\_\_

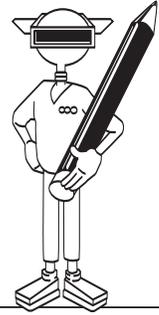
- Use your answers to questions 1, 2, and 3 and write an equation for the total distance of the trip in terms of only the variable  $a$ . \_\_\_\_\_





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# Student Logbook



## Simplifying Algebraic Expressions

As you work through the tutorial, complete the following statements and questions.

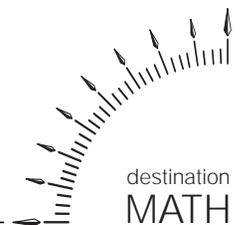
1. a. Dijit writes 2.5 as the fraction \_\_\_\_\_ .  
 b. When this fraction is substituted for 2.5 into the equation  $34 + 2(2.5t - 1) + 2[\frac{1}{2}(2.5t - 1) - 2] = 102$ , the result is \_\_\_\_\_ .
2. To what does the left side of the equation in Question 1b refer?  
 \_\_\_\_\_
3. a. Simplify the expression  $2(\frac{5}{2}t - 1)$ . \_\_\_\_\_  
 b. What does this expression represent? \_\_\_\_\_
4. a. Simplify the expression  $2[\frac{1}{2}(\frac{5}{2}t - 1) - 2]$ . \_\_\_\_\_  
 b. What does this expression represent? \_\_\_\_\_
5. a. Using the simplified expressions you just produced, rewrite the expression for the weight of all the machinery in the left part of the cargo space. \_\_\_\_\_  
 b. What is the numerical value of this expression? \_\_\_\_\_  
 c. In the expression, substitute the appropriate decimal for  $\frac{5}{2}$ . \_\_\_\_\_  
 d. Simplify the expression. \_\_\_\_\_  
 e. Using this simplified expression, write the equation that describes the weight on both sides of the cargo space. \_\_\_\_\_  
 f. Translate the expression into words. \_\_\_\_\_  
 \_\_\_\_\_

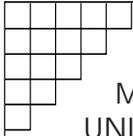
### Key Words:

Simplify  
 Order of operations  
 Like terms  
 Equation  
 Constant

### Learning Objectives:

- Simplifying one side of an equation using the distributive property of multiplication over addition and following the order of operations
- Combining like terms
- Investigating the elements of an algebraic expression





COURSE: **MSC V**  
 MODULE 1: **Essentials of Algebra**  
 UNIT 3: **Simple Equations**

Your  
Turn



## Simplifying Algebraic Expressions

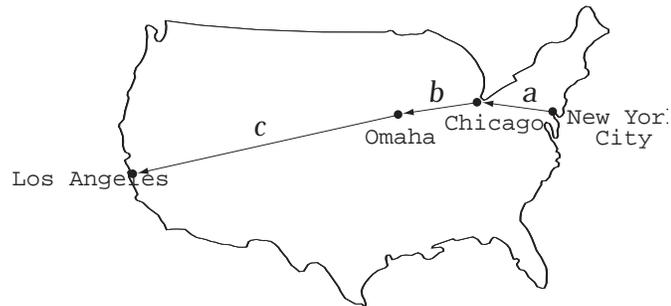
The distance in miles between New York City and Los Angeles can be expressed by the following equation where  $a$  represents the distance between New York City and Chicago:

$$a + \left[\left(\frac{1}{2} \times a\right) + 58\right] + \{4\left[\left(\frac{1}{2} \times a\right) + 58\right] - 241\} = 2,856$$

1. Rewrite the expression  $\left(\frac{1}{2} \times a\right) + 58$  without using parentheses. \_\_\_\_\_

2. Use the distributive property and simplify the expression  $4\left[\left(\frac{1}{2} \times a\right) + 58\right]$ . \_\_\_\_\_

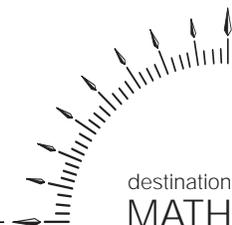
3. Use your answer in (2) and simplify the expression  $4\left[\frac{1}{2} \times a\right] + 58 - 241$ . \_\_\_\_\_

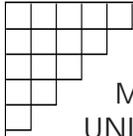


4. Using the simplified expressions in (1) and (3), rewrite the equation in terms of  $a$ .  
 \_\_\_\_\_

5. Simplify the left side of the equation in (4) by combining like terms.  
 \_\_\_\_\_

6. Use the expression in (5) and rewrite the equation that represents the total distance between New York City and Los Angeles. \_\_\_\_\_

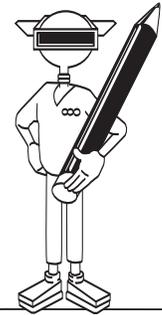




COURSE: **MSC V**  
 MODULE 1: **Essentials of Algebra**  
 UNIT 3: **Simple Equations**

## Solving Simple Equations

## Student Logbook



**As you work through the tutorial, complete the following statements and questions.**

1. The original expression for the weight of the machinery in the the cargo space is  $1d + 2b + 2t$ , where  $d$  represents the weight of the dredge,  $b$  represents the weight of the bulldozer, and  $t$  represents the weight of the truck.

a. What would the expression be if one more truck were placed in the cargo space? \_\_\_\_\_

b. The equation that represents the original weight in tons in the cargo space is  $1d + 2b + 2t = 102$ . What has to be done to the right side of the equation if one more truck is added to the left side of the cargo space?  
 \_\_\_\_\_

2. The variable  $t$  represents the weight in tons of one truck. The simplified equation for the original weights of the trucks in the left and right cargo spaces is  $7.5t + 27 = 102$ .

a. What is the first step Dijit can use to isolate  $7.5t$  in the equation?  
 \_\_\_\_\_

b. What can Dijit do to eliminate the decimal point on the left while keeping the equation balanced? \_\_\_\_\_

c. What can Dijit next do to find the value of  $t$ ? \_\_\_\_\_

d. What is the value in tons of  $t$ ? \_\_\_\_\_

3. a. How can Dijit check the value of  $t$  in 2 (d)? \_\_\_\_\_  
 \_\_\_\_\_

b. Substitute the value of  $t$  into the left side of the equation and show that it checks?  
 \_\_\_\_\_

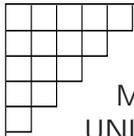
### Key Words:

Equation  
 Constant  
 Coefficient  
 Inverse operation  
 Substitute  
 Order of operations

### Learning Objectives:

- Balancing an equation
- Isolating a variable by adding or subtracting a constant from both sides of the equation
- Multiplying or dividing both sides of an equation by the coefficient of the variable to solve the equation
- Checking a solution by substituting the value of a variable into the equation used to solve it
- Solving a 2-step equation using inverse operations





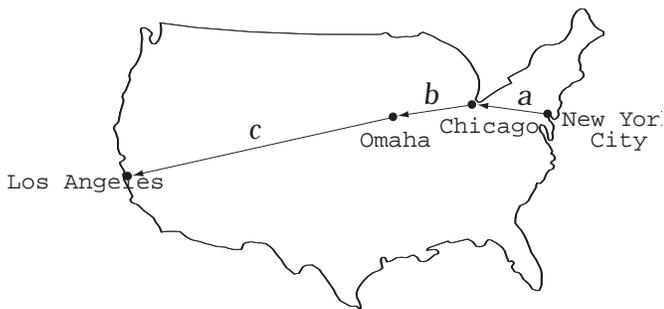
COURSE: **MSC V**  
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# Your Turn

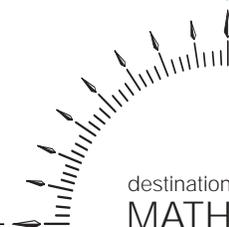


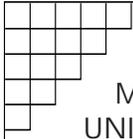
## Solving Simple Equations

The distance in miles from New York City to Los Angeles is represented by the equation:  $\frac{7a}{2} + 49 = 2,856$ , where  $a$  is equal to the distance between New York City and Chicago.

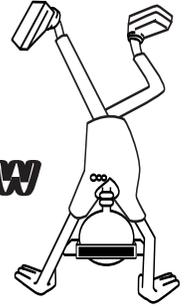


1. What is the first step to isolate  $\frac{7a}{2}$  in this equation? \_\_\_\_\_
2. What does the equation look like now? \_\_\_\_\_
3. What must be done to the equation in (2) to remove the denominator of the coefficient of  $a$ ? \_\_\_\_\_
4. What does the equation look like now? \_\_\_\_\_
5. In the equation  $7a = 5,614$ , what must be done to isolate the variable while keeping the equation balanced? The variable  $a$  represents the distance between NYC and Chicago. The variable  $b$  represents the distance between Chicago and Omaha, Nebraska.  
 \_\_\_\_\_
6. If  $a = 802$ , use the equation  $b = \frac{1}{2}a + 58$  to find the value of  $b$ . \_\_\_\_\_
7. The variable  $c$  represents the distance between Omaha and Los Angeles. Use the value of  $b$  from Question 6 and the equation  $c = 4b - 241$  to find the value of  $c$ .  
 \_\_\_\_\_





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 UNIT 3: **Simple Equations**



## Unit Review

### Using Variables to Express Relationships

- Together, the planets Jupiter, Mars, and Saturn have 36 moons. Use the variables  $j$ ,  $m$ , and  $s$  to represent the number of moons around each planet and answer the questions that follow.
  - Write an equation to show that: Mars has two less than one-fourth the number of moons than Jupiter. \_\_\_\_\_
  - Write an equation to show that Saturn has two more than eight times the number of moons than Mars. \_\_\_\_\_
  - Use the equations in (a) and (b) and write an equation for the total number of moons around these planets in terms of  $j$ , the number of moons around Jupiter.

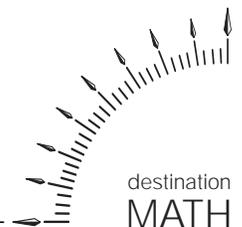
### Simplifying Algebraic Expressions

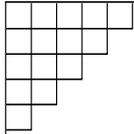
The variable  $j$  represents the number of moons around Jupiter.

- An equation for the number of moons around Jupiter, Mars, and Saturn in terms of  $j$  is  $j + (\frac{1}{4}j - 2) + [8(\frac{1}{4}j - 2)] + 2 = 36$ 
  - Use the distributive property and simplify the expression.  $8(\frac{1}{4}j - 2)$  \_\_\_\_\_
  - Simplify the left side of the original equation in terms of  $j$ . \_\_\_\_\_
  - Solve the equation in (b) to find the number of moons around Jupiter.

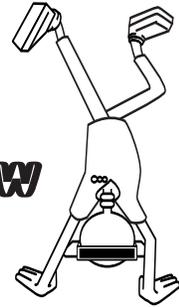
### Solving Simple Equations

- Solve this equation for  $c$ :  $4(3c + 7) - 5c = -c - 44$
  - Use substitution and check your answer.





# Unit Review



4. The equation  $\frac{13}{4}j = 52$  represents the number of moons around Jupiter.
- Solve this equation for  $j$ . Show your work.
  - If the number of moons  $m$  around Mars equals  $\frac{1}{4}j - 2$ , find the number of Martian moons. Show your work.
  - If the number of moons  $s$  around Saturn equals  $8m + 2$ , how many moons does Saturn have? \_\_\_\_\_

## Putting It All Together

5. Each of these equations has 3 terms on the left side. Complete the table and solve for the variable in each equation.

Equation	Simplified 2nd term	Simplified 3rd term	Simplified equation	Value of variable
$6 + 3(a + 6) + \frac{2}{5}(10a - 7.5) = 91$				
$34 - [\frac{1}{2}(6k - 2) + 8] + 2(2k + 12) = 68$				
$66 + [\frac{7}{3}(f + 54)] - [4(\frac{1}{3}f - 16)] = 277$				

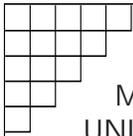
6. a. Not every linear equation in one variable has one and only one solution. Solve each equation, showing your work.

$2(5 + x) - 10 = 2x$        $3(2 + x) = 18 + 3x$

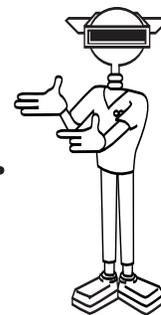
Explain your answer to 6a. \_\_\_\_\_

\_\_\_\_\_





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## Unit Assessment

Each chemical element has an atomic number. The atomic number tells you how many protons are in the nucleus of an atom.

1. The atomic number of iron is two more than three times the atomic number of oxygen.

a. Using the chemical symbols  $Fe$  for iron and  $O$  for oxygen, write an equation that represents the relationship between the atomic numbers of  $Fe$  and  $O$ .

\_\_\_\_\_

b. Which of the following expresses the atomic number of  $O$  in terms of  $Fe$ ?

(1)  $3 \times Fe + \frac{2}{3}$

(2)  $3 \div Fe + \frac{2}{3}$

(3)  $Fe \div 3 - \frac{2}{3}$

(4)  $Fe + 3 - \frac{2}{3}$

2. The atomic number of calcium ( $Ca$ ) is one-half that of iron ( $Fe$ ), plus seven.

a. Write an equation that represents the atomic number of  $Ca$  in terms of  $Fe$ .

b. Which of the following expresses the atomic number of  $Fe$  in terms of  $Ca$ ?

(1)  $\frac{1}{2} \times (Ca - 7)$

(2)  $2 \times (Ca - 7)$

(3)  $2 \times (Ca - 3.5)$

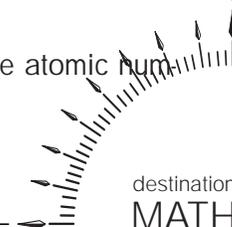
(4)  $7 \times (Ca - \frac{1}{2})$

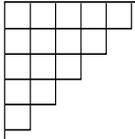
3. The sum of the atomic numbers for oxygen, iron, and calcium is 54. Use the symbols  $O$ ,  $Fe$ , and  $Ca$  and write an equation that represents the sum.

\_\_\_\_\_

4. Use your answers in 1b, 2a, and 3 and write an equation for the sum of the atomic numbers of these elements in terms of  $Fe$ . \_\_\_\_\_

5. Solve the equation in 4 to find the atomic number  $Fe$ .

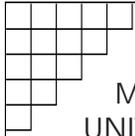




# Unit Assessment

6. Katie and Clarence work in Lone Wolf National Park. To get to work each day, Katie has to drive five miles more than twice the number of miles Clarence drives.
- a. Let the distance between Clarence's home and the park be represented by the variable  $d$ . Express the distance that Katie drives in terms of  $d$ .
- \_\_\_\_\_
- b. The sum of the distances Katie and Clarence drive to work is 47 miles. Write an equation in terms of  $d$  that represents this sum.
- \_\_\_\_\_
- c. How far does each person live from the park? \_\_\_\_\_
- \_\_\_\_\_

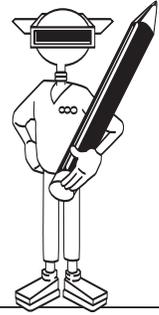




COURSE: **MSC V**  
 MODULE 1: **Essentials of Algebra**  
 UNIT 4: **Variable on Both Sides  
 of the Equation**

## Writing Equations

## Student Logbook



**As you work through the tutorial, complete the following statements and questions.**

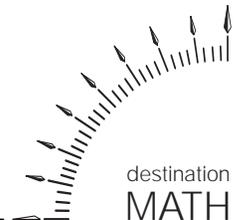
1. What is the total value of the insurance check Mary received? \_\_\_\_\_
2. Monique's formula for distributing the money between Mary and Simon, written in words, is \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
3. To represent Monique's formula algebraically, the variable \_\_\_\_\_ is chosen to represent \_\_\_\_\_.
4.  $24,000 - x$  represents \_\_\_\_\_.
5. Write an expression to represent 50% of what is left over after Mary gets her share. \_\_\_\_\_
6. Mary's share plus  $\frac{1}{4}$  of the total value of the insurance check is represented by the expression \_\_\_\_\_.
7. Dijit simplified the left side of the equation to \_\_\_\_\_. The right side of the equation, when simplified, is \_\_\_\_\_.
8. In algebra, a \_\_\_\_\_ can be used on \_\_\_\_\_ sides of an \_\_\_\_\_ sign to represent equivalent quantities.

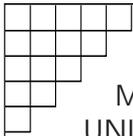
### Key Words:

Variable  
 Expression  
 Equation  
 Simplify

### Learning Objectives:

- Using a variable to represent an unknown quantity in a problem
- Using the same variable to represent a 2nd unknown quantity
- Writing an equation that represents the conditions of the problem
- Simplifying each side of an equation





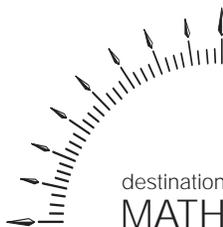
COURSE: **MSC V**  
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 of the Equation

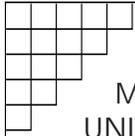
## Writing Equations

Your  
Turn



- Chip is on one of two teams building a railroad track originally planned to be 100 miles long. The railroad company has decided to connect to a new town, but does not know how many miles of additional track will be needed. Chip's team will build one half of the entire track. Let  $n$  represent the length of the additional track in miles. Write an expression that represents how many miles of track Chip's team will build. \_\_\_\_\_
- Your parents have decided to increase your allowance by \$20. This is the same as doubling your allowance. Let  $a$  represent your previous allowance and write an equation in terms of  $a$  that represents your new allowance. \_\_\_\_\_
- Jules's mother wanted some new pots for her plants, so she gave Jules enough money and sent him to the garden supply store. He lost \$10. His mother complained that he had lost one half of the money. Let  $m$  represent the amount of money that Jules's mother gave him and write an equation in terms of  $m$  that represents how much he lost. \_\_\_\_\_
- Simplify each expression.
  - $\frac{1}{3}(15 + 3x)$  \_\_\_\_\_
  - $x + \frac{1}{5}(25 + 10x) + 3$  \_\_\_\_\_
- Simplify the expressions on each side of the following equations:
  - $2(x + 5) = \frac{1}{4}(16 - 2x)$   
 Left side \_\_\_\_\_ Right side \_\_\_\_\_
  - $\frac{1}{3}(6x + 36) = 4(3x + 7)$   
 Left side \_\_\_\_\_ Right side \_\_\_\_\_
  - $\frac{3}{4}(4x + 12) = 3(2x + 5) + 2$   
 Left side \_\_\_\_\_ Right side \_\_\_\_\_

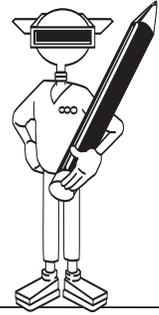




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 UNIT 4: **Variable on Both Sides  
 of the Equation**

## Simplifying Both Sides of an Equation

## Student Logbook



**As you work through the tutorial, complete the following statements and questions.**

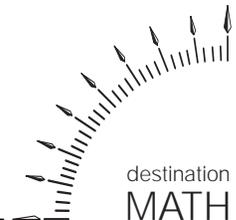
1. Dijit wants to solve the equation  $12,000 - \frac{1}{2}x = x + 6,000$  for  $x$ . What does this equation represent? \_\_\_\_\_ .
2. To remove the  $x$  from the right side of the equation, Dijit can \_\_\_\_\_  $x$  from the right side of the equation because \_\_\_\_\_ is the \_\_\_\_\_ operation of addition.
3. To collect the  $x$  terms on the right side of the equation, you can \_\_\_\_\_  $\frac{1}{2}x$  to the left side and to the right side of the equation.
4.  $1\frac{1}{2}$  is a \_\_\_\_\_ number.
5. What is the equation that results when  $x$  terms are collected on one side of the equation and like terms are combined? \_\_\_\_\_ .
6. What equation results when 6,000 is subtracted from both sides of the equation and like terms are combined? \_\_\_\_\_ .
7. To remove the denominator in the expression  $\frac{3x}{2}$ , you can \_\_\_\_\_ both sides of the equation by \_\_\_\_\_ .
8. What is the equation after all like terms have been collected and combined on each side of the equation? \_\_\_\_\_ .
9. To solve an equation with the same variable on both sides of the equals sign, use \_\_\_\_\_ operations to collect the variable terms on one side of the equation, and \_\_\_\_\_ the variable terms by simplifying \_\_\_\_\_ sides.

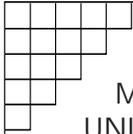
### Key Words:

Equation  
 Inverse operation  
 Mixed number  
 Improper fraction  
 Isolate

### Learning Objectives:

- Collecting the variable terms on one side of the equation
- Isolating the variable term





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 UNIT 4: **Variable on Both Sides**  
 of the Equation

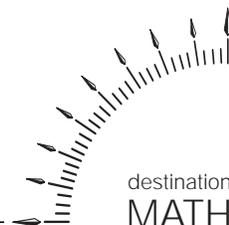
Your  
Turn

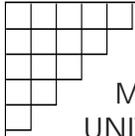


## Simplifying Both Sides of an Equation

- Without solving for  $x$ , collect and combine like terms on the left and the right sides of the equation,  $3 + 2x + x = x + 6$ . \_\_\_\_\_
- Without solving for  $x$ , collect and combine like terms on the left and right sides of the equation,  $8 - 3x + 2x = 3x + 4$ . \_\_\_\_\_
- Describe how you could simplify the equation,  $5 - 2x + 6x = 3x + 10$ .  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
- What would you do to combine the  $x$  - terms on the right side of the of the equation  $19,500 - \frac{1}{2}x = x - 7,800$ ? \_\_\_\_\_ .
  - Subtract  $x$  from both sides of the equation
  - Add  $\frac{1}{2}x$  to both sides of the equation
  - Subtract  $\frac{1}{2}x$  from both sides of the equation
- After you combine the  $x$  - terms on the right side of the equation in Question 4, What is the simplified equation? \_\_\_\_\_ .
 

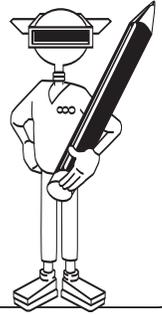
<b>a.</b> $19,500 = x - 7,800$	<b>b.</b> $19,500 - \frac{1}{2}x = 7,800$
<b>c.</b> $19,500 = 1\frac{1}{2}x - 7,800$	<b>d.</b> $7,800 = \frac{1}{2}x + 19,500$
- In the equation from Question 4, write the coefficient of  $x$  as an improper fraction and rewrite the equation. \_\_\_\_\_
- Explain how to remove the denominator in the coefficient of  $x$  in Question 6.  
 \_\_\_\_\_





COURSE: **MSC V**  
 MODULE 1: **Essentials of Algebra**  
 UNIT 4: **Variable on Both Sides  
 of the Equation**

# Student Logbook



## Checking the Solution to an Equation

As you work through the tutorial, complete the following statements and questions.

- To calculate Mary's share of the check, you need to solve the equation \_\_\_\_\_ for the variable \_\_\_\_\_ .
- The value of Mary's share is \_\_\_\_\_ .
- To find Mary's share, which was \$ \_\_\_\_\_ , Dijit \_\_\_\_\_ each side of the equation by \_\_\_\_\_ .
- You can check your answer by using \_\_\_\_\_ .
  - inverse operations
  - substitution
  - isolating the variables
- Explain how you know that the solution to an equation is correct. \_\_\_\_\_  
 \_\_\_\_\_
- To calculate Simon's share of the check, Dijit \_\_\_\_\_ Mary's share from the \_\_\_\_\_ of the check. Simon's share is \_\_\_\_\_ .
- To solve an equation with the same variable on both sides of the equals sign,
  - \_\_\_\_\_ the variable.
  - check the solution by \_\_\_\_\_ in the \_\_\_\_\_ equation.
  - check that the \_\_\_\_\_ is complete and satisfies the \_\_\_\_\_ in the problem.

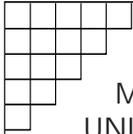
### Key Words:

Inverse operation  
Solve  
Substitution

### Learning Objectives:

- Solving for the variable
- Checking the solution in the original equation
- Checking that the solution is complete and satisfies the conditions in the problem





COURSE: **MSC V**  
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 of the Equation

## Checking the Solution to an Equation

# Your Turn



For Questions 1–4, solve the equation.

1.  $x + x + 3 = 3x + 2$  \_\_\_\_\_

2.  $\frac{1}{2}(6x + 8) = 2x + 10$  \_\_\_\_\_

3.  $2(y + 5) - 2 = 1 - (y + 2)$  \_\_\_\_\_

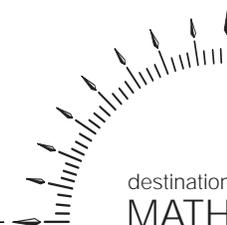
4.  $3(w + 4) + 5 = 2(w + 10)$  \_\_\_\_\_

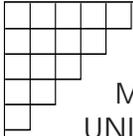
5. Solve and check the equation  $3(x + 2) = x + 12$ .

6. **a.** Two times a man's current age equals his current age plus 30. Write an equation to represent this situation \_\_\_\_\_

**b.** How old is the man now? \_\_\_\_\_ yrs

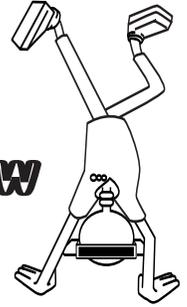
7. Two people are bargaining over the price of a car. The potential buyer asks the seller if he would accept an offer \$6,000 lower than the asking price. The seller refuses, saying, "That would be  $\frac{3}{5}$  of my asking price." What is the asking price of the car? \_\_\_\_\_





COURSE: **MSC V**  
 MODULE 1: **Essentials of Algebra**  
 UNIT 4: **Variable on Both Sides  
 of the Equation**

# Unit Review



## Writing Equations

1. Three fifths of the water in a water tank is the same as the amount of water in a full tank less 10 gallons. Let  $w$  represent the number of gallons of water in the tank. Write an equation to represent how much water is in the tank.

\_\_\_\_\_

2. Apply the distributive property and simplify each side of the following equations:

a.  $28(x + 3) = \frac{1}{4}(32 - x)$  Left side \_\_\_\_\_ Right side \_\_\_\_\_

b.  $\frac{1}{6}(x + 36) = 3(x + 2)$  Left side \_\_\_\_\_ Right side \_\_\_\_\_

## Simplifying Both Sides of an Equation

3. Collect the variable terms on one side of each equation and rewrite the equation:

a.  $184 - \frac{2}{3}x = x - 14$  \_\_\_\_\_

b.  $9,650 - 3x = \frac{1}{2}x + 870$  \_\_\_\_\_

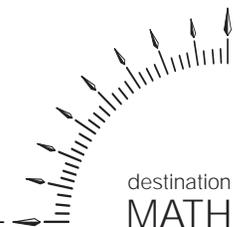
c.  $123 + x = 4x - 87$  \_\_\_\_\_

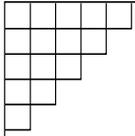
4. When you isolate the variable in the equation  $720 = \frac{2x}{3} - 130$ , the answer is \_\_\_\_\_.

a.  $360 = x - 195$     b.  $1,080 = x - 65$     c.  $1,080 = x - 195$

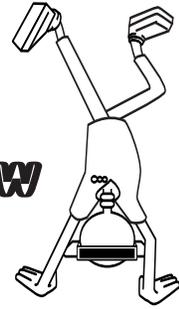
## Checking the Solution to an Equation

5. Solve the equation  $.50(450 - x) = x + 30$ . Show your work and check your solution through substitution.





# Unit Review



## Putting It All Together

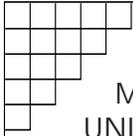
6. Austin and Jack decided to buy a \$120 skateboard that they would share. Because Jack uses the skateboard more than Austin does, Jack should pay a larger portion of the total cost. Fifty percent of what is left over after Austin pays his share is equal to Austin's share plus  $\frac{1}{5}$  of the total cost of the skateboard. If  $x$  represents Austin's share of the cost, find the cost of each boy's share of the skateboard.

- a. Austin's share of the cost of the skateboard \_\_\_\_\_
- b. Jack's share of the cost of the skateboard \_\_\_\_\_

7. The Fundamental Theorem of Algebra states that the number of unique solutions of an equation in one variable is no more than the greatest exponent in the equation. A linear equation with one variable has no more than one unique solution because the greatest exponent of the variable is 1.

- a. What is the greatest exponent in the equation  $x^3 + 2x^2 - x - 2 = 0$ ?  
\_\_\_\_\_.
- b. According to the Fundamental Theorem, the number of unique solutions of the equation is no greater than \_\_\_\_\_.
- c. Show by checking which of the numbers in the set  $\{1, -1, 2, -2\}$  are solutions of this equation. \_\_\_\_\_





COURSE: **MSC V**  
 MODULE 1: **Essentials of Algebra**  
 UNIT 4: **Variable on Both Sides  
 of the Equation**

## Unit Assessment



1. Dina and Sophia compared their scores on a video game. They let  $d$  represent Dina's score and  $s$  represent Sophia's score. Their total score was 786, so that  $d + s = 786$  and  $d = 786 - s$ . Dina's score was 72 points less than Sophia's. An equation that represents this situation is \_\_\_\_\_ .

- a.  $786 - s = s - 72$   
 b.  $s - 786 = s - 72$   
 c.  $786 + s = s - 72$   
 d.  $786 + s = s + 72$

2. Remove the parentheses on both sides of the equation  $\frac{1}{3}(x + 120) = x + \frac{1}{4}(7.60)$

- a. Left side: \_\_\_\_\_  
 b. Right side: \_\_\_\_\_

3. When you isolate the variable in the equation  $18,720 = \frac{8x}{3}$ , the answer is \_\_\_\_\_ .

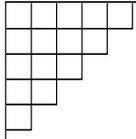
- a.  $49,920 = x$   
 b.  $18,720 = x$   
 c.  $7,020 = x$   
 d.  $6,240 = x$

4. Collect the variable terms on one side in each of the following equations:

- a.  $23,720 + \frac{1}{3}x = \frac{2}{3}x - 645$  \_\_\_\_\_  
 b.  $93 + 2x = 6x + 141$  \_\_\_\_\_  
 c.  $884 - \frac{1}{4}x = \frac{3}{4}x - 25$  \_\_\_\_\_

5. Isolate the variable in  $18,633 = 4x + 89$ . \_\_\_\_\_





# Unit Assessment

6. Solve the equation  $.50(970 - x) = 2x - 45$ . Show your work and check your answer.

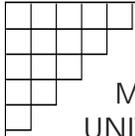
Solve:

Check:

7. The cost of a book of tickets to the fair was \$28.50. Tom and Geena shared the cost of a book of tickets, but Geena used more of the tickets than Tom. Fifty percent of the cost of Geena's share of the tickets is equal to Tom's share plus 30% of the total cost of the tickets. Let  $x$  represent Tom's share and find out how much each person should pay. Check your answer.

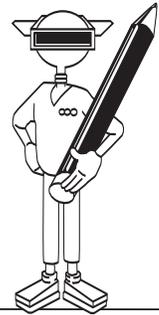
- a. Tom's share \_\_\_\_\_
- b. Geena's share \_\_\_\_\_





COURSE: **MSC V**  
 MODULE 1: **Essentials of Algebra**  
 UNIT 5: **Solving Literal Equations**

# Student Logbook



## Identifying the Variables in a Given Formula

As you work through the tutorial, complete the following statements and questions.

1. The Coneyville water tank is built as a section of a cone known as a(n) \_\_\_\_\_ .

2. In the formula for the volume of the water tank, what do each of these variables represent?

a.  $h =$  \_\_\_\_\_

b.  $r =$  \_\_\_\_\_

c.  $R =$  \_\_\_\_\_

d.  $v =$  \_\_\_\_\_

3. The \_\_\_\_\_ of a circle is the length of any line segment drawn from the center of a circle to any point on the \_\_\_\_\_ .

4. What is the relationship between the radius  $r$  and the diameter  $d$  of a circle?  
 \_\_\_\_\_

5. For the water tank that is being rebuilt, the radius of the \_\_\_\_\_ base is twice the radius of the \_\_\_\_\_ base.

6. Literal equations can be simplified by using \_\_\_\_\_ to express one \_\_\_\_\_ in terms of another and by multiplying and combining \_\_\_\_\_ terms.

7. List two ways literal equations can sometimes be simplified.  
 \_\_\_\_\_  
 \_\_\_\_\_

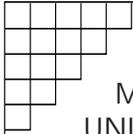
### Key Words:

Frustum  
 Cone  
 Volume  
 Radius  
 Circumference  
 Diameter  
 Like terms

### Learning Objectives:

- Identifying the variables in the formula for the volume of the frustum of a cone
- Recognizing the radius and diameter of a circle
- Using substitution to express one radius in terms of the other
- Simplifying algebraic expressions by multiplying and combining like terms





COURSE: **MSC V**  
 MODULE 1: **Essentials of Algebra**  
 UNIT 5: **Solving Literal Equations**

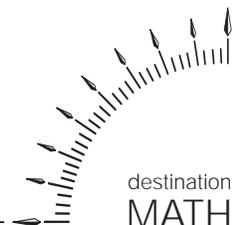
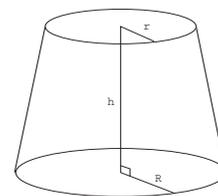
Your  
Turn

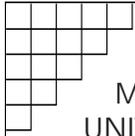


## Identifying the Variables in a Given Formula

- The equation  $d = rt$  is used to find the distance  $d$  traveled at a known rate of speed  $r$  for a certain amount of time  $t$ .
  - List the variables in the formula and tell what each represents.  
 \_\_\_\_\_
  - Express the variable  $r$  in terms of  $t$  and  $d$ . In other words, rewrite the formula with  $r$  as the subject. \_\_\_\_\_
- The area of a rectangle is equal to the length of the rectangle times its width. Use variables  $a$ ,  $l$ , and  $w$  to write a literal equation for the area of a rectangle. \_\_\_\_\_
- The diameter of a circle is 30 cm. What is the radius of the circle?  
 \_\_\_\_\_
- The diameter of one circle is equal to the radius of a second circle. The diameter of the small circle is 5 cm. What is the diameter in centimeters of the second circle? \_\_\_\_\_
- What mathematical operation is implied in the expression  $\pi r$ ?  
 \_\_\_\_\_

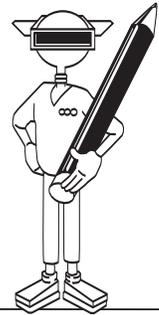
- Dijit knows that the formula for the volume of a frustum is  $v = \frac{1}{3}\pi h (r^2 + rR + R^2)$  where  $h$  is the height,  $r$  is the radius of the upper base, and  $R$  is the radius of the lower base. Help Dijit rewrite a simplified equation for the volume of a frustum that has a height  $h$  of 12 and a top radius  $r$  of 4.





COURSE: **MSC V**  
 MODULE 1: **Essentials of Algebra**  
 UNIT 5: **Solving Literal Equations**

# Student Logbook



## Rewriting a Formula in Terms of a Different Variable

As you work through the tutorial, complete the following statements and questions.

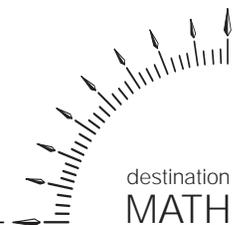
- In the literal equation  $v = \frac{1}{3}\pi h(7r^2)$ , what two symbols does Jesús have values for? \_\_\_\_\_ and \_\_\_\_\_.
- Which variable can he find the value of by sending someone to the site?
- Which variable in the equation above is not known? \_\_\_\_\_
- What must be done to the equation  $v = \frac{1}{3}\pi h(7r^2)$  to remove the denominator of the fraction from the right side? \_\_\_\_\_
- What must be done to the equation  $3v = \pi h(7r^2)$  to remove  $\pi$  from the right side? \_\_\_\_\_
- Dividing both sides of the equation in (5) by  $7r^2$  has the same result as multiplying both sides of the equation by \_\_\_\_\_.
- Which equation represents the height of the tank Jesús is working on?  
 \_\_\_\_\_  
 a.  $h = \frac{\pi 7^2}{3v}$   
 b.  $h = \frac{3v}{\pi 7r^2}$   
 c.  $h = \frac{\pi v}{3(7r^2)}$   
 d.  $h = \frac{3(7^2)}{\pi v}$
- To isolate a particular variable in a literal equation, use \_\_\_\_\_ operations so that the particular variable is the \_\_\_\_\_ term on one side of the \_\_\_\_\_.

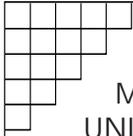
### Key Words:

Pi ( $\pi$ )  
 Volume  
 Isolate  
 Inverse operation

### Learning Objectives:

- Using the properties of equality to rewrite a formula for a particular variable





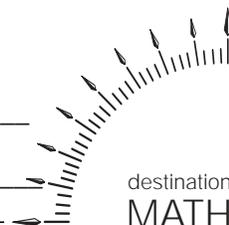
COURSE: **MSC V**  
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 UNIT 5: **Solving Literal Equations**

Your  
Turn

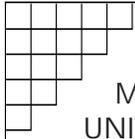


## Rewriting a Formula in Terms of a Different Variable

- The perimeter of a rectangle can be found using the formula  $p = 2(l + w)$ .
  - List and identify the variables in the formula.  
 \_\_\_\_\_
  - Express the length  $l$  of a rectangle in terms of the perimeter  $p$  and the width  $w$ . \_\_\_\_\_
  - Express the width  $w$  of a rectangle in terms of the perimeter  $p$  and the length  $l$ . \_\_\_\_\_
- The formula for the circumference of a circle is  $C = \pi d$  where  $d$  is the length of a diameter.
  - Express the diameter  $d$  of a circle in terms of its circumference  $c$ .  
 \_\_\_\_\_
  - Express the radius  $r$  of a circle in terms of its circumference  $c$ . \_\_\_\_\_
- The formula for the area  $A$  of a circle is  $A = \pi r^2$ . Express the radius  $r$  of a circle in terms of its area. \_\_\_\_\_
- Last weekend, members of the Coneyville Running Club participated in a 5-kilometer race. The fastest runner in the club finished the race in 17.2 minutes. The slowest runner in the club finished the race in 35.6 minutes. Use the formula,  $d = rt$  to answer the following questions, and round your answers to the nearest hundredth.
  - What was the rate of speed in Km/min of the fastest runner in the club? \_\_\_\_\_
  - What was the rate of speed in Km/min of the slowest runner in the club? \_\_\_\_\_
  - How many minutes did it take the fastest runner to run 7 kilometers? \_\_\_\_\_
  - How many minutes did it take the slowest runner to run 2 kilometers? \_\_\_\_\_
  - How many kilometers can the fastest runner run in 12 minutes? \_\_\_\_\_
  - How many kilometers can the slowest runner run in 45 minutes? \_\_\_\_\_

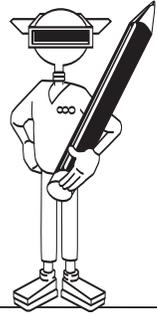


destination  
MATH



COURSE: **MSC V**  
 MODULE 1: **Essentials of Algebra**  
 UNIT 5: **Solving Literal Equations**

# Student Logbook



## Substituting Values & Solving an Equation

As you work through the tutorial, complete the following statements and questions.

1. Dijit now has an equation to solve for the height of the frustum,  $h = \frac{3v}{\pi 7r^2}$

What is the value of each of the following variables?

a.  $v =$  \_\_\_\_\_

b.  $r =$  \_\_\_\_\_

c.  $\pi \approx$  \_\_\_\_\_

2. Rewrite the literal equation solved for  $h$ , substituting the known values from (1). \_\_\_\_\_

3. What is the height of the Coneyville water tank? \_\_\_\_\_

4. How do Dijit and Jesús verify that the height is correct?

\_\_\_\_\_  
 \_\_\_\_\_

5. a. To solve a literal equation for a specific variable, \_\_\_\_\_  
 the known values for the other \_\_\_\_\_.

- b. Use the \_\_\_\_\_ of \_\_\_\_\_ to solve for the subject of the equation.

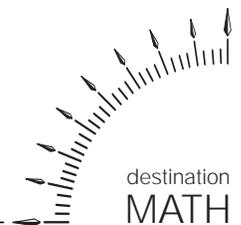
6. To check the solution of an equation, \_\_\_\_\_ the values into the original literal equation and see if both sides of the equation are \_\_\_\_\_.

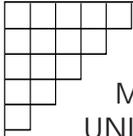
### Key Words:

Substitute  
 Simplify  
 Improper fraction  
 Common factor

### Learning Objectives:

- Substituting values in a literal equation to solve for a particular variable
- Applying the order of operations to simplify expressions
- Checking a solution in the original formula





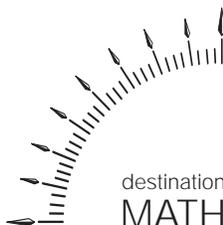
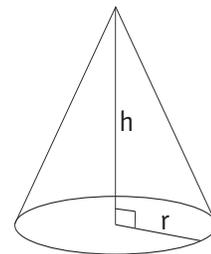
COURSE: **MSC V**  
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 UNIT 5: **Solving Literal Equations**

Your  
Turn

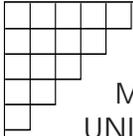


## Substituting Values & Solving an Equation

- The density  $d$  of an object is equal to its mass  $m$  divided by its volume  $v$ , or  $d = \frac{m}{v}$ . The recycling center receives a container of crushed aluminum cans with a mass of 15 kg and a total volume of 5,550 cc. Find the density of the aluminum cans in  $\text{g}/\text{cm}^3$  and round your answer to the nearest tenth. \_\_\_\_\_
- Rewrite the formula for density to solve for  $m$ . \_\_\_\_\_
  - Find the mass of an object with a density of  $19.3 \text{ g}/\text{cm}^3$  and a volume of  $115 \text{ cm}^3$ . \_\_\_\_\_
- A park in Coneyville has a large circular jogging trail around a field. The diameter of the trail is 120 m.
  - What is the radius in meters of the trail? \_\_\_\_\_
  - The formula for the circumference  $C$  of a circle is  $C = \pi d$  where  $d$  is the diameter. Substitute the known values to find the circumference in meters of the jogging trail. Use 3.14 for the value of  $\pi$ . \_\_\_\_\_
  - The formula for the area  $A$  of a circle is  $A = \pi r^2$  where  $r$  is a radius of the circle. Substitute the known values to find the area in square meters of the field surrounded by the circular trail. \_\_\_\_\_
- The volume  $v$  of a cone is given by  $v = \frac{1}{3} \pi r^2 h$ , where  $r$  is the radius of the base, and  $h$  is the height.
  - Rewrite this expression to solve for the height. \_\_\_\_\_
  - Calculate the height of an ice-cream cone that holds 98 cc of ice cream, and has a radius of 2.5 cm. Use 3.14 for the value of  $\pi$  and round your answer to the nearest whole centimeter. \_\_\_\_\_

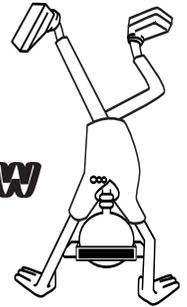


destination  
MATH



COURSE: **MSC V**  
 MODULE 1: **Essentials of Algebra**  
 UNIT 5: **Solving Literal Equations**

## Unit Review

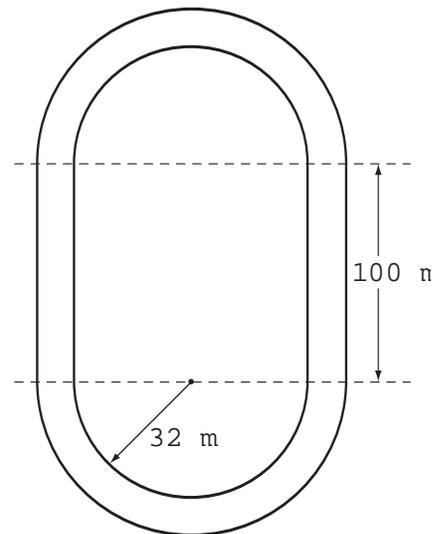


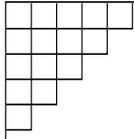
### Identifying the Variables in a Given Formula

- Rockridge has a water tank similar to the one Jesús rebuilt for Coneyville. The tank is also a frustum, but the bottom radius  $R$  is 8 times longer than the top radius. The formula for the volume  $v$  of a frustum is  $v = \frac{1}{3}\pi h (r^2 + rR + R^2)$  which is the height of the frustum.
  - Express the bottom radius in terms of the top radius. \_\_\_\_\_
  - Rewrite the formula for the volume  $v$  of the frustum in terms of  $v$  and  $\pi$  by substituting the expression for  $R$  in part a, and simplifying.

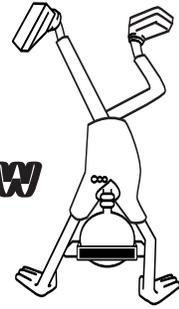
### Rewriting a Formula in Terms of a Different Variable

- The oval track at Coneyville needs a new surface. The straight part of the track is rectangular, with dimensions that are 100 m long and 8 m wide. The curved parts are each halves of an annulus and the radius of the inner circle is 32 m. The area of a rectangle is given by  $A = lw$ . The area of an annulus is given by  $A = \pi(R^2 - r^2)$ , where  $r$  is the radius of the inner circle and  $R$  is the radius of the outer circle.
  - If  $r = \frac{4}{5}R$ , what is an expression for the total area of the curved parts of the track in terms of  $R$  and  $\pi$ ? \_\_\_\_\_





# Unit Review



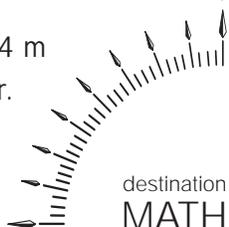
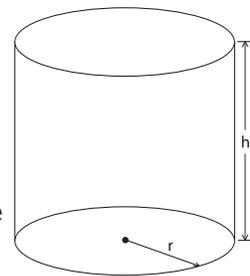
- b. What is the value of  $R$ ? \_\_\_\_\_
- c. Let  $\pi = 3.14$  and find the areas combined in square meters of the curved portion of the track to the nearest whole number. Show your work.
- d. What is the total area in square meters of the two straight portions of the track?  
\_\_\_\_\_
- e. To the nearest whole number, how many square meters of new surface will be needed for the track? \_\_\_\_\_

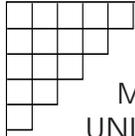
## Substituting Values & Solving an Equation

- 3. Garson's farm has ordered a new grain tower to hold the feed for the horses. This tower will be a right circular cylinder whose lateral surface  $L$  area is given by  $L = 2\pi rh$ , where  $r$  is radius of the base and  $h$  is the height of the cylinder.
  - a. Rewrite the formula  $L = 2\pi rh$  in terms of  $r$ . \_\_\_\_\_
  - b. How many meters long is the radius of the grain tower if the height is 9.75 m and the lateral surface area is  $600 \text{ m}^2$ ? Use  $\pi = 3.14$  and round your answer to the nearest hundredth. \_\_\_\_\_

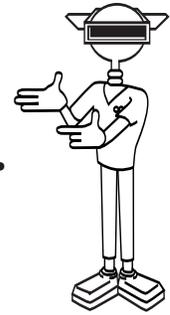
## Putting It All Together

- 4. The volume,  $v$ , of a cylinder is equal to the area,  $A$ , of the circular base times the height,  $h$ . The area of a circle is  $\pi r^2$ . These formulas can be expressed as literal equations:  $v = Ah$  and,  $A = \pi r^2$ .
  - a. Use substitution to combine these two formulas and express the volume  $v$  in terms of  $\pi$ ,  $r$ , and  $h$ . \_\_\_\_\_
  - b. Rewrite the expression in (a) solved for  $h$ . \_\_\_\_\_
  - c. Let  $\pi = 3.14$  and find the height in meters of a cylinder that has a radius of 4 m and a volume of  $500 \text{ m}^3$ . Round your answer to the nearest whole number.  
\_\_\_\_\_





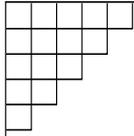
COURSE: **MSC V**  
 MODULE 1: **Essentials of Algebra**  
 UNIT 5: **Solving Literal Equations**



## Unit Assessment

- The circumference  $C$  of a circle is  $C = 2\pi r$  where  $r$  is the radius of the circle. Rewrite this equation solved for  $r$ . \_\_\_\_\_
- The perimeter of a square of side length  $s$  is found using the formula  $p = 4s$ .
  - Write a formula for the side length,  $s$ , of a square in terms of its perimeter,  $p$ . \_\_\_\_\_
  - Find the side length of a square with perimeter of 36 cm. \_\_\_\_\_
- The formula for simple interest is  $I = prt$ , where  $I$  is the interest paid,  $p$  is the original principal, and  $t$  is the time. Rewrite this literal expression solved for  $r$ . \_\_\_\_\_
- The area of a triangle is  $\frac{1}{2}$  the base  $b$  times the height  $h$ , or  $A = \frac{1}{2}bh$ . If you know the area of a triangle and the measure of the height, what operations can you apply to this literal equation to solve the equation for  $b$ ? \_\_\_\_\_
- The formula for the volume  $v$  of a ball is  $v = \frac{4}{3}\pi r^3$  where  $r$  is the radius of the ball.
  - Calculate the volume of a ball if  $r = 2$  inches. Use 3.14 for  $\pi$ , and round your answer to the nearest hundredth. \_\_\_\_\_  $\text{cm}^3$
  - Rewrite the formula solved for  $r^3$ . \_\_\_\_\_





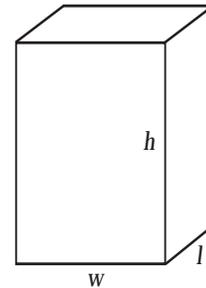
# Unit Assessment



6. The volume of a right rectangular prism is given by the formula  $V = l \times w \times h$ .

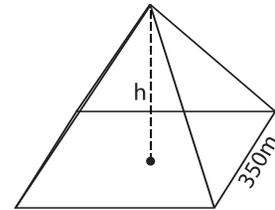
a. Rewrite the formula solved for the height. \_\_\_\_\_

b. A right rectangular prism has a length of 10 cm, a width of 5 cm, and a volume of  $1,000 \text{ cm}^3$ . What is its height? \_\_\_\_\_



7. The pyramid of Quetzalcoatl in Cholula, Mexico, was the largest building constructed in pre-Columbian Mexico. The volume of the structure is estimated to be about 3 million cubic meters. The base of the pyramid is a square with 350 m on each side.

a. The formula for the volume of a pyramid is  $V = \frac{1}{3} Bh$ , where  $B$  is the area of the base and  $h$  is the height of the pyramid. Write a formula for the height in terms of the volume and area of the base.

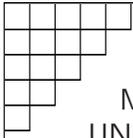


b. Use the formula from part a and calculate the height in meters of this pyramid.

Rewrite your answer to the nearest whole number. \_\_\_\_\_

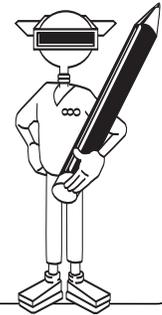
\_\_\_\_\_





COURSE: **MSC V**  
 MODULE 2: **Fundamentals of Geometry**  
 UNIT 1: **Geometry Fundamentals**

# Student Logbook



## Naming & Measuring Angles

As you work through the tutorial, complete the following statements and questions.

1. A protractor is used to \_\_\_\_\_ .
2. Angles are measured in units called \_\_\_\_\_ .
3. An angle containing  $90^\circ$  is called a(n) \_\_\_\_\_ angle.
4. When two lines meet to form a right angle, they are \_\_\_\_\_ to one another.
5. What is the symbol for "is perpendicular to." \_\_\_\_\_
6. A parallelogram is a \_\_\_\_\_ whose two pairs of \_\_\_\_\_ are \_\_\_\_\_ .
7. A straight angle contains \_\_\_\_\_ degrees.
8. What symbol is used to represent an angle? \_\_\_\_\_
9. Which letter represents the vertex of angle  $\angle COP$ ? \_\_\_\_\_
10. An obtuse angle contains more than \_\_\_\_\_ degrees but less than \_\_\_\_\_ degrees.
11. Are the angles formed by the corners of the pool table right angles or obtuse angles? \_\_\_\_\_ Explain. \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

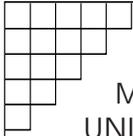
**Key Words:**

- Line
- Line segment
- Parallel
- Perpendicular
- Rectangle
- Parallelogram
- Angle
- Degree
- Right angle
- Straight angle
- Obtuse angle

**Learning Objectives:**

- Defining a right angle
- Using a protractor to measure angles
- Knowing the meaning of 'perpendicular'
- Recognizing a parallelogram as a 4-sided figure having opposite parallel sides
- Recognizing a straight angle
- Naming angles
- Defining obtuse angles





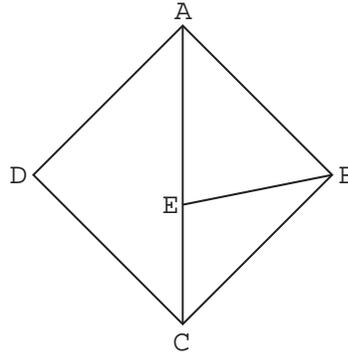
COURSE: **MSC V**  
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Your  
Turn



## Naming & Measuring Angles

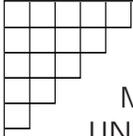
Sophie takes her dog Jeffrey to a baseball diamond to run. Use the diagram of the baseball diamond to complete the questions.



- Sophie notices that the baseball diamond has four sides and that both pairs of opposite sides are parallel. What is this shape called? \_\_\_\_\_
- Angle ADC is a right angle. How many degrees are in this angle? \_\_\_\_\_
- If  $\angle ADC$  is a right angle, what might Sophie know about the segments that meet at point D? \_\_\_\_\_
- Sophie and Jeffrey begin walking directly from C to A. When they reach E, Jeffrey begins running toward B. What kind of angle is  $\angle CEB$ ? \_\_\_\_\_
- To measure the number of degrees contained in  $\angle CEB$ , what tool could Sophie use? \_\_\_\_\_
- Name a straight angle whose vertex is at E. \_\_\_\_\_
- Sophie walks across the baseball diamond from C to A. Is her path a line or a line segment? \_\_\_\_\_  
 Explain your answer. \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

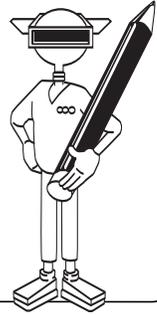


destination  
MATH



COURSE: **MSC V**  
 MODULE 2: **Fundamentals of Geometry**  
 UNIT 1: **Geometry Fundamentals**

# Student Logbook



## Defining Complementary & Supplementary Angles

As you work through the tutorial, complete the following statements and questions.

1. An obtuse angle contains more than \_\_\_\_\_°, but less than \_\_\_\_\_°.
2. If you subtract an angle measuring  $135^\circ$  from a straight angle, the difference is an angle measuring \_\_\_\_\_.
3. An acute angle contains more than \_\_\_\_\_°, but less than \_\_\_\_\_°.
4. Supplementary angles are two angles whose measures add up to \_\_\_\_\_ degrees.
5. Complementary angles are two angles whose measures add up to \_\_\_\_\_ degrees.
6. Can a pair of angles be both complementary and supplementary?  
 \_\_\_\_\_ How do you know? \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

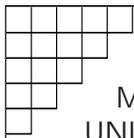
### Key Words:

Degrees  
 Obtuse angle  
 Acute angle  
 Supplementary angle  
 Complementary angle

### Learning Objectives:

- Defining an acute angle
- Defining supplementary angles
- Defining complementary angles
- Writing equations to show relationships between angles





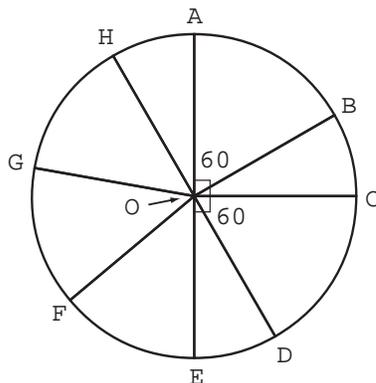
COURSE: **MSC V**  
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Your  
Turn



## Defining Complementary & Supplementary Angles

After going to the movies, Carla and Roudy share a circular pizza. Carla cuts the pizza into 8 unequal slices. AOE is a diameter of the circle and  $CO \perp AE$ . Use the diagram to complete the following questions.



1.  $\angle AOB$  measures  $60^\circ$  what is the measure of  $\angle BOC$ ? \_\_\_\_\_

2. Name two angles that are complementary to  $\angle BOC$ . \_\_\_\_\_  
 \_\_\_\_\_

3. Is  $\angle BOE$  acute or obtuse? \_\_\_\_\_ How do you know? \_\_\_\_\_  
 \_\_\_\_\_

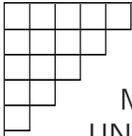
4. Name an angle that is supplementary to  $\angle DOA$ . \_\_\_\_\_

5. Angles EOF, FOG, and GOH each have a measure of  $x$ . Angle AOH has a measure of  $30^\circ$ .

a. Write an equation you could use to find the value of  $x$ . \_\_\_\_\_

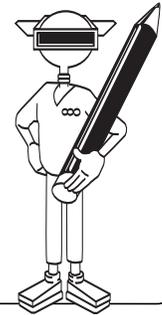
b. Use your equation to find the value of  $x$ . \_\_\_\_\_  
 \_\_\_\_\_





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# Student Logbook



## Recognizing Congruent Angles

As you work through the tutorial, complete the following statements and questions.

- If a pair of angles have measures whose sum is  $180^\circ$ , the angles are \_\_\_\_\_.
- Describe in words how the notation  $m\angle a$  is read. \_\_\_\_\_
- Pairs of nonadjacent congruent angles formed by intersecting lines are called \_\_\_\_\_.
- What is the symbol that means "is congruent to"? \_\_\_\_\_
- Dijit placed his pool cue on the table to form 2 pairs of nonadjacent congruent angles. Dijit found that  $\angle a \cong$  \_\_\_\_\_ and  $\angle b \cong$  \_\_\_\_\_.
- Are angles c and y congruent? \_\_\_\_\_
- Why are angles x and d called alternate interior angles? \_\_\_\_\_
- What do you know about the measures of angles k and d?  
\_\_\_\_\_

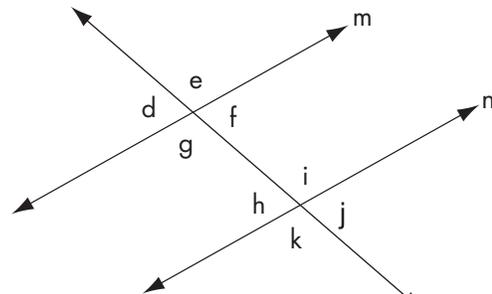
**Key Words:**

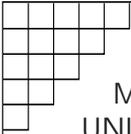
- Congruent angles
- Supplementary angles
- Vertical angles
- Alternate interior angles
- Alternate exterior angles

**Learning Objectives:**

- Recognizing supplementary angles
- Defining congruent angles
- Defining vertical angles
- Establishing congruence between pairs of angles
- Identifying pairs of alternate interior and alternate exterior angles

- Angles d and f are \_\_\_\_\_ angles.
- The angle verticle to angle j is \_\_\_\_\_.
- e and k are called \_\_\_\_\_
- Lines m and n are parallel. What is true of pairs of alternate exterior angles? \_\_\_\_\_



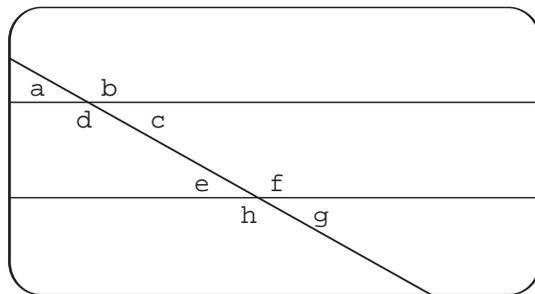


# Your Turn



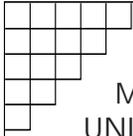
## Recognizing Congruent Angles

Javier goes to the swimming pool to practice laps, but finds that he cannot swim a complete lap. Two of the lane separators in the pool are parallel, but the third is stretched sideways across the pool. Use the diagram of the pool to complete the questions.

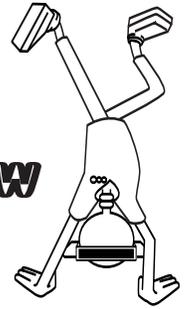


1. Which four angles are supplementary to  $\angle a$ ? \_\_\_\_\_
2. Are angles  $a$  and  $c$  congruent? \_\_\_\_\_ Explain your answer. \_\_\_\_\_  
 \_\_\_\_\_
3. Name all the angles that are congruent to  $\angle e$ . \_\_\_\_\_
4. What angle is vertical  $\angle g$ ? \_\_\_\_\_
5. What do you know about the measures of vertical angles? \_\_\_\_\_  
 \_\_\_\_\_
6. Name all the pairs of alternate interior angles in the figure. \_\_\_\_\_
7. Are angles  $b$  and  $g$  alternate exterior angles? \_\_\_\_\_ Explain your answer. \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_





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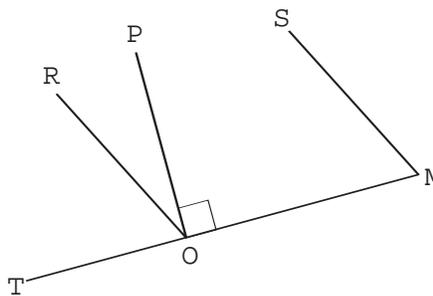


# Unit Review

## Naming & Measuring Angles

In the figure below,  $PO \perp TM$  and  $RO$  is parallel to  $SM$ . Use the letters to name as many examples of each of the following as you can.

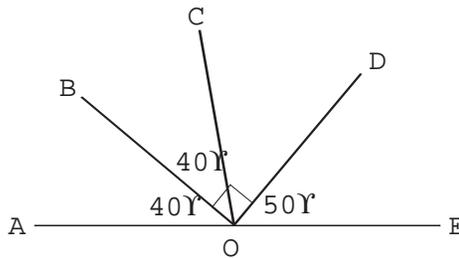
1. a right angle \_\_\_\_\_
2. an obtuse angle \_\_\_\_\_
3. a straight angle \_\_\_\_\_
4. a pair of parallel line segments  
\_\_\_\_\_



5. a pair of perpendicular line segments \_\_\_\_\_

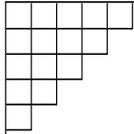
## Defining Complementary & Supplementary Angles

In the diagram below,  $\angle BOD$  is a right angle. Use the diagram to complete the questions.

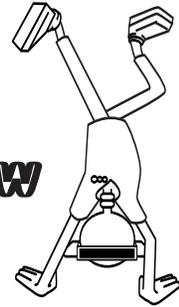


6. Name two acute angles that make up  $\angle AOC$ . \_\_\_\_\_
7. Name an angle complementary to  $\angle BOC$ . \_\_\_\_\_
8. Name an angle supplementary to  $\angle COE$ . \_\_\_\_\_





# Unit Review



## Recognizing Congruent Angles

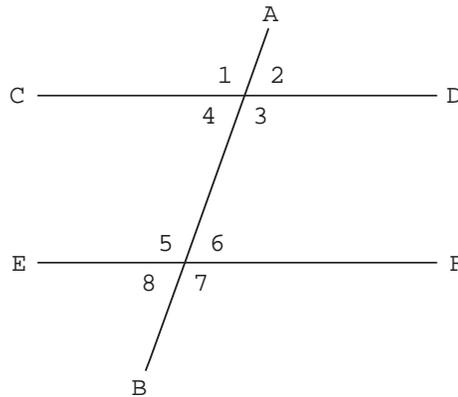
In the diagram below, segment CD is parallel to segment EF. Angle 2 is an acute angle. Use the diagram to complete the questions.

9. Name four pairs of vertical angles.

\_\_\_\_\_

10. Name two pairs of alternate interior angles. \_\_\_\_\_

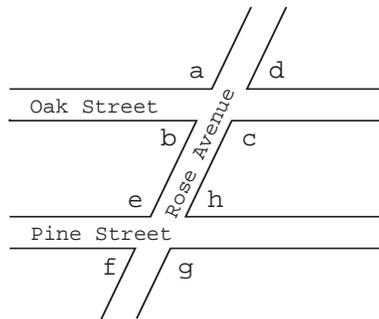
11. Name two pairs of alternate exterior angles. \_\_\_\_\_



12. Name all the angles congruent to  $\angle 5$ . \_\_\_\_\_

## Putting It All Together

In the street map below, Oak and Pine Streets are parallel. Angle d is an acute angle measuring  $80^\circ$ . Angle g has a measure of  $120^\circ$ . Use the map to complete the questions.

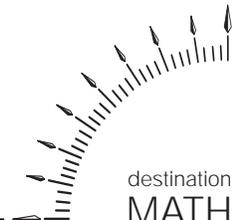


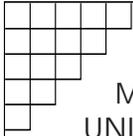
13. How do you know that Rose Avenue is not perpendicular to Oak Street?  
\_\_\_\_\_

14. What kind of angle is  $\angle g$ ? \_\_\_\_\_

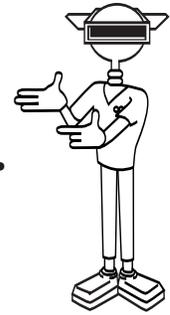
15. Angles a and g are a pair of \_\_\_\_\_ angles.

16. Explain how you know that angles d and g are supplementary. \_\_\_\_\_  
\_\_\_\_\_



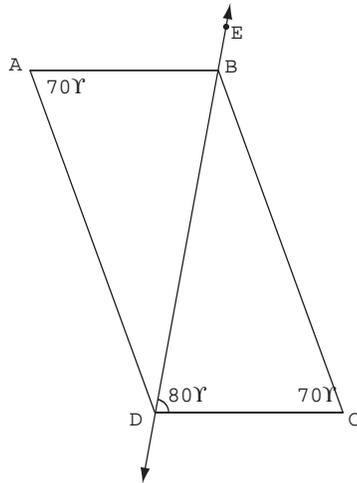


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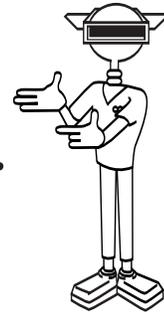
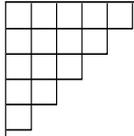
# Unit Assessment

Use the diagram below to answer the questions that follow. In the diagram, both pairs of opposite sides are parallel.



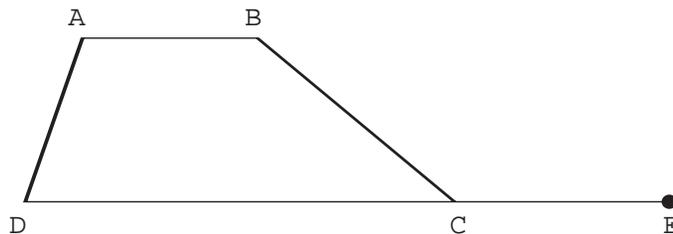
1. What type of figure is polygon ABCD? \_\_\_\_\_
2. Name an angle whose measure is  $70^\circ$ . \_\_\_\_\_
3. Is  $\angle BDC$  an acute, obtuse, or straight angle? \_\_\_\_\_
4. Draw a perpendicular line segment from D that intersects line segment AB. Label the point of intersection F.
  - a. What is the measure of  $\angle AFD$ ? \_\_\_\_\_ What kind of angle is this? \_\_\_\_\_
  - b. Name a pair of supplementary angles that have F as their vertex. \_\_\_\_\_





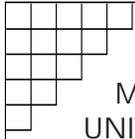
# Unit Assessment

6. Angle BDC is one of a pair of alternate interior angles. Name the other angle. \_\_\_\_\_
7. What do you know about the measures of alternate interior angles between two parallel lines?  
\_\_\_\_\_
8. Angle ABE has a measure of  $x$ . Write an equation that expresses the relationship  $x$  and the measure of  $m \angle ABD$ . \_\_\_\_\_
9. Use the equation in 8 to find the value of  $x$ . Show your work.
10. Are angles ABE and DBC a pair of vertical angles? \_\_\_\_\_ Explain.  
\_\_\_\_\_
11. A trapezoid is a quadrilateral with exactly two sides that are parallel. Sides  $\overline{AB}$  and  $\overline{CD}$  of trapezoid ABCD are parallel. Use what you know about parallel lines and angles to answer the following questions.



- a.  $\angle ABC$  and  $\angle BCE$  are called \_\_\_\_\_ .
- b. What is the sum of  $m \angle BCE$  and  $m \angle BCD$ ? \_\_\_\_\_
- c. What is the sum of  $m \angle ABC$  and  $m \angle BCD$ ? \_\_\_\_\_
- d. What is the sum of  $m \angle BAD$  and  $m \angle ADC$ ? \_\_\_\_\_
- e. What is the sum of all of the interior angles of a trapezoid? \_\_\_\_\_

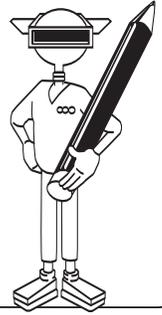




COURSE: **MSC V**  
 MODULE 2: **Fundamentals of Geometry**  
 UNIT 2: **Triangles**

## Classifying Triangles by Sides

## Student Logbook



**As you work through the tutorial, complete the following statements and questions.**

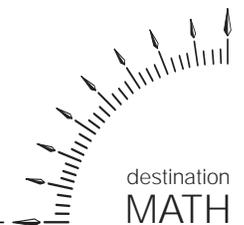
1. The total weight of Dijit and the glider is \_\_\_\_\_ lb.
2. The area of sail needed for the glider to carry Dijit safely is \_\_\_\_\_ ft<sup>2</sup>.
3. A quadrilateral has \_\_\_\_\_ sides and \_\_\_\_\_ angles.
4. In the description of the sail, the length along the keel is \_\_\_\_\_ ,  
and the width of the support rod is \_\_\_\_\_ .
5. A(n) \_\_\_\_\_ triangle is a triangle that contains a \_\_\_\_\_ degree angle.
6. A triangle that has two equal sides is called a(n) \_\_\_\_\_ triangle.
7. Can a triangle be classified as both an isosceles triangle and a right triangle? \_\_\_\_\_ If so, what measurement must one of the angles have? \_\_\_\_\_
8. When you draw a triangle, how do you show that two sides are equal?  
\_\_\_\_\_
9. A scalene triangle has \_\_\_\_\_ equal sides.
10. Can a scalene triangle also be a right triangle? \_\_\_\_\_
11. What are two ways to classify triangles? \_\_\_\_\_

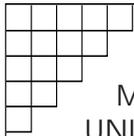
### Key Words:

Quadrilateral  
 Area  
 Triangle  
 Angle  
 Right triangle  
 Isosceles triangle  
 Scalene triangle

### Learning Objectives:

- Dissecting a quadrilateral into sets of triangles
- Defining a right triangle
- Defining an isosceles triangle
- Defining a scalene triangle



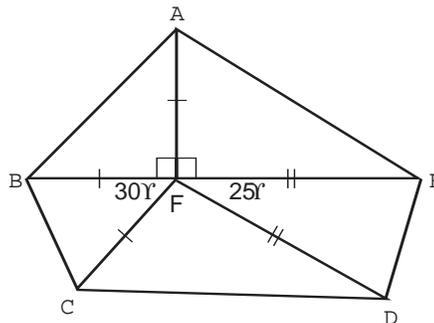


# Your Turn



## Classifying Triangles by Sides

Use this figure to answer questions 1–8.



1. Is figure  $AFCDE$  a quadrilateral? Why or why not? \_\_\_\_\_

2. Triangle  $\triangle BFC$  has two equal sides. What kind of triangle is this?

- a. right triangle
- b. scalene triangle
- c. isosceles triangle
- d. scalene right triangle

3. Which triangle is an isosceles right triangle? \_\_\_\_\_

4. Which triangle is a scalene right triangle? \_\_\_\_\_

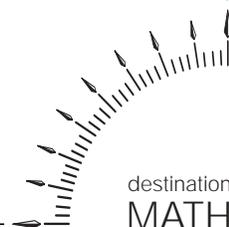
5. Triangle  $\triangle CFD$  has three unequal sides. What kind of triangle is it?

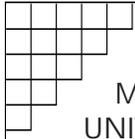
- a. right triangle      b. isosceles triangle      c. scalene triangle
- d. isosceles right triangle

6. Triangle  $\triangle AFE$  has three unequal sides and a  $90^\circ$  angle. Which of the following best describes this triangle? \_\_\_\_\_

- a. right triangle      b. scalene triangle      c. isosceles right triangle
- d. scalene right triangle

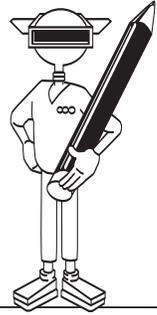
7. Quadrilateral  $AEDF$  is divided into two triangles,  $\triangle AEF$  and \_\_\_\_\_ .





COURSE: MSC V  
 MODULE 2: Fundamentals of Geometry  
 UNIT 2: Triangles

# Student Logbook



## Exploring the Area of a Triangle

As you work through the tutorial, complete the following statements and questions.

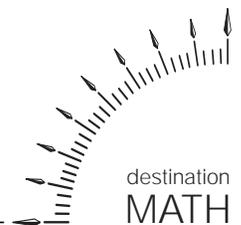
1. Dividing a rectangle by a diagonal results in creating two \_\_\_\_\_ having \_\_\_\_\_ areas.
2. The area  $A$  of a rectangle equals \_\_\_\_\_. So, one half of the area of a rectangle,  $\frac{1}{2}(b \times h)$ , equals the area of a \_\_\_\_\_.
3. The height of a triangle is a \_\_\_\_\_ segment drawn from a \_\_\_\_\_ of the triangle to the opposite side.
4. Dijit divides the sail into two equal triangles and finds the area of one of the triangles. How does Dijit find the total area of the sail? \_\_\_\_\_
5. What is the total area of the glider sail? \_\_\_\_\_
6. How many degrees are in a triangle? \_\_\_\_\_
7. An equiangular triangle has \_\_\_\_\_ equal \_\_\_\_\_° angles.
8. An equilateral triangle has \_\_\_\_\_ sides.
9. Can a triangle be equiangular but not equilateral? \_\_\_\_\_

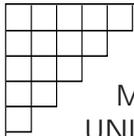
### Key Words:

Triangle  
 Area  
 Rectangle  
 Parallelogram  
 Equilateral triangle  
 Equiangular triangle

### Learning Objectives:

- Relating the area of a triangle to the area of a rectangle
- Identifying the height of a triangle
- Calculating the area of a triangle
- Defining an equilateral triangle





COURSE: **MSC V**  
 MODULE 2: **Fundamentals of Geometry**  
 UNIT 2: **Triangles**

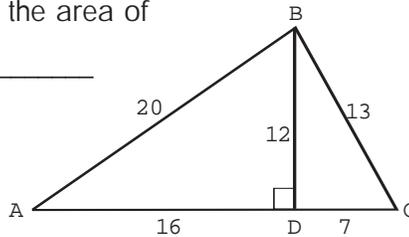
Your Turn



# Exploring the Area of a Triangle

1. What formula is can you use to calculate the area of a triangle? \_\_\_\_\_

2. If  $\overline{BD}$  is a height in  $\triangle ABC$  which of the following represents the base of triangle  $\triangle ABC$ ?



\_\_\_\_\_

- a.  $\overline{AB}$    b.  $\overline{BC}$    c.  $\overline{AD}$    d.  $\overline{AC}$

3. What is the measure of  $\angle BDA$ ? \_\_\_\_\_

4. What kind of triangle is  $\triangle BDA$ ? \_\_\_\_\_

5. What is the length of the  $\overline{AC}$  ? \_\_\_\_\_

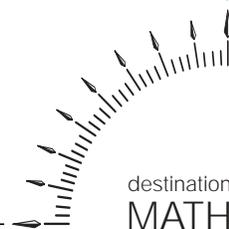
6. What is  $\overline{BD}$  ? \_\_\_\_\_

7. What is the area of  $\triangle ABC$ ? \_\_\_\_\_

8. What is the area of  $\triangle BDC$ ? \_\_\_\_\_

9. What is the area of  $\triangle BDA$ ? \_\_\_\_\_

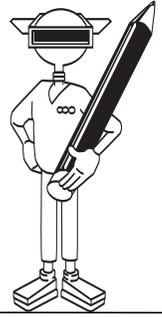
10. Write an equation that shows the relationship between the areas of the triangles in questions 7, 8, and 9 \_\_\_\_\_.





COURSE: **MSC V**  
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 UNIT 2: **Triangles**

# Student Logbook



## Classifying Triangles by Angles

As you work through the tutorial, complete the following statements and questions.

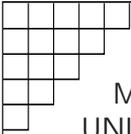
1. What instrument is used to measure angles? \_\_\_\_\_
2. An angle that measures more than \_\_\_\_\_ degrees but less than \_\_\_\_\_ degrees is called an acute angle.
3. The sum of the measures of the angles of a triangle is \_\_\_\_\_ .
4. A right triangle contains exactly \_\_\_\_\_ right angle.
5. A straight angle has a measure of \_\_\_\_\_ .
6. Can a triangle contain a straight angle? \_\_\_\_\_
7. Explain your answer to Question 6. \_\_\_\_\_  
\_\_\_\_\_
8. An acute triangle has three \_\_\_\_\_ angles.
9. An angle that measures more than \_\_\_\_\_ degrees but less than \_\_\_\_\_ degrees is called an obtuse angle.
10. An obtuse triangle has one \_\_\_\_\_ angle.
11. Can an obtuse triangle have more than 1 obtuse angle? \_\_\_\_\_  
Explain your answer. \_\_\_\_\_

### Key Words:

Right angle  
 Right triangle  
 Straight angle  
 Acute angle  
 Acute triangle  
 Obtuse angle  
 Obtuse triangle

### Learning Objectives:

- Applying the triangle sum formula to find missing angle measures
- Identifying right triangles
- Identifying acute triangles
- Identifying obtuse triangles

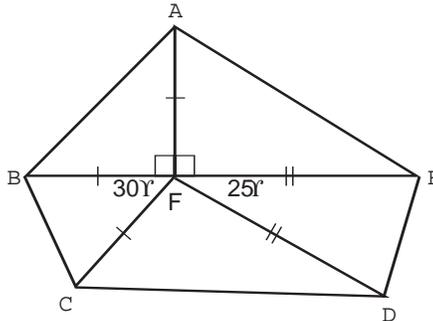


# Your Turn

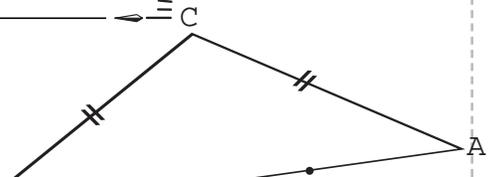
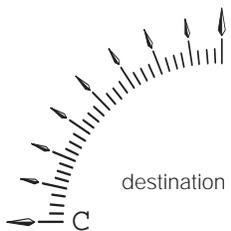


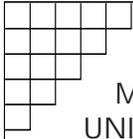
## Classifying Triangles by Angles

Answer each question using the following diagram.



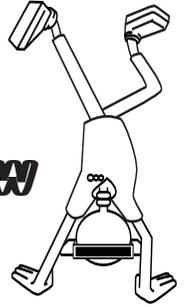
1. Which triangle(s) have right angles?  
\_\_\_\_\_
2. Which triangle(s) are right triangles? \_\_\_\_\_
3. Which triangle(s) have all acute angles? \_\_\_\_\_
4. Which triangle(s) are acute? \_\_\_\_\_
5. Which triangle(s) have obtuse angles? \_\_\_\_\_
6. Which triangle(s) are obtuse? \_\_\_\_\_
7. Name one straight angle in the figure. \_\_\_\_\_
8. **a.** Which two triangles that share a common side make up a third triangle? \_\_\_\_\_
- b.** What kind of triangles are those named in 8a?  
\_\_\_\_\_  
\_\_\_\_\_





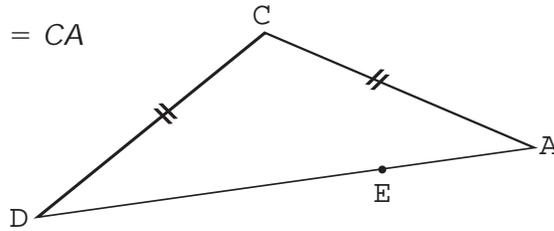
COURSE: **MSC V**  
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## Unit Review



### Classifying Triangles by Sides

In the figure on the right,  $CD = CA$   
 and  $\angle DCA = 110^\circ$ .

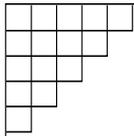


1. What kind of triangle is  $\triangle ACD$ ? \_\_\_\_\_
2. Draw  $CE$ . If  $\overline{CD}$ ,  $\overline{CE}$ , and  $\overline{DE}$  are not congruent, what kind of triangle is  $\triangle CED$ ? \_\_\_\_\_
3. Draw a segment from  $E$  perpendicular to  $CA$ . Label the point of intersection  $B$ . How many degrees are in  $\angle ABE$ ? \_\_\_\_\_
4. What kind of triangle is  $\triangle CBE$ ? \_\_\_\_\_

### Exploring the Area of a Triangle

In  $\triangle CBE$  above,  $BE = 5$  cm, and  $CB = 8$  cm.

5. Find the area of  $\triangle CBE$ . Show your work below.
6. Which line segment did you use as the height? \_\_\_\_\_
7. Is triangle  $\triangle CBE$  equilateral? \_\_\_\_\_  
 Explain your answer. \_\_\_\_\_  
 \_\_\_\_\_



# Unit Review



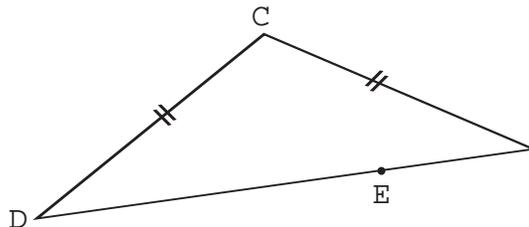
## Classifying Triangles by Angles

In the diagram  $\triangle CDA$  is isosceles. The angles opposite the equal sides of an isosceles triangle are equal.

8. Find  $m\angle CDA$  and  $m\angle CAD$ . \_\_\_\_\_

9. What other term could describe isosceles  $\triangle CDA$ ? \_\_\_\_\_

10. If  $m\angle DCE$  is less than  $90^\circ$ , what kind of triangle is  $\triangle CDE$ ? \_\_\_\_\_

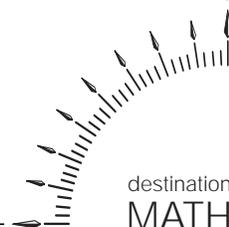


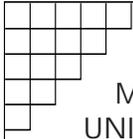
## Putting It All Together

11. The headings across the top row of the table are terms that classify triangles by their sides. The headings in the first column are terms that classify triangles by their angles. For each pair of conditions, draw a triangle and mark any equal sides or angles. If it is not possible to draw a triangle that satisfies both conditions, write *not possible* for that triangle.

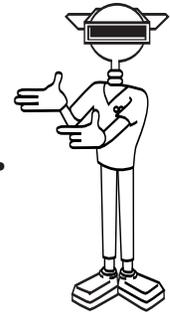
Triangles

	Scalene	Isosceles	Equilateral
Acute			
Right			
Obtuse			



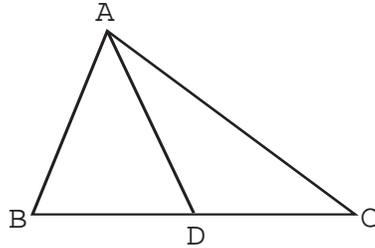


COURSE: **MSC V**  
 MODULE 2: **Fundamentals of Geometry**  
 UNIT 2: **Triangles**



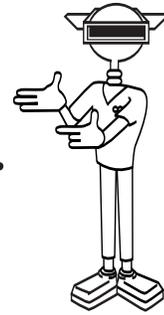
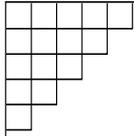
# Unit Assessment

Study the diagram and answer each question below. In this figure,  $AB = 4$ ,  $AC = 6.2$ , and  $BC = 6.6$ . Point  $D$  is the midpoint of  $BC$ .



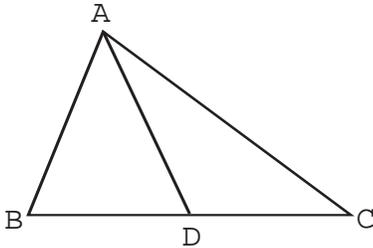
1. Define a scalene triangle. \_\_\_\_\_
2. Can a scalene triangle also be isosceles? \_\_\_\_\_ Why or why not?  
\_\_\_\_\_
3. What triangle in this figure is an acute triangle? \_\_\_\_\_
4. If  $m\angle ADC$  is greater than  $\angle ADB$ , identify an obtuse triangle in the figure.
5. What are the lengths of  $\overline{BD}$  and  $\overline{DC}$ ? \_\_\_\_\_
6. Draw  $\overline{AE}$  perpendicular to  $\overline{BC}$ . If  $AE = 3.8$ , find the area of  $\triangle ABC$  to the nearest tenth. Show your work in the space provided.
7. What is the area of  $\triangle ABD$  to the nearest tenth? Show your work below.





# Unit Assessment

8. In the figure, what is the area of  $\triangle ADC$  to the nearest tenth? Show your work below.

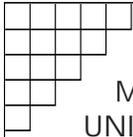


9. What do you notice about the areas of  $\triangle ABD$  and  $\triangle ADC$ ? Explain your observation. \_\_\_\_\_  
\_\_\_\_\_

10. In the space below, draw an isosceles right triangle,  $\triangle DEF$ . Mark the hypotenuse, the side opposite the right angle, as  $EF$ .

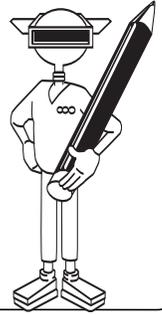
- Use like markings to show which sides of  $\triangle DEF$  are equal.
- Use a protractor and measure the angles to the nearest degree. Label the measure of each angle. \_\_\_\_\_
- Draw a second triangle with  $EF$  as one side of equilateral triangle labeled  $\triangle EFG$ .
- Use markings to show the equal sides of  $\triangle EFG$ .
- Use a protractor and measure the angles to the nearest degree. Label the measure of each angle. What do you observe? \_\_\_\_\_  
\_\_\_\_\_





COURSE: MSC V  
 MODULE 2: Fundamentals of Geometry  
 UNIT 3: Volume & Surface Area

# Student Logbook



## Calculating the Volume of a Right Triangular Prism

As you work through the tutorial, complete the following statements and questions.

1. What property of a figure do you measure using cubic feet—perimeter, area, distance, volume, or weight? \_\_\_\_\_
2. \_\_\_\_\_ is a three-dimensional measurement that describes how much \_\_\_\_\_ an object takes up.
3. What is Dijit trying to find the volume of? \_\_\_\_\_
4.  $B$  is the area of the rectangular base of the prism. How can you write the expression  $b \times h \times l$  using the variable  $B$ ? \_\_\_\_\_.
5. What is the difference between what the variables  $B$  and  $b$  represent?  
\_\_\_\_\_
6. A prism that is formed by a set of rectangles is called a(n) \_\_\_\_\_.
7. A prism in which all the faces are rectangles is called a(n) \_\_\_\_\_.
8. What kind of prism is Dijit's new apartment? \_\_\_\_\_
9. What is the formula for the volume of a right triangular prism in terms of  $b$ ,  $h$ , and  $l$ ? \_\_\_\_\_.
10. What is the volume of Dijit's new apartment? \_\_\_\_\_

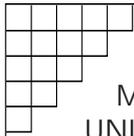
### Key Words:

Volume  
 Triangular prism  
 Rectangular prism  
 Right prism  
 Length  
 Width  
 Height  
 Base

### Learning Objectives:

- Classifying a prism according to its base
- Identifying right prisms
- Expressing the volume of a right triangular prism  
 $V = \frac{1}{2}(bh)l$
- Calculating the volume of a right triangular prism





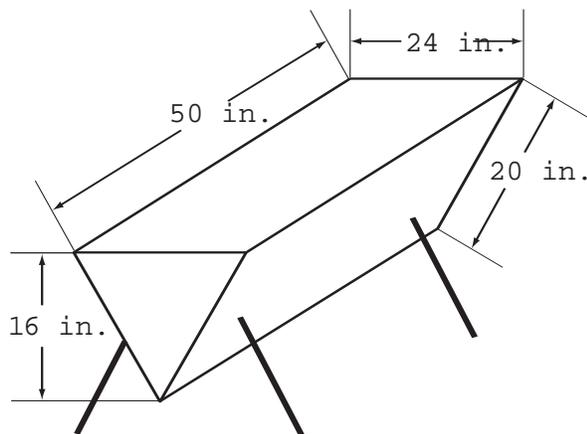
COURSE: **MSC V**  
 MODULE 2: **Fundamentals of Geometry**  
 UNIT 3: **Volume & Surface Area**

# Your Turn



## Calculating the Volume of a Right Triangular Prism

Dijit decides to build a glass table to go with his couch. Sophie designs the table below. It is a hollow prism that she will fill with brightly colored marbles.



1. What kind of prism is the table? \_\_\_\_\_

2. Sophie needs to calculate the quantity of marbles she will need to fill the table. Should she find the area, the surface area, or the volume of the table?

\_\_\_\_\_

Explain your answer. \_\_\_\_\_

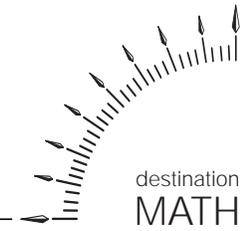
\_\_\_\_\_

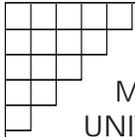
3. What formula can Sophie use to calculate the volume of the table? \_\_\_\_\_

4. What formula can Sophie use to find the area of the base,  $B$ , in terms of  $b$  and  $h$ ? \_\_\_\_\_

5. Using the measurements in the figure above, find the area of the triangular base. Include the correct unit in your answer. \_\_\_\_\_

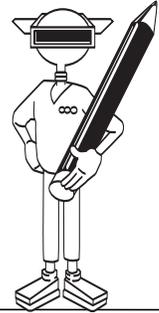
6. Find the volume of the table. Include the correct unit in your answer. \_\_\_\_\_





COURSE: MSC V  
 MODULE 2: Fundamentals of Geometry  
 UNIT 3: Volume & Surface Area

# Student Logbook



## Calculating the Surface Area of a Right Triangular Prism

As you work through the tutorial, complete the following statements and questions.

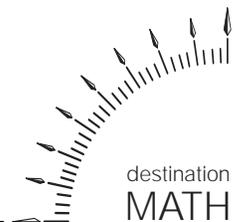
1. What does Dijit need to calculate before Sophie can buy the aluminum foil for the walls of his new apartment? \_\_\_\_\_
2. The \_\_\_\_\_ of a prism can be found by finding the sum of the areas of the \_\_\_\_\_ of the prism.
3. Why doesn't Dijit need to use the entire surface area? \_\_\_\_\_
4. How does Dijit find the area of each rectangular wall? \_\_\_\_\_
5. How does Dijit find the area of each triangular wall? \_\_\_\_\_
6. The \_\_\_\_\_ of a prism are the flat surfaces that make up the prism.

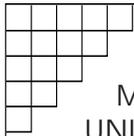
### Key Words:

Surface area  
 Triangular prism  
 Right prism  
 Faces  
 Base  
 Height  
 Triangle  
 Rectangle

### Learning Objectives:

- Defining the surface area of an object
- Defining the faces of a right triangular prism
- Recognizing a foldout for a right triangular prism
- Calculating part of the surface area of a right triangular prism





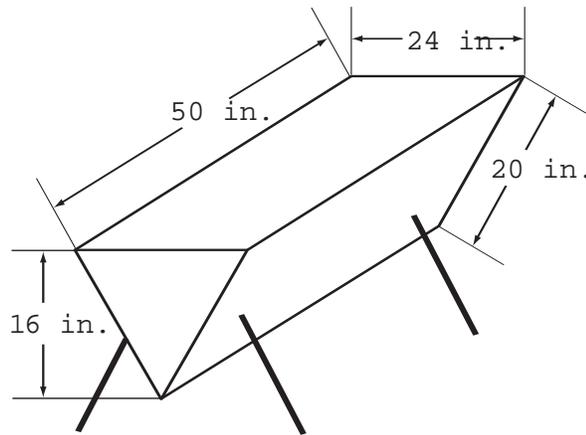
COURSE: **MSC V**  
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Your  
Turn

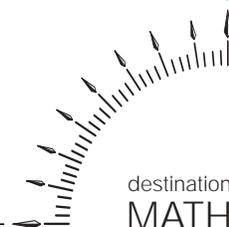


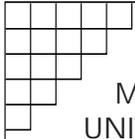
## Calculating the Surface Area of a Right Triangular Prism

Dijit is afraid that the glass table in his apartment will get scratched. Sophie tells him that he can cover the outside glass with a thin, transparent, scratch-resistant film.



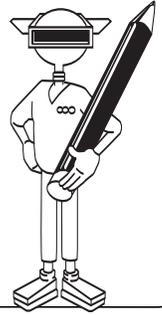
1. Sophie needs to calculate how much film she will need to cover the table. Does she calculate the surface area of the table or its volume? \_\_\_\_\_  
 Explain. \_\_\_\_\_
2. How many surfaces does this table have? \_\_\_\_\_
3. Which surfaces have the same area? \_\_\_\_\_
4. What are the dimensions of the top face of the table?  
 \_\_\_\_\_
5. What is the area of the top of the table? \_\_\_\_\_
6. What are the dimensions of the rectangular faces? \_\_\_\_\_
7. What is the area of each rectangular face? \_\_\_\_\_
8. What are the dimensions of the triangular face of the table?  
 \_\_\_\_\_
9. What is the area of each triangular face? \_\_\_\_\_
10. What is the total surface area in square inches of the table? \_\_\_\_\_





COURSE: MSC V  
 MODULE 2: Fundamentals of Geometry  
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# Student Logbook



## Calculating the Volume & Surface Area of a Right Cylinder

As you work through the tutorial, complete the following statements and questions.

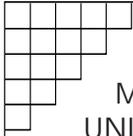
- In a right cylinder, the height of the cylinder is \_\_\_\_\_ to the bases.
- What is the formula for the area of a circle? \_\_\_\_\_
- How do you find the volume of a cylinder? \_\_\_\_\_
- What is the relationship between a radius and a diameter of a circle?  
\_\_\_\_\_
- The \_\_\_\_\_ of a circle is its perimeter.
- What is the formula for calculating the circumference of a circle? \_\_\_\_\_
- How does the circumference of the circles relate to the rectangular face of the cylinder?  
\_\_\_\_\_  
\_\_\_\_\_
- What is an approximation for  $\pi$ , rounded to the nearest hundredth?  
\_\_\_\_\_
- What does  $r$  represent in the formula for the circumference of a circle and in the formula for the area of a circle? \_\_\_\_\_  
\_\_\_\_\_

### Key Words:

Volume  
 Right cylinder  
 Surface area  
 Perimeter  
 Circumference  
 Pi ( $\pi$ )  
 Diameter  
 Radius  
 Length

### Learning Objectives:

- Calculating the volume of a right cylinder
- Calculating the circumference of a circle
- Calculating the surface area of a right cylinder



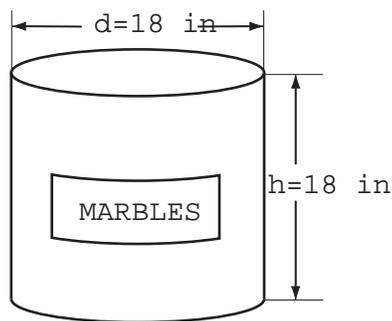
COURSE: MSC V  
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 UNIT 3: Volume & Surface Area

Your  
Turn



## Calculating the Volume & Surface Area of a Right Cylinder

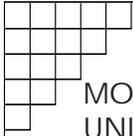
Sophie will need enough marbles to fill a volume of 5,000 cubic inches for Dijit's table. Dijit visits a craft store to buy the marbles and finds that he needs to calculate the volume of a cylindrical tub containing marbles.



He measures the diameter  $d$  and height  $h$  of the tub and sketches the figure above.

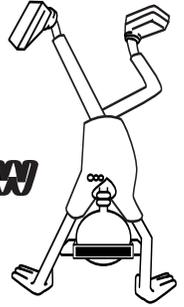
1. What is the formula for finding the volume of the tub.
2. What is the value in inches of  $r$  for this tub? \_\_\_\_\_
3. Using 3.14 as a value for  $\pi$ , what is the area of the circular base?  
 Round your answer to the nearest tenth, and use the correct unit  
 of measure. \_\_\_\_\_  
 \_\_\_\_\_
4. Use the answers in 3, and find the volume of the tub. Round your answer  
 to the nearest tenth, and use the correct unit of measure. \_\_\_\_\_
5. If Dijit buys the entire tub, will there be enough marbles to fill his table?  
 If not, what is the volume that remains to be filled? \_\_\_\_\_





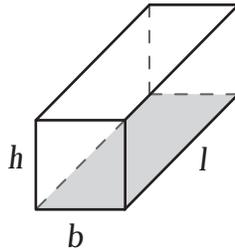
COURSE: **MSC V**  
 MODULE 2: **Fundamentals of Geometry**  
 UNIT 3: **Volume & Surface Area**

## Unit Review



### Calculating the Volume of a Right Triangular Prism

1. In this rectangular prism,  $b = 5$  inches,  $h = 5$  inches, and  $l = 20$  inches, with



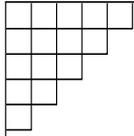
- a. What is the area in square inches of the base whose sides are  $b$  and  $l$ ? \_\_\_\_\_
- b. What is the volume of the prism in cubic inches? \_\_\_\_\_

### Calculating the Surface Area of a Right Triangular Prism

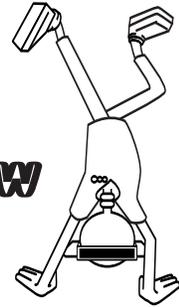
2. Follow the steps below to find the surface area of the prism above. Show your work. Include the correct units of measure in your answers.
- a. How many faces does a rectangular prism have? \_\_\_\_\_
- b. What is the area of each square face of the prism? \_\_\_\_\_  
 \_\_\_\_\_
- c. What is the area of each rectangular face that is not a square? \_\_\_\_\_  
 \_\_\_\_\_
- d. What is the surface area of the prism? \_\_\_\_\_

### Calculating the Volume & Surface Area of a Right Cylinder

3. A right cylinder has a radius of 10 inches and a height of 24 inches. Use 3.14 as the value of  $\pi$ , and include units in your answer.
- a. Find the area of the base of the cylinder. \_\_\_\_\_
- b. Find the volume of the cylinder. \_\_\_\_\_



# Unit Review



## Putting It All Together

4. A high school drama department will stage Shakespeare's *Julius Caesar*. To make some columns for a Roman building, the drama teacher bought huge foam cylinders. To buy paint for the cylinders, the students need to find the surface area of each column. The teacher knows that the height of each cylinder is 18 ft and its volume of  $226 \text{ ft}^3$ .

a. Explain in words how to find the area of each base of a cylindrical column.

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b. Find the area of each circular base. Round your answer to the nearest tenth. \_\_\_\_\_

c. Explain in words how to find the radius of the base of each column.

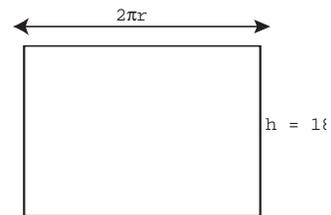
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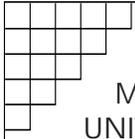
d. Use 3.14 as the value of  $\pi$  and find the radius. Round your answer to the nearest whole number.

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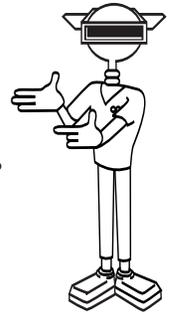
e. Use 3.14 as the value of  $\pi$  and find the surface area of each column. Show your work, rounding your answer to the nearest whole number.

---





COURSE: **MSC V**  
 MODULE 2: **Fundamentals of Geometry**  
 UNIT 3: **Volume & Surface Area**



# Unit Assessment

1. How are a right triangular prism and a right rectangular prism different ?

\_\_\_\_\_

\_\_\_\_\_

2. What formula do you use to find the area of a circle? \_\_\_\_\_

3. If you know the area of the base of a right cylinder and its height, how do you find its volume? \_\_\_\_\_

4. How are a diameter and a radius of a circle related? \_\_\_\_\_

\_\_\_\_\_

5. How are the circumference and a radius of a circle related? \_\_\_\_\_

\_\_\_\_\_

6. How many rectangular faces does a triangular prism have? \_\_\_\_\_

7. To calculate the volume of a right rectangular prism, a friend multiplies  $b \times l$ . Is this correct? If not, what was done wrong? \_\_\_\_\_

\_\_\_\_\_

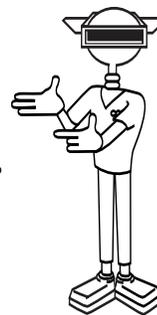
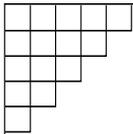
\_\_\_\_\_

8. In a right cylinder, what shape is the base? \_\_\_\_\_

9. What dimensions do you need to know to find the surface area of a right triangular prism? \_\_\_\_\_

\_\_\_\_\_

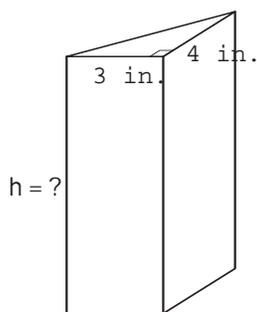
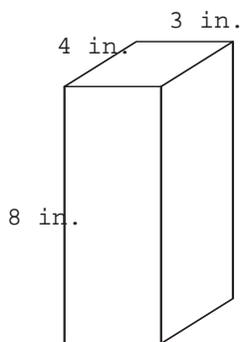


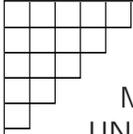


# Unit Assessment

10. In the space below, draw a net or pattern for a right triangular prism.

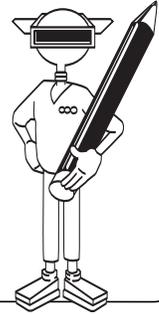
11. Here are a right rectangular prism and a right triangular prism. What is the height  $h$  of the triangular prism so that it has the same volume as the rectangular prism? Show your work.





COURSE: **MSC V**  
 MODULE 3: **Radicals & Exponents**  
 UNIT 1: **Introduction to Radicals  
 & Pythagorean Theorem**

# Student Logbook



## Exploring the Pythagorean Theorem

**As you work through the tutorial, complete the following statements and questions.**

- The weather satellite will receive energy through its \_\_\_\_\_.
- Each panel is a different size square. What is the area of each of the three solar panels? \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_
- What is the total number of cells in the 9 ft<sup>2</sup> and 16 ft<sup>2</sup> panels? \_\_\_\_\_
- The area of a square is calculated using the formula \_\_\_\_\_.
- What number do you multiply by itself to get 16? \_\_\_\_\_
  - What number do you multiply by itself to get 25? \_\_\_\_\_
- The three solar panels are arranged around a right triangle. What lengths are the sides of the triangle? \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_
- In a right triangle, the \_\_\_\_\_ of the longest side is equal to the sum of the squares of the two legs.
- Write  $3 \times 3 + 4 \times 4 = 5 \times 5$  using exponents. \_\_\_\_\_
- Who first stated the Pythagorean theorem? \_\_\_\_\_ Select your answer from the following choices: **a.** Dijit **b.** Pythagoras **c.** Leo Potts
- In any right triangle, which side is the hypotenuse? \_\_\_\_\_
  - How does the length of the hypotenuse compare to the lengths of the two legs? \_\_\_\_\_
- What is a square number? \_\_\_\_\_

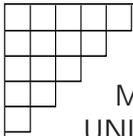
### Key Words:

Right triangle  
 Hypotenuse  
 Pythagorean theorem  
 Exponent  
 Square  
 Square number

### Learning Objectives:

- Identifying the hypotenuse in a right triangle
- Using variables to represent the Pythagorean theorem
- Identifying a right triangle given the measure of its sides





COURSE: **MSC V**  
 MODULE 3: **Radicals & Exponents**  
 UNIT 1: **Introduction to Radicals  
 & Pythagorean Theorem**

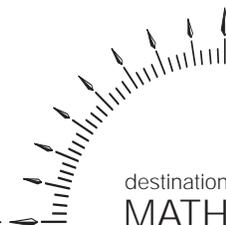
Your  
Turn

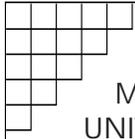


## Exploring the Pythagorean Theorem

Dijit wonders if he can build a larger satellite with solar panels arranged around a triangle with side  $a$  of 13 meters, side  $b$  of 14 meters, and side  $c$  of 15 meters.

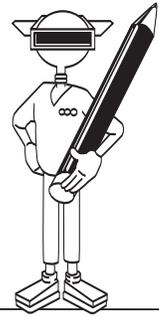
- How can the Pythagorean theorem,  $a^2 + b^2 = c^2$ , be used to determine if this is a right triangle? \_\_\_\_\_  
\_\_\_\_\_
- What is the value of  $a^2 + b^2$ ? \_\_\_\_\_
- What is the value of  $c^2$ ? \_\_\_\_\_
- Is this a right triangle? \_\_\_\_\_ Explain your answer. \_\_\_\_\_  
\_\_\_\_\_
- Substitute these values for  $a$ ,  $b$ , and  $c$  into the equation  $a^2 + b^2 = c^2$ .  
 $a = 5$  meters,  $b = 12$  meters, and  $c = 13$  meters. \_\_\_\_\_
- What is the value of the sum on the left side of the equation? \_\_\_\_\_
- What is the value of the right side of the equation? \_\_\_\_\_
- Is this triangle a right triangle? \_\_\_\_\_ Explain your answer.  
\_\_\_\_\_
- Which side of this triangle is the hypotenuse? \_\_\_\_\_





COURSE: **MSC V**  
 MODULE 3: **Radicals & Exponents**  
 UNIT 1: **Introduction to Radicals**  
 & **Pythagorean Theorem**

# Student Logbook



## Investigating Squares & Square Roots

As you work through the tutorial, complete the following statements and questions.

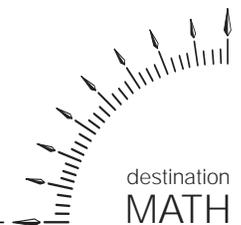
1. A square number is a number raised to the \_\_\_\_\_ power.
2. What is  $8^2$ ? \_\_\_\_\_
3.  $x^2$  means \_\_\_\_\_.
4. The squares of whole numbers are called \_\_\_\_\_.
5. The \_\_\_\_\_ of a number is the number you multiply by itself to get the square number.
6. What is the square root of 64? \_\_\_\_\_
7. What is the symbol for square root called? \_\_\_\_\_
8. a. What is the radicand? \_\_\_\_\_  
 b. Name the radicand in the statement  $\sqrt{64} = 8$ . \_\_\_\_\_
9. What is the square root of  $9 \text{ ft}^2$  ( $\sqrt{9 \text{ ft}^2}$ )? \_\_\_\_\_
10. Is the square root of 30 closer to 5 or 6? \_\_\_\_\_ Explain \_\_\_\_\_
11. How do you find the volume of a cube? \_\_\_\_\_  
 \_\_\_\_\_
12. The symbol for the cube root of a number is the \_\_\_\_\_ symbol with an index of \_\_\_\_\_.
13. Using symbols, write "the cube root of 27 equals 3." \_\_\_\_\_

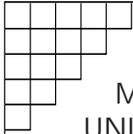
### Key Words:

Square root  
 Radical  
 Radicand  
 Cube number  
 Cube root  
 Index

### Learning Objectives:

- Completing a table of square numbers up to 12
- Determining the square roots of some perfect squares
- Plotting squares and square roots on a number line
- Investigating cubing a number and cube roots with reference to the volume of a cube





COURSE: **MSC V**  
 MODULE 3: **Radicals & Exponents**  
 UNIT 1: **Introduction to Radicals**  
 & **Pythagorean Theorem**

Your  
Turn



## Investigating Squares & Square Roots

1. Complete this table of squares.

Number	6	7	8	9
Square				

Use the table to answer questions 2 through 7.

2. Between what two consecutive square numbers does 60 lie? \_\_\_\_\_

3. Between what two consecutive whole numbers does  $\sqrt{60}$  lie? \_\_\_\_\_

4. Of the two numbers in question 3, which one is closer to  $\sqrt{60}$ ? \_\_\_\_\_  
 Explain your answer. \_\_\_\_\_

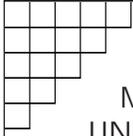
5. Between what two consecutive square numbers does 44 lie? \_\_\_\_\_

6. What two consecutive whole numbers must  $\sqrt{44}$  lie between? \_\_\_\_\_

7. a. Which of the following decimal numbers is closest to  $\sqrt{44}$ ? \_\_\_\_\_  
 (1) 6.2    (2) 6.4    (3) 6.5    (4) 6.6

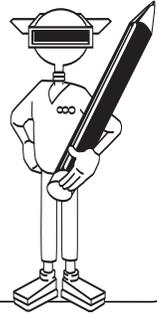
b. Explain your answer. \_\_\_\_\_  
 \_\_\_\_\_





COURSE: **MSC V**  
 MODULE 3: **Radicals & Exponents**  
 UNIT 1: **Introduction to Radicals**  
 & **Pythagorean Theorem**

# Student Logbook



## Defining Irrational Numbers

As you work through the tutorial, complete the following statements and questions.

- How long is each antenna on MetSat? \_\_\_\_\_
- What is the diameter of the satellite? \_\_\_\_\_
- The hypotenuse of a right triangle is always opposite the \_\_\_\_\_ .  
It is always the \_\_\_\_\_ side.
- The Pythagorean theorem states that  $a^2 + b^2 = c^2$ .  
On MetSat,  $a = 12$  and  $c = 20$ . Substitute these values into the equation. \_\_\_\_\_<sup>2</sup> +  $b^2 =$  \_\_\_\_\_<sup>2</sup>
- a. What is the value of  $12^2$ ? \_\_\_\_\_  
b. What is the value of  $20^2$ ? \_\_\_\_\_
- Rewrite  $144 + b^2 = 400$  solved for  $b^2$ . \_\_\_\_\_
- What is the square root of  $b^2$ ? \_\_\_\_\_
- What is an irrational number? \_\_\_\_\_
- When  $\sqrt{3}$  is estimated using a calculator, the digits to the right of the decimal point go on \_\_\_\_\_ !
- What is the most accurate way to write two times the square root of 3?  
\_\_\_\_\_
- What is a rational number? \_\_\_\_\_
- Can any irrational number be written as a fraction with whole numbers as its numerator and denominator? \_\_\_\_\_

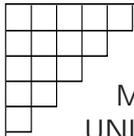
### Key Words:

Square  
 Square root  
 Right triangle  
 Hypotenuse  
 Rational number  
 Irrational number

### Learning Objectives:

- Finding the length of the 3rd side of a right triangle given the measures of two sides
- Locating the square root of a number between consecutive integers
- Recognizing irrational numbers as nonterminating, nonrepeating decimals
- Classifying numbers as either rational or irrational





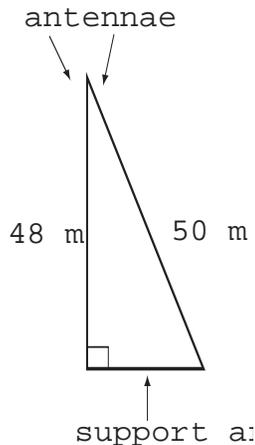
COURSE: **MSC V**  
 MODULE 3: **Radicals & Exponents**  
 UNIT 1: **Introduction to Radicals & Pythagorean Theorem**

# Your Turn



## Defining Irrational Numbers

Dijit has built the antennae for a larger satellite. The two antennae and a support arm form a right triangle.



1. If  $c$  represents the hypotenuse, write an equation using  $a$ ,  $b$ , and  $c$  that expresses the relationship between the lengths of the sides of a right triangle.

\_\_\_\_\_

2. Now write the equation substituting the values shown in the diagram at the right. Let  $a$  represent the length of the leg you know, and let  $b$  represent the length of the leg you need to find.

\_\_\_\_\_

3. Simplify the equation until you have a value for  $b^2$ . Show all your work.

4. Write all the factors of  $b^2$  found in(3) above. \_\_\_\_\_

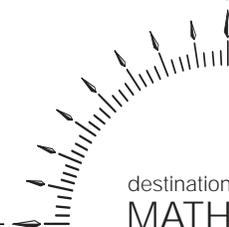
5. Of the factors found in (4), which factors are perfect squares? \_\_\_\_\_

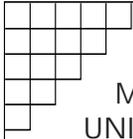
6. What is  $4 \times 49$ ? \_\_\_\_\_

7. What is the square root of  $4 \times 49$ ? Show your work.

8. What is  $b$  in simplest form? \_\_\_\_\_

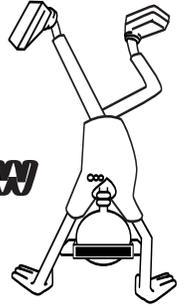
9. Is  $b$  a rational or irrational number? \_\_\_\_\_  
 Explain. \_\_\_\_\_





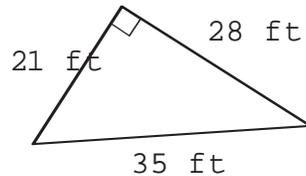
COURSE: **MSC V**  
 MODULE 3: **Radicals & Exponents**  
 UNIT 1: **Introduction to Radicals  
 & Pythagorean Theorem**

# Unit Review



## Exploring the Pythagorean Theorem

1. Use this right triangle to answer the following questions.



- What is the length of the hypotenuse? \_\_\_\_\_
- How do you know which side is the hypotenuse? \_\_\_\_\_
- What is the sum of the squares of the lengths of the two legs? \_\_\_\_\_
- What is the square of the hypotenuse length? \_\_\_\_\_

## Investigating Squares & Square Roots

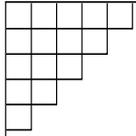
2. Evaluate each of the following numbers.

- $\sqrt{49}$  \_\_\_\_\_
- $\sqrt{12^2}$  \_\_\_\_\_
- $2^3$  \_\_\_\_\_
- $3^3$  \_\_\_\_\_
- $\sqrt[3]{8}$  \_\_\_\_\_

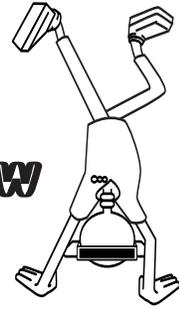
## Defining Irrational Numbers

- Between which two consecutive whole numbers does the square root of 150 lie? \_\_\_\_\_ and \_\_\_\_\_
- Find the length of the hypotenuse in a right triangle if the legs have lengths of 5 feet and 12 feet. \_\_\_\_\_





# Unit Review



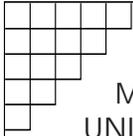
## Putting It All Together

5. The two longest sides in a right triangle have lengths of 75 and 85. Find the length of the third side. Show your work.
6. Classify the following numbers as rational or irrational. If the number is rational, express it as a decimal or an equivalent fraction in simplest form.

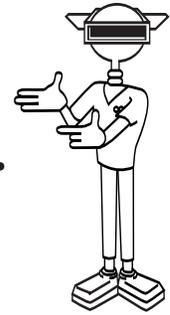
Number	Rational/Irrational	Equivalent Fractional/Decimal Form
0.3333...		
$\sqrt{15}$		
$\sqrt{6}$		
$\frac{1}{7}$		
$\sqrt{5^2}$		
$\sqrt{289}$		

7. What are the first five non-zero perfect cube numbers? \_\_\_\_\_ ,  
 \_\_\_\_\_ , \_\_\_\_\_ , \_\_\_\_\_ , \_\_\_\_\_





COURSE: **MSC V**  
 MODULE 3: **Radicals & Exponents**  
 UNIT 1: **Introduction to Radicals & Pythagorean Theorem**



# Unit Assessment

1. Evaluate each of the following numbers.

a.  $\sqrt{100}$  \_\_\_\_\_

b.  $\sqrt{121}$  \_\_\_\_\_

c.  $8^2$  \_\_\_\_\_

d.  $4^3$  \_\_\_\_\_

e.  $\sqrt[3]{1}$  \_\_\_\_\_

2. a. What theorem is represented by the equation  $a^2 + b^2 = c^2$ ?

\_\_\_\_\_

b. Explain the theorem in your own words. \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

c. Which sides of the triangle are represented by each of the variables?

\_\_\_\_\_

\_\_\_\_\_

3. Rewrite the equation  $15^2 = 225$  using a radical symbol. \_\_\_\_\_

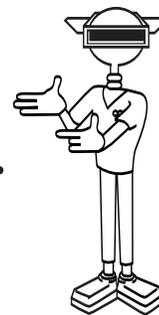
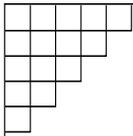
4. Which is greater,  $2^3$  or  $3^2$ ? \_\_\_\_\_

5. Which is greater,  $\sqrt[3]{27}$  or  $\sqrt{25}$ ? \_\_\_\_\_

6. For which values of  $n$  is  $n^2 = n^3$ ? \_\_\_\_\_

7.  $23^2 = 529$  and  $24^2 = 576$ . Explain how you can tell that  $\sqrt{530}$  is approximately 23 and not 24. \_\_\_\_\_





# Unit Assessment

8. Can a right triangle have sides whose lengths are 18, 24, and 30?

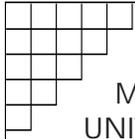
\_\_\_\_\_ Explain your answer. \_\_\_\_\_  
\_\_\_\_\_

9. The volume of a cube is  $343 \text{ in}^3$ . What is the length of one edge of the cube? \_\_\_\_\_

10. Using the radical symbol, write three square roots that are rational numbers. \_\_\_\_\_ , \_\_\_\_\_ , \_\_\_\_\_

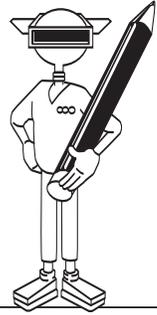
11. Write three square roots that are irrational numbers. \_\_\_\_\_ , \_\_\_\_\_ , \_\_\_\_\_





COURSE: **MSC V**  
 MODULE 3: **Radicals & Exponents**  
 UNIT 2: **Introduction to Scientific Notation**

# Student Logbook



## Writing Numbers using Scientific Notation

As you work through the tutorial, complete the following statements and questions.

- The distance to the satellite is  $2.37 \times$  \_\_\_\_\_ km.
- Rewrite  $10^4$ 
  - using multiple factors of 10 ( $10 \times 10 \dots$ )
  - in standard form \_\_\_\_\_
- The distance to the satellite can also be written as \_\_\_\_\_ km.
- When you multiply a number by a power of 10, you move the decimal point to the right as many decimal places as there are \_\_\_\_\_  
\_\_\_\_\_.
- Multiplying by 10,000 means that you move the decimal point \_\_\_\_\_ places to the right.
- The value of the exponent also tells you \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_.
- A number in scientific notation is written as the product of two numbers:  
a number that is greater than or equal to \_\_\_\_\_ but less than \_\_\_\_\_  
and a power of \_\_\_\_\_.

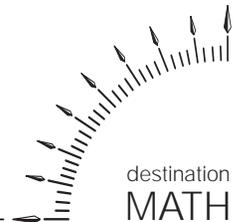
**Key Words:**

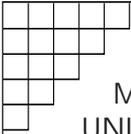
Scientific notation  
 Decimal point

**Learning**

**Objective:**

- Writing a number using scientific notation





COURSE: **MSC V**  
 MODULE 3: **Radicals & Exponents**  
 UNIT 2: **Introduction to Scientific Notation**

Your  
Turn



## Writing Numbers using Scientific Notation

- Dijit learns that the sun is  $9.3 \times 10^7$  miles from Earth.
  - Write  $10^7$  without using an exponent. \_\_\_\_\_
  - To write  $9.3 \times 10^7$  in standard form, how many places to the right do you move the decimal point in 9.3? \_\_\_\_\_
  - In the number below, place a decimal point so that the number equals  $9.3 \times 10^7$ .

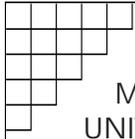
**9 3 0 0 0 0 0 0 0 0 0 0**

- Write  $9.3 \times 10^7$  miles in standard form. \_\_\_\_\_
- Select the expression that is written correctly in scientific notation.
    - $11 \times 10^3$
    - $1.4 \times 100^2$
    - $1.9 \times 10^{11}$
    - $0.4 \times 10^3$
    - $6.2 \times 1^5$

- Complete this table. If a number is written in scientific notation, write it in standard form. If a number is written in standard form, write it in scientific notation.

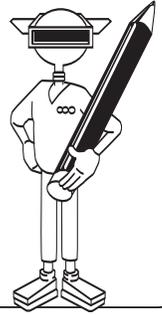
Scientific Notation	Standard Form
$7.5 \times 10^9$	
$4.3 \times 10^4$	
	9,200
$2.8 \times 10^{12}$	
	1,600,000,000





COURSE: MSC V  
 MODULE 3: Radicals & Exponents  
 UNIT 2: Introduction to Scientific Notation

# Student Logbook



## Comparing Numbers in Scientific Notation

As you work through the tutorial, complete the following statements and questions

- To write a number in scientific notation, you move the decimal point until \_\_\_\_\_ .
- 1 kilometer = \_\_\_\_\_ meters
- To change meters to kilometers, you divide by \_\_\_\_\_ .
- Explain why you divide rather than multiply when you change meters to kilometers. \_\_\_\_\_  
\_\_\_\_\_
- After Dijit moves the pod, what is its new distance in scientific notation?  
\_\_\_\_\_
- What is the pod's new distance from Earth in standard form? \_\_\_\_\_  
\_\_\_\_\_
- When you are comparing two numbers in scientific notation, why should you compare the exponents first? \_\_\_\_\_  
\_\_\_\_\_
- Which number is greater,  $2.3 \times 10^6$  or  $9.3 \times 10^5$ ? \_\_\_\_\_  
 Explain. \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

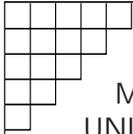
### Key Words:

Scientific notation  
 Decimal point

### Learning Objectives:

- Converting numbers from standard form to scientific notation
- Recognizing that 1 kilo is equal to  $10^3$
- Using the on-line calculator to express numbers in scientific notation
- Comparing two numbers written in scientific notation





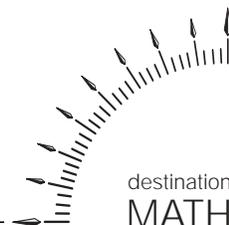
COURSE: **MSC V**  
 MODULE 3: **Radicals & Exponents**  
 UNIT 2: **Introduction to Scientific Notation**

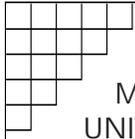
Your  
Turn



## Comparing Numbers in Scientific Notation

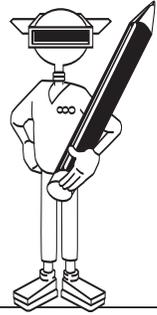
- Dijit learns that Mercury is 36 million miles from the sun.
  - Write 36 million in standard form. \_\_\_\_\_
  - A number in scientific notation is written as the product of two numbers. Describe each of the two numbers. \_\_\_\_\_  
\_\_\_\_\_
  - To write 36 million in scientific notation, what is the first number in the product? \_\_\_\_\_
  - How many places did you move the decimal point to write the first number in the product? \_\_\_\_\_
  - What value should the exponent in the second number of the product have? \_\_\_\_\_
  - Write 36 million in scientific notation. \_\_\_\_\_
  - Dijit learns that Mars is  $1.4 \times 10^8$  miles from the sun. Which is closer to the sun, Mercury or Mars? \_\_\_\_\_
  - Explain your answer to part g.  
\_\_\_\_\_
- A drop of water contains  $3.3 \times 10^{19}$  molecules. Write this number in standard form. \_\_\_\_\_  
 List two advantages of writing a number like this in scientific notation.  
 \_\_\_\_\_  
 \_\_\_\_\_
- Our galaxy contains about 350 billion stars (350,000,000,000). Write this number using scientific notation. \_\_\_\_\_





COURSE: **MSC V**  
 MODULE 3: **Radicals & Exponents**  
 UNIT 2: **Introduction to Scientific Notation**

# Student Logbook



## Writing Numbers Between 0 & 1 in Scientific Notation

As you work through the tutorial, complete the following statements and questions.

1. Express the diameter of a carbon atom in standard form.

\_\_\_\_\_

2. Complete the table below.

Power of 10	Standard form	Exponent	Number of zeros
$10^3$			
$10^2$			
$10^1$			
$10^0$			
$10^{-1}$		-1	1

3. As the exponent decreases by 1, what happens to the value of the number? \_\_\_\_\_

4. Explain why  $10^0 = 1$ . \_\_\_\_\_

5. The number in a negative exponent tells you the number of zeros or power of ten under \_\_\_\_\_.

6. Express the diameter of a carbon atom in scientific notation. \_\_\_\_\_

7. Express the diameter of a titanium atom in scientific notation. \_\_\_\_\_

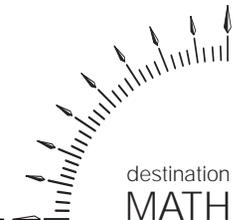
8. Express the diameter of a titanium atom in standard form.  
 \_\_\_\_\_

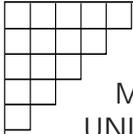
### Key Words:

Scientific notation  
 Decimal point

### Learning Objectives:

- Writing a number between 0 and 1 in scientific notation
- Exploring powers of 10 that are negative integers and 0
- Converting numbers from scientific notation to standard form





COURSE: **MSC V**  
 MODULE 3: **Radicals & Exponents**  
 UNIT 2: **Introduction to Scientific Notation**

Your  
Turn



## Writing Numbers Between 0 & 1 in Scientific Notation

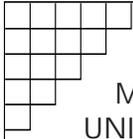
1. In the table below, the given numbers are written in standard form. If the scientific notation of a number is correct, write *correct* in the column next to the number in the table. If the scientific notation of the number in standard form is not correct, write the correct scientific notation in the table.

Standard form	Scientific notation	
0.23	$2.3 \times 10^1$	
0.0006	$6 \times 10^{-4}$	
0.0081	$8.1 \times 10^{-3}$	
0.9	$0.9 \times 10^{-1}$	
0.00000007	$7 \times 10^{-7}$	

2. In the table below, the given numbers are written in scientific notation. If the standard form of the number in scientific notation is correct, write *correct* in the column next to the number in the table. If the standard form of a number in scientific notation is not correct, write the correct standard form in the table.

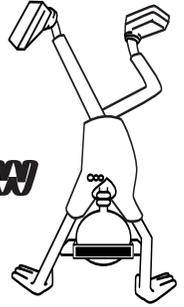
Scientific notation	Standard form	
$4.3 \times 10^1$	43	
$7 \times 10^{-3}$	0.0007	
$3.9 \times 10^{-5}$	0.0000039	
$6.65 \times 10^{-2}$	0.0665	
$1.2 \times 10^{-6}$	$\frac{1}{1,200,000}$	





COURSE: **MSC V**  
MODULE 3: **Radicals & Exponents**  
UNIT 2: **Introduction to Scientific Notation**

## Unit Review



### Writing Numbers using Scientific Notation

- At its closest point, Mars is 55.7 million kilometers from Earth.
  - Write this distance in standard form. \_\_\_\_\_
  - Write this distance in scientific notation. \_\_\_\_\_
- At its farthest point, Mars is 399 million kilometers from Earth.
  - Write this distance in standard form. \_\_\_\_\_
  - Write this distance in scientific notation. \_\_\_\_\_

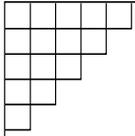
### Comparing Numbers in Scientific Notation

- At its closest point, how far is Mars from Earth in meters? Express your answer in scientific notation. \_\_\_\_\_
- At its farthest point, how far is Mars from Earth in meters? Express your answer in scientific notation. \_\_\_\_\_
- At its closest point, Venus is  $4.14 \times 10^{10}$  meters from Earth. Which planet comes closer to Earth, Venus or Mars? \_\_\_\_\_

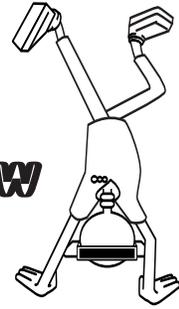
### Writing Numbers Between 0 & 1 in Scientific Notation

- The length of a human chromosome is 0.000001 meter.
  - Write this length in scientific notation. \_\_\_\_\_
  - Write this length in scientific notation in centimeters. \_\_\_\_\_





# Unit Review



## Putting It All Together

7. The word googol was invented by a 9-year-old child to describe a very large number. When Dijit looked up the definition of a googol, Dijit discovered that a googol is the number 1 followed by one hundred zeros.

a. Can you write a googol in standard form? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

b. Write one googol using scientific notation. \_\_\_\_\_

c. Using a googol as an example, write a sentence explaining to a friend how using scientific notation can be an efficient way to express large and small values. \_\_\_\_\_

\_\_\_\_\_

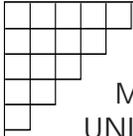
\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_





COURSE: **MSC V**  
MODULE 3: **Radicals & Exponents**  
UNIT 2: **Introduction to Scientific Notation**



# Unit Assessment

1. Write each number in scientific notation.

a. 0.02 \_\_\_\_\_

b. 1,453,000 \_\_\_\_\_

c. 10.58 \_\_\_\_\_

d. 0.000006 \_\_\_\_\_

e. 767,000,000,000 \_\_\_\_\_

f. twelve million \_\_\_\_\_

2. Write each number in standard form.

a.  $1.36 \times 10^{-4}$  \_\_\_\_\_

b.  $9.3 \times 10^7$  \_\_\_\_\_

c.  $2 \times 10^{-2}$  \_\_\_\_\_

d.  $1.7 \times 10^{-3}$  \_\_\_\_\_

e.  $8.09 \times 10^{-7}$  \_\_\_\_\_

f.  $5.602 \times 10^{-8}$  \_\_\_\_\_

3. Rewrite each number in meters using scientific notation in meters.

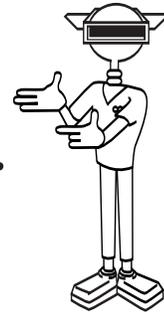
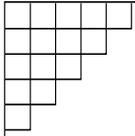
a.  $1 \times 10^{-2}$  cm \_\_\_\_\_

b.  $8 \times 10^4$  mm \_\_\_\_\_

c.  $6.3 \times 10^8$  km \_\_\_\_\_

d.  $9.045 \times 10^{-4}$  km \_\_\_\_\_





# Unit Assessment

4. Rewrite the following measurements in order from least to greatest.

$$6.023 \times 10^{-9} \text{ km}$$

$$6,023 \text{ m}$$

$$60.23 \text{ mm}$$

$$6,023,000 \text{ cm}$$

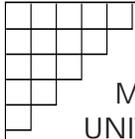
$$6.023 \times 10^{-4} \text{ km}$$

$$6 \text{ mm}$$

\_\_\_\_\_ , \_\_\_\_\_ , \_\_\_\_\_ ,

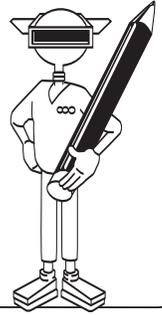
\_\_\_\_\_ , \_\_\_\_\_ , \_\_\_\_\_





COURSE: **MSC V**  
 MODULE 4: **Ratio & Proportion**  
 UNIT 1: **Ratio**

# Student Logbook



## Defining Ratio

As you work through the tutorial, complete the following statements and questions.

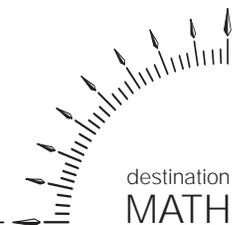
1. List three types of recyclable materials in Rockridge. \_\_\_\_\_  
 \_\_\_\_\_
2. What can organic materials be turned into? \_\_\_\_\_
3. What is the ratio of organic materials to recyclable materials in every 40 pounds of Rockridge's garbage? \_\_\_\_\_  
 \_\_\_\_\_
4. A \_\_\_\_\_ is a relationship between \_\_\_\_\_ quantities.
5. What symbol is used to separate the two numbers in a ratio? \_\_\_\_\_
6. What are the two numbers in a ratio called? \_\_\_\_\_
7. What is the ratio of organic materials to recyclable materials in 20 pounds of Rockridge's garbage? \_\_\_\_\_
8. How do you express a ratio in its simplest form? \_\_\_\_\_  
 \_\_\_\_\_
9. What is the greatest common factor of the terms in the ratio 16 : 24?  
 \_\_\_\_\_
10. What is the ratio of organic materials to recyclable materials in its simplest form? \_\_\_\_\_

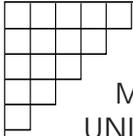
### Key Words:

Ratio  
 Simplest form

### Learning Objectives:

- Defining the terms and symbols of a ratio
- Expressing a ratio in lowest terms
- Recognizing equivalent ratios





COURSE: **MSC V**  
 MODULE 4: **Ratio & Proportion**  
 UNIT 1: **Ratio**

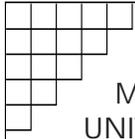
## Your Turn



### Defining Ratio

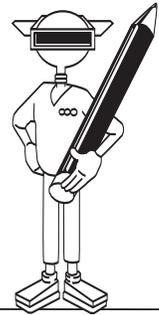
- Lee Foster and some of her friends have joined an after-school softball league in Rockridge. The league is made up of 36 boys and 48 girls.
  - Based on the information given, what terms would Lee write down to find the ratio of boys to girls? \_\_\_\_\_
  - What is the greatest common factor of these terms? \_\_\_\_\_
  - What is the ratio of boys to girls in simplest form? \_\_\_\_\_
- In their last game, Lee's team had 17 hits, 2 errors, but only 5 runs. What is the team's ratio of runs to hits to errors? \_\_\_\_\_
- Since Lee joined the league, she has been at bat 36 times. Of the times she was at bat, she got a hit 9 times. The rest of the times she struck out.
  - What is her ratio of hits to strikeouts in simplest form? \_\_\_\_\_
  - How many times would Lee have to be at bat before she is likely to get a hit? \_\_\_\_\_
- Lee's softball team, the Lions, has 21 players. Her team has the same ratio of boys to girls as the league. How many of the Lions are boys, and how many are girls? \_\_\_\_\_
- In order to make the playoffs, teams in the softball league must have a win/lose ratio of better than 1 : 1. The Lions have won 12 games and lost 6.
  - Can the Lions make the playoffs? \_\_\_\_\_
  - What is the Lions' win/lose ratio? \_\_\_\_\_





COURSE: **MSC V**  
 MODULE 4: **Ratio & Proportion**  
 UNIT 1: **Ratio**

# Student Logbook



## Expressing Ratios as Equivalent Fractions & Decimals

As you work through the tutorial, complete the following statements and questions.

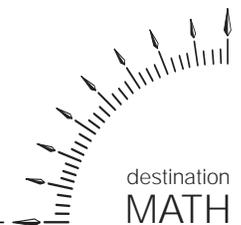
- To find the sum of the parts that make up the whole from the terms in a ratio, \_\_\_\_\_.
- Write fractional parts of a whole represented by the ratio 2 : 3.  
\_\_\_\_\_
- Write decimals to represent the fractions you wrote in Question 2. \_\_\_\_\_
- What percents represent the decimals you wrote in Question 3? \_\_\_\_\_
- How many tons of garbage does Rockridge generate in a week? \_\_\_\_\_
- How many tons of Rockridge's garbage is composed of organic materials? \_\_\_\_\_
- How many tons of Rockridge's garbage is composed of recyclables?  
\_\_\_\_\_
- Brass is a mixture of zinc and copper. The ratio of zinc to copper is 1 : 2. List the steps needed to determine the amount of zinc present in 99 kilograms of brass.  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

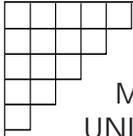
### Key Words:

Fraction  
 Decimal  
 Percent

### Learning Objectives:

- Using ratios to express parts of whole quantities
- Expressing ratios in decimal form
- Expressing ratios as percents





COURSE: **MSC V**  
 MODULE 4: **Ratio & Proportion**  
 UNIT 1: **Ratio**

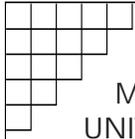
Your  
Turn



## Expressing Ratios as Equivalent Fractions & Decimals

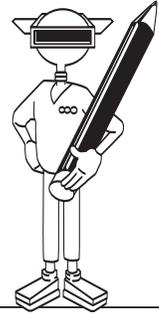
- To reduce the amount of garbage going into their landfill, the residents of Coney Valley started a recycling program. In this program, residents put recyclable materials in separate containers. They estimate that the ratio of people who recycle their garbage to people who do not recycle is 3 : 5.
  - What fraction of the people in Coney Valley recycle their garbage?  
\_\_\_\_\_
  - What fraction of the people in Coney Valley do not recycle? \_\_\_\_\_
  - What percentage of the people in Coney Valley recycle? \_\_\_\_\_
  - What percentage of the people in Coney Valley do not recycle? \_\_\_\_\_
- Coney Valley has a population of 8,246. How many people recycle? \_\_\_\_\_ How many do not? \_\_\_\_\_
- By the end of this year, the people who live in Coney Valley hope to get at least 75% of their citizens to recycle. When this happens, what will be the ratio of people who recycle to people who do not? \_\_\_\_\_
- The ratio of paper to plastics to metals in Coney Valley's recycled materials is 4 : 2 : 1. Rainbow Recycling will only accept recycled materials from Coney Valley if they contain less than 30% plastics.
  - What percentage to the nearest whole number of the recycled materials from Coney Valley are plastics? \_\_\_\_\_
  - Will Rainbow Recycling accept Coney Valley's recycled materials?  
\_\_\_\_\_





COURSE: MSC V  
 MODULE 4: Ratio & Proportion  
 UNIT 1: Ratio

# Student Logbook



## Forming Ratios Between Unlike Quantities

As you work through the tutorial, complete the following statements and questions.

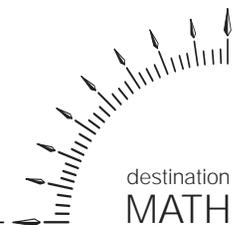
1. What are the recyclable materials in Rockridge's garbage? \_\_\_\_\_  
 \_\_\_\_\_
2. What is the total number of parts in Rockridge's recyclables? \_\_\_\_\_
3. What material makes up  $\frac{1}{2}$  of Rockridge's recyclables? \_\_\_\_\_
4. What is the sum of the fractions that make up the parts of Rockridge's recyclables? \_\_\_\_\_
5. What percent represents the sum of all the parts? \_\_\_\_\_
6. How many tons of recyclable glass does Rockridge generate? \_\_\_\_\_
7. What kind of chart or graph can be used to represent the parts in the ratio of Rockridge's recyclables? \_\_\_\_\_
8. Why is the pie chart divided into 10 sectors? \_\_\_\_\_  
 \_\_\_\_\_
9. How many sectors of the pie chart are used to represent paper? \_\_\_\_\_
10. If the amount of recyclable materials in Rockridge changes, what happens to the ratio of recyclable materials? \_\_\_\_\_

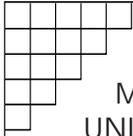
### Key Words:

Ratio  
 Terms

### Learning Objectives:

- Forming ratios by comparing different quantities
- Using a pie chart (circle graph) to represent ratios





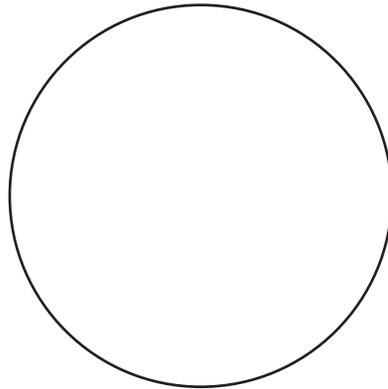
COURSE: **MSC V**  
 MODULE 4: **Ratio & Proportion**  
 UNIT 1: **Ratio**

Your  
Turn

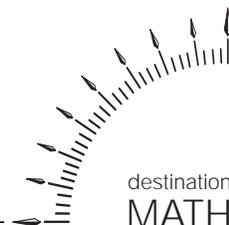


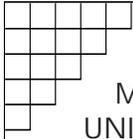
## Forming Ratios Between Unlike Quantities

- The Laser Music CD store in Rockridge has divided its CDs into six categories; Jazz, Classical, Rock, Pop, R&B, and Country. The ratio is  $1 : 1 : 3 : 4 : 1 : 2$ .
  - What is the total number of parts in the ratio of CD categories? \_\_\_\_\_
  - What category makes up  $\frac{1}{3}$  of the CDs? \_\_\_\_\_
  - What is the sum of the fractions representing the categories? \_\_\_\_\_
  - What percent represents the Rock category? \_\_\_\_\_
  - The Laser Music CD store has 8,000 CDs. How many of them are in the Rock category? \_\_\_\_\_
- Use this circle to create a pie chart that represents the categories of CDs. Label each region in the chart, and color in each region if possible.

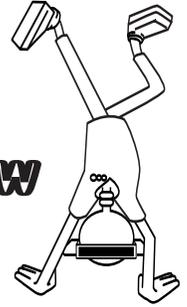


- How many sectors is your pie chart divided into? \_\_\_\_\_
- How many sectors are used to represent the Country CDs? \_\_\_\_\_





COURSE: **MSC V**  
 MODULE 4: **Ratio & Proportion**  
 UNIT 1: **Ratio**



## Unit Review

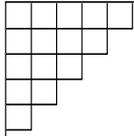
### Defining Ratio

1. At the Rockridge Second Annual Extreme Sports Competition, there are 56 contestants entered in the mountain bike race, and 32 contestants entered the windsurfing competition.
  - a. Write the ratio of mountain bikers to windsurfers. \_\_\_\_\_
  - b. What is the greatest common factor in this ratio? \_\_\_\_\_
    - (1) 7
    - (2) 4
    - (3) 12
    - (4) 8
  - c. Write this ratio in simplest form. \_\_\_\_\_

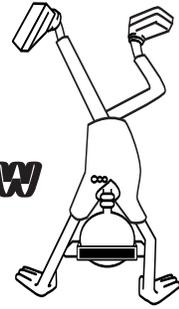
### Expressing Ratios as Equivalent Fractions & Decimals

2. There were 364 contestants in the Rockridge Extreme Sports Competition. The ratio of contestants in land sports to water sports was 7 : 2.
  - a. What fraction of the contestants were in land sports? \_\_\_\_\_  
 What fraction were in water sports? \_\_\_\_\_
  - b. What percentage to the nearest whole number of the contestants were in land sports? \_\_\_\_\_  
 What percentage to the nearest whole number were in water sports?  
 \_\_\_\_\_
  - c. Explain how you were able to find the percentages from the ratio of land and water contestants. \_\_\_\_\_  
 \_\_\_\_\_





# Unit Review



## Forming Ratios Between Unlike Quantities

3. The Extreme Sports Triathlon was a very hard race. 42 of the 65 contestants dropped out of the race. Half of the people who dropped out did so during the swimming portion of the race. One-third of the dropouts stopped during the foot race. One-sixth of the dropouts did not finish the bicycle race.

- a. What is the ratio of people who dropped out while swimming to people who dropped out while running to people who dropped out while biking? \_\_\_\_\_
- b. If twice as many people enter the race next year and the drop out rate stays the same, what will be the ratio of people who drop out while swimming, running, and biking?

(1) 3 : 2 : 1

(2) 6 : 3 : 2

(3) 1 : 2 : 3

(4) 2 : 3 : 1

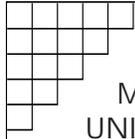
## Putting It All Together

4. a. The Extreme Sports Committee decided to build a new stadium for the games. The architects who designed the stadium built a scale model. The length of the new stadium will be 225 meters and its height will be 30 m when it is complete. The length of the scale model is 75 cm, and its width is 25 cm. Use this information to complete the table.

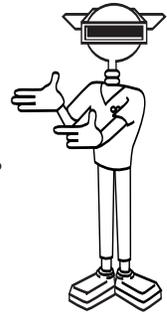
- b. What is the ratio between the scale model and the stadium? \_\_\_\_\_

Dimensions	Actual Stadium	Scale Model
Length	225 m	75 cm
Width		25 cm
Height	30 m	



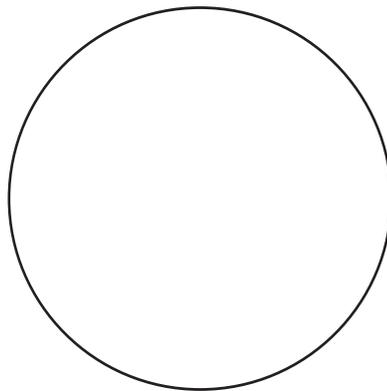


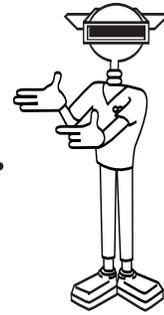
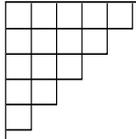
COURSE: **MSC V**  
 MODULE 4: **Ratio & Proportion**  
 UNIT 1: **Ratio**



## Unit Assessment

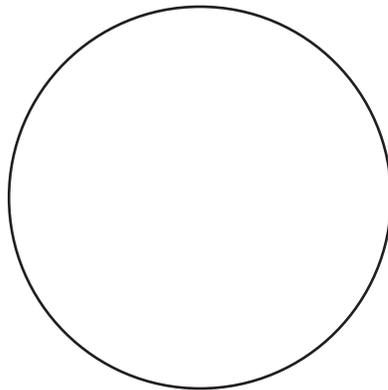
1. The Rockridge television station conducted a random phone survey to find out what viewers thought about their 11 o'clock news program. When the station finished their survey, they had called 96 men and 160 women.
  - a. What is the ratio in simplest form of women to men in the station's survey? \_\_\_\_\_
  - b. What are the terms in the ratio? \_\_\_\_\_
  
2. The ratio of dogs to cats to birds in the Coney Valley pet show was 7 : 5 : 2.
  - a. What fraction in lowest terms of the pets were dogs? \_\_\_\_\_  
 Cats? \_\_\_\_\_ Birds? \_\_\_\_\_
  - b. What percentage to the nearest whole number of the pets were dogs? \_\_\_\_\_ Cats? \_\_\_\_\_ Birds? \_\_\_\_\_
  - c. If there were 172 animals entered into the pet show, how many were dogs? \_\_\_\_\_ Cats? \_\_\_\_\_ Birds? \_\_\_\_\_
  - d. In the space provided, create a pie chart to represent the ratio among the three kinds of animals at the pet show. Label each region of your chart.





## Unit Assessment

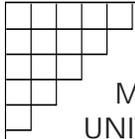
3. The Rockridge High School marching band has 240 members. 144 of the band members play brass instruments, 72 play woodwind instruments, 24 play percussion instruments.
- Write in simplest terms the ratio of brass players to woodwind players to percussion players in the high school band. \_\_\_\_\_
  - Which band instrument makes up 30% of the band? \_\_\_\_\_
  - In the space provided, create a pie chart to represent the three types of band instruments in the Rockridge High School Marching Band. Label each region of your chart.



- At the beginning of the school year, the band director of the Rockridge Middle School has 112 6th-graders signed up for the middle school band. If the band director wants to keep the same ratio of brass to woodwind to percussion players in the middle school band as in the high school band, how many of the 112 new band students should play each type of instrument? Round your answers to the nearest whole number.

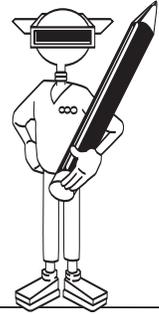
\_\_\_\_\_





COURSE: **MSC V**  
 MODULE 4: **Ratio & Proportion**  
 UNIT 2: **Proportion**

# Student Logbook



## Defining a Proportion

As you work through the tutorial, complete the following statements and questions.

1. What are the four kinds of race officials needed at the bicycle race?

\_\_\_\_\_

\_\_\_\_\_

2. What is the estimated attendance for the race? \_\_\_\_\_

3. How many race officials are needed for every 250 people? \_\_\_\_\_

4. What is the ratio of race officials to people in attendance? \_\_\_\_\_

5. How many race officials would be needed if there were 500 people in attendance? \_\_\_\_\_

6. What can you say about the ratios  $2 : 250$  and  $4 : 500$ ?

\_\_\_\_\_

7. Write each ratio as a fraction.  $2 : 250$  \_\_\_\_\_  $4 : 500$  \_\_\_\_\_

8. Equivalent ratios are \_\_\_\_\_ to each other, and equivalent fractions are also \_\_\_\_\_ to each other.

9. A proportion is a statement of \_\_\_\_\_ between \_\_\_\_\_.

10. As the estimated attendance increases, the number of race officials will also \_\_\_\_\_ proportionally.

11. What is the ratio, in lowest terms, of side to perimeter in the tiers of Dijit's congratulatory race cake? \_\_\_\_\_

12. A proportion can be written using equivalent \_\_\_\_\_ or equivalent \_\_\_\_\_.

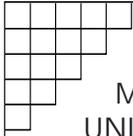
### Key Words:

Ratio  
 Equality  
 Equivalent fraction  
 Proportion

### Learning Objectives:

- Recognizing a proportion as an equivalence between ratios
- Writing equivalent ratios as equivalent fractions





COURSE: **MSC V**  
 MODULE 4: **Ratio & Proportion**  
 UNIT 2: **Proportion**

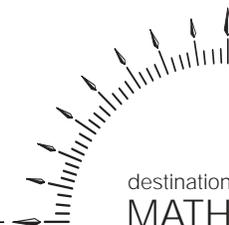
## Your Turn

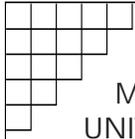


### Defining a Proportion

The estimated attendance of 37,500 people at the Tour d'Longhorn Bay could generate quite a bit of trash, especially when they are enjoying refreshments. Dijit decided to ask Rainbow Recycling for help. They suggested that 3 recycling bins were needed to collect trash for 1,125 people.

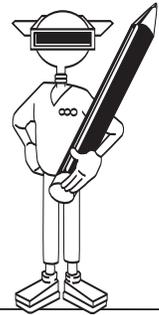
- What is the ratio of recycling bins to people that Rainbow Recycling recommends? \_\_\_\_\_
- Which of the following ratios is equivalent to the ratio in Question 1?  
\_\_\_\_\_
  - $3 : 2,250$
  - $6 : 1,125$
  - $6 : 4,500$
  - $6 : 2,250$
- Write a proportion that equates the ratios of Questions 1 and 2.  
\_\_\_\_\_
- A proportion can also be written as two equivalent fractions. Which of the following sets of equivalent fractions is correct for the proportion you wrote in Question 3? \_\_\_\_\_
  - $\frac{6}{1,125} = \frac{3}{2,550}$
  - $\frac{3}{1,125} = \frac{6}{2,250}$
  - $\frac{1,125}{3} = \frac{2,250}{6}$
  - $\frac{3}{1,125} = \frac{2,250}{6}$
- A certain square has side of length 10 units.
  - What is the ratio of a side to the perimeter of the square?  
\_\_\_\_\_
  - A second square has sides that measure 3 times the length of the sides of the first square. Use equivalent fractions to express that the ratio of side length to perimeter is equal for these squares. \_\_\_\_\_





COURSE: **MSC V**  
 MODULE 4: **Ratio & Proportion**  
 UNIT 2: **Proportion**

# Student Logbook



## Solving for a Variable in a Proportion

As you work through the tutorial, complete the following statements and questions.

1. What proportion using the variable  $c$  is used to find out how many race officials are needed?  
\_\_\_\_\_
2. What does  $c$  represent?  
\_\_\_\_\_
3. When you solve for  $c$ , how many race officials are needed? \_\_\_\_\_
4. In a proportion, the product of the \_\_\_\_\_ is equal to the product of the \_\_\_\_\_.
5. What are the means of a proportion? \_\_\_\_\_
6. The \_\_\_\_\_ of a proportion are its \_\_\_\_\_ terms, that is, its first and fourth terms.
7. In the proportion  $2 : 250 = 300 : 37,500$ , the product of the means is \_\_\_\_\_ and the product of the extremes is \_\_\_\_\_.
8. What is true when you cross-multiply the terms in a proportion? \_\_\_\_\_  
\_\_\_\_\_
9. What can be used to represent a missing term in a proportion? \_\_\_\_\_  
\_\_\_\_\_
10. State the means/extremes property in terms of  $a$ ,  $b$ ,  $c$ , and  $d$ , its four terms: if \_\_\_\_\_,  
then \_\_\_\_\_.

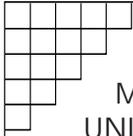
### Key Words:

Ratio  
 Proportion  
 Means  
 Extremes  
 Cross-multiplication

### Learning Objectives:

- Setting up a proportion involving a variable
- Solving for the variable in a proportion
- Recognizing the means/extremes property: if  $a : b = c : d$ , then  $ad = bc$
- Identifying the means and the extremes in a proportion





COURSE: **MSC V**  
 MODULE 4: **Ratio & Proportion**  
 UNIT 2: **Proportion**

Your  
Turn



## Solving for a Variable in a Proportion

Dijit knows that 3 recycling bins are enough for every 1,125 people attending the Tour d'Longhorn Bay. The planning committee needs to know the total number of recycling bins Dijit will need for the 37,500 people that will attend the bike race.

1. Let  $r$  represent the number of recycling bins needed. Then use the variable  $r$  to write a proportion that will help Dijit solve this problem. \_\_\_\_\_

2. Rewrite the proportion as two equivalent fractions. \_\_\_\_\_

3. Which of the following expressions can you use to isolate  $r$ ?  
\_\_\_\_\_

a.  $\frac{1}{37,500} \times \frac{3}{1,125} = \frac{r}{37,500} \times \frac{1}{37,500}$     b.  $\frac{37,500}{1} \times \frac{3}{1,125} = \frac{r}{37,500} \times \frac{37,500}{1}$

c.  $\frac{37,500}{1} \times \frac{3}{1,125} = \frac{r}{37,500} \times \frac{1}{37,500}$     d.  $\frac{1}{37,500} \times \frac{3}{1,125} = \frac{r}{37,500} \times \frac{37,500}{1}$

4. Find the value of  $r$  so that Dijit will know how many recycling bins are needed. \_\_\_\_\_

5. The ratio of children to adults in Longhorn Bay is 3 : 2. Dijit expects the same ratio of children to adults at the bike race. If 15,000 adults attend the race, how many children will attend? (*Hint*: Let  $c$  represent the number of children and first write a proportion.) \_\_\_\_\_

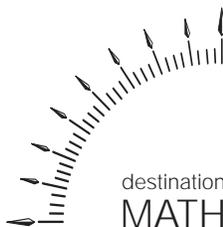
6. Which proportion shows the equivalent ratios of children to adults in Longhorn Bay and at the bike race? \_\_\_\_\_

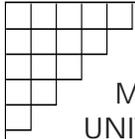
a.  $3 : 2 = 22,500 : 15,000$

b.  $2 : 3 = 15,000 : 22,500$

c.  $3 : 2 = 15,000 : 22,500$

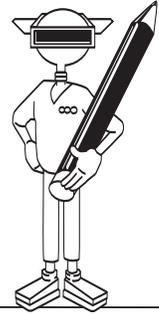
d.  $2 : 3 = 22,500 : 15,000$





COURSE: **MSC V**  
 MODULE 4: **Ratio & Proportion**  
 UNIT 2: **Proportion**

# Student Logbook



## Applying the Means/ Extremes Property

As you work through the tutorial, complete the following statements and questions.

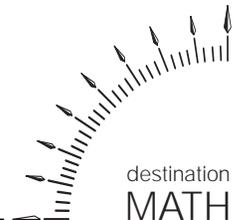
1. How much does the mobile first-aid unit weigh in pounds? \_\_\_\_\_
2. One pound is equal to \_\_\_\_\_ kilogram(s).
3. What does  $d$  represent? \_\_\_\_\_
4. To find out how much the mobile first-aid unit weighs in kilograms, what proportion can you use? \_\_\_\_\_
5. Before solving a proportion, you must make sure the \_\_\_\_\_ in the numerator are the same and the \_\_\_\_\_ in the denominator are the same.
6. How do you find the cross-products in a proportion? \_\_\_\_\_
7. What is the weight of the mobile first-aid unit in kilograms? \_\_\_\_\_
8. To solve a proportion, the units on each side of the equal sign must be written in the \_\_\_\_\_.
9. In a proportion that contains 3 of the 4 terms, which term can be isolated in order to find its value?  
\_\_\_\_\_

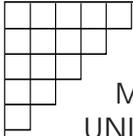
### Key Words:

Proportion  
 Cross-multiplication  
 Cross-products

### Learning Objectives:

- Solving for the variable in a proportion using cross-multiplication
- Calculating cross-products to check a solution in a proportion
- Converting standard units to metric units using proportions





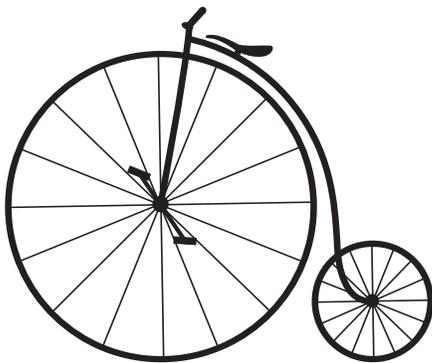
COURSE: **MSC V**  
 MODULE 4: **Ratio & Proportion**  
 UNIT 2: **Proportion**

## Applying the Means/ Extremes Property

# Your Turn



1. There is a club of antique bicycle enthusiasts in the area of Longhorn Bay who maintain antique bikes. Every year, they have a show. The high-wheelers, like the one shown below, are always a favorite.



The ratio of the diameter of the front wheel to the diameter of the rear wheel of a typical high-wheeler is  $5 : 2$ . If the diameter of the front wheel is 150 cm, what is the diameter in centimeters of the rear wheel? \_\_\_\_\_

2. Dijit is making T-shirts for the antique bike show. The T-shirts will have a graphic of a high-wheeler bicycle and the words "I Love Antique Bikes!" on the front. Dijit wants the front wheel and the back wheel of the graphic to be in the ratio  $5 : 2$ , as in the actual bike. The diameter of the front wheel of the high-wheeler on the T-shirt will be 4 inches. Dijit is unsure of the correct proportion and writes  $5 : 2 = 4 : 2$ .

a. Why is Dijit's proportion incorrect? \_\_\_\_\_

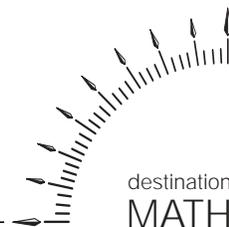
\_\_\_\_\_

b. What is a correct proportion to solve this problem?

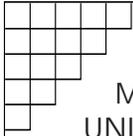
\_\_\_\_\_

3. Dijit found out that the ratio of high-wheelers to other antique bikes in the antique bike show was  $1 : 9$ . If there are 15 high-wheelers at the antique bike show, how many other antique bikes are at the show?

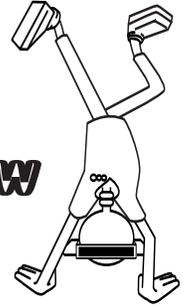
\_\_\_\_\_



destination  
MATH



COURSE: **MSC V**  
MODULE 4: **Ratio & Proportion**  
UNIT 2: **Proportion**



## Unit Review

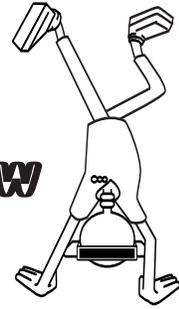
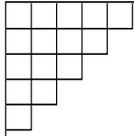
### Defining a Proportion

1. Dijit wondered if the number of times a bicycle wheel turns is related to the number of times the pedals turn. Roudy turned the bike upside down and placed a piece of masking tape on the wheel. He turned the pedals while Dijit counted the number of times the wheel turned. When Roudy turned the pedals 4 times, the wheel turned exactly 7 times.
  - a. Write a ratio that represents the number of times the pedals turn to the number of times the wheel turns. \_\_\_\_\_
  - b. When Roudy turned the pedals 8 times, the wheel turned exactly 14 times. Write a ratio using these values to represent the number of times the pedals turn to the number of times the wheel turns. \_\_\_\_\_

### Solving for a Variable in a Proportion

2. Dijit, Marla, and Roudy are walking through a park on a sunny day. A tree along the path casts a shadow that is 15 feet long. Dijit wonders how tall the tree is. The *Earth Guide* says that if two objects cast a shadow at the same time of day, then the ratio of each object's height to the length of its shadow is the same for both objects.
  - a. If Marla is 5 feet 2 inches tall, and her shadow is 3 feet 8 inches long, what is the height of the tree to the nearest foot? (*Hint: Convert feet to inches.*) \_\_\_\_\_
  - b. If Roudy is 6 feet tall, how long is his shadow to the nearest inch?  
\_\_\_\_\_





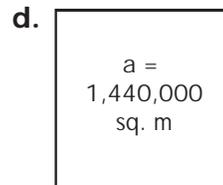
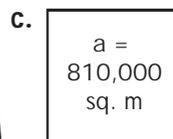
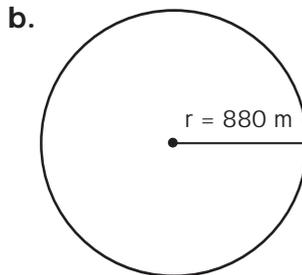
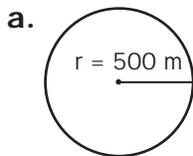
# Unit Review

## Applying the Means/Extremes Property

3. Dijit's mobile first-aid unit weighs 2,667 pounds. The ratio of the weight of the unit to the weight it can carry is 7 : 3.
- a. Can the mobile first-aid unit carry 8 people if the average weight is 150 pounds per person? \_\_\_\_\_ Explain why or why not. \_\_\_\_\_
- b. How much weight could the unit carry in kilograms? Assume that the ratio of kilograms to pounds is 1 kg : 2.2 lb. \_\_\_\_\_

## Putting It All Together

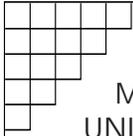
4. Dijit wants to organize a children's bike race to go along with next year's Tour d'Longhorn Bay. The ratio of the length of the adult race to the length of the children's race will be 8 : 2. The race courses can be square or circular. Which of the following race courses would work best for the children's race? (Let  $\pi = 3.14$ ) \_\_\_\_\_



### Helpful information

Adult race length	12 miles
Diameter of a circle	$d = 2r$
Circumference of a circle	$\pi d$ or $2\pi r$ , where $\pi \approx 3.14$
Area of a square	$s^2$ , when $s$ represents the length of one side of a square
Ratio of miles to kilometers	1 mi : 1.6 km
Ratio of kilometers to meters	1 km : 1,000 m





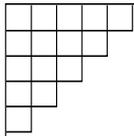
COURSE: **MSC V**  
 MODULE 4: **Ratio & Proportion**  
 UNIT 2: **Proportion**



## Unit Assessment

- Before this year's Tour d'Longhorn Bay, Dijit helped the race committee send out invitations to possible race contestants. In their first mailing, the committee sent out 320 invitations and got back 80 entries.
  - What is the ratio of sent invitations to entries? \_\_\_\_\_
  - Suppose the race committee had sent out twice as many invitations and received twice as many entries. What would the ratio of sent invitations to entries have been?  
\_\_\_\_\_
  - Write a proportion using the ratios in parts a and b above.  
\_\_\_\_\_
  - How can the proportion in part c be written using equivalent fractions?  
\_\_\_\_\_
- The Longhorn Bay Women's Sports Club contacted Dijit to see if they could help encourage more women to participate in the Tour d'Longhorn Bay. Usually, the ratio of women to men in the race is 4 : 9.
  - If 243 men are signed up to participate in the race, how many women are signed up? \_\_\_\_\_
  - Write a proportion using the expected ratio of women to men, and the actual ratio, using the number of actual participants. \_\_\_\_\_  
 What are the means of this proportion? \_\_\_\_\_  
 What are the extremes in this proportion? \_\_\_\_\_
  - If the ratio of women to men in the race were 4 to 5, and 243 men took part, how many women would be in the race? Round your answer to the nearest whole number. \_\_\_\_\_





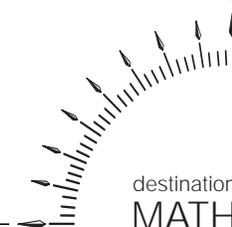
## Unit Assessment

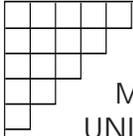
3. The Longhorn Bay Convention and Visitors Bureau wants to make sure that there are enough hotel rooms available for the spectators at the Tour d'Longhorn Bay. Based on last year's figures, 2 hotel rooms are needed for every 75 spectators. The bureau checked with the hotels in Longhorn Bay and found that there were 344 rooms available the night of the race. Are there enough hotel rooms available for 37,500 spectators? \_\_\_\_\_

Explain your answer. \_\_\_\_\_

4. The finish times in minutes for the top five racers in the Tour d'Longhorn Bay are listed in the table. The length of the race was 12 miles. Use the ratio 1 mi: 1.6 km and calculate each racer's speed in both miles per hour and kilometers per hour. Round your answers to the nearest tenth.

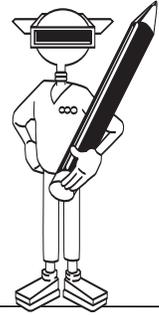
Place	Time	Miles/Hour	Kilometers/Hour
1	30 min		
2	32 min		
3	38 min		
4	41 min		
5	46 min		





COURSE: **MSC V**  
 MODULE 4: **Ratio & Proportion**  
 UNIT 3: **Direct & Inverse Variation**

# Student Logbook



## Exploring & Solving Direct Variation Problems

**As you work through the tutorial, complete the following statements and questions.**

- About how deep can whales dive? \_\_\_\_\_
- Underwater pressure is produced by the \_\_\_\_\_ of water pressing against a submerged body.
- Pressure varies directly with depth. This means that the \_\_\_\_\_ the dive, the greater the pressure. The more \_\_\_\_\_ the dive, the lower the pressure.
- In direct variation, an increase in one quantity causes a(n) \_\_\_\_\_ in another quantity. Likewise, a decrease in one quantity causes a(n) \_\_\_\_\_ in another quantity.
- When two quantities vary directly, the ratio of one quantity to the other is \_\_\_\_\_. The two quantities are \_\_\_\_\_.
- What symbol represents the expression "is proportional to"? \_\_\_\_\_
- The relationship between pressure and depth is constant. This means that \_\_\_\_\_.
- What were the pressure and depth measurements for Miki Nishio's first dive? pressure \_\_\_\_\_ depth \_\_\_\_\_
- What proportion did Dijit and Miki use to find the unknown depth of the second dive? \_\_\_\_\_
- What was the maximum depth that Dijit calculated for Miki's second dive? \_\_\_\_\_

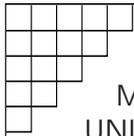
### Key Words:

Direct variation  
 Direct proportion  
 Equivalent ratio  
 Equivalent fraction

### Learning Objectives:

- Recognizing a direct variation
- Using the symbol for proportion to represent a direct variation
- Expressing a direct variation as a proportion
- Solving a proportion for a variable





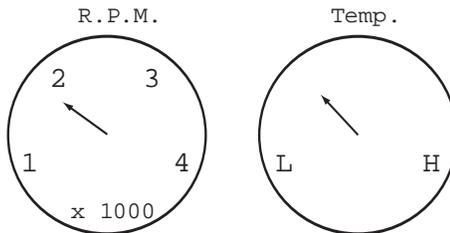
COURSE: **MSC V**  
 MODULE 4: **Ratio & Proportion**  
 UNIT 3: **Direct & Inverse Variation**

# Your Turn

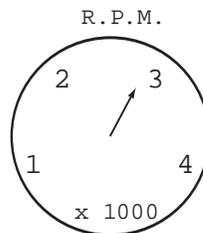


## Exploring & Solving Direct Variation Problems

1. On Miki Nishio's boat, the temperature of the engine varies directly with the engine's speed measured in revolutions per minute (rpm). When Miki checked the gauges, they looked like this:



The next time Miki checked the gauges, the engine speed gauge looked like this:

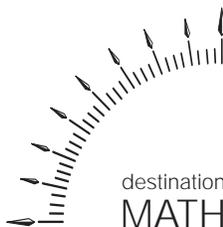


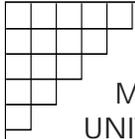
Which gauge shows the correct change in temperature? \_\_\_\_\_

**a.** Temp. **b.** Temp. **c.** Temp. **d.** Temp.

2. Miki's boat travels at a constant speed. The distance of the boat from shore varies directly with the time spent traveling. In 5 minutes, the boat travels 1 mile.

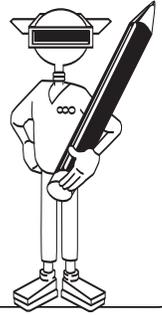
- a. How many miles does Miki's boat travel in 1 hour? \_\_\_\_\_
- b. The trip to the location where Miki wanted to dive took  $3\frac{1}{2}$  hours. How many miles was Miki from the shore? \_\_\_\_\_
- c. Write a proportion between the ratios in parts (a) and (b). \_\_\_\_\_





COURSE: **MSC V**  
 MODULE 4: **Ratio & Proportion**  
 UNIT 3: **Direct & Inverse Variation**

# Student Logbook



## Exploring Inverse Variation

**As you work through the tutorial, complete the following statements and questions.**

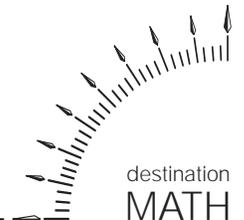
- For all Meshed Gear Co. cogs, the number of revolutions per minute (rpm) is \_\_\_\_\_ to the number of teeth on the cog.
- What does "revolutions per minute" mean? \_\_\_\_\_
- Use symbols and represent the statement, "*R is inversely proportional to T.*" \_\_\_\_\_
- The multiplicative inverse of a number or variable is the \_\_\_\_\_ of that number or variable.
- What is the inverse of the variable *T*? \_\_\_\_\_
- An increase in the number of teeth causes a proportional \_\_\_\_\_ in the number of revolutions. Thus, the larger the cog, the \_\_\_\_\_ it turns.
- Represent the statement "*R is inversely proportional to T*" as a ratio. \_\_\_\_\_
- The ratio of revolutions per minute to the number of teeth is constant for all cogs. Therefore, the ratio of rpm to teeth for the small cog and the large cog are \_\_\_\_\_ ratios.
- Rewrite the proportion:  $r : \frac{1}{t} = R : \frac{1}{T}$  as two equivalent fractions.
- Dividing a number by a fraction is equivalent to multiplying the number by the reciprocal of the fraction. Therefore, the proportion  $r : \frac{1}{t} = R : \frac{1}{T}$  can be written as \_\_\_\_\_.

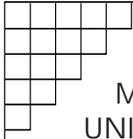
### Key Words:

Inverse variation  
 Inversely proportional  
 Reciprocal  
 Equivalent ratio  
 Equivalent fraction

### Learning Objectives:

- Recognizing an inverse variation
- Using the symbol for proportion to represent an inverse relationship
- Expressing an inverse relationship as a proportion
- Writing an inverse variation as two equivalent products





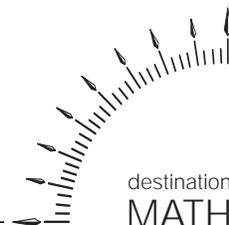
COURSE: **MSC V**  
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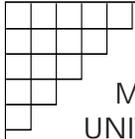
Your  
Turn



## Exploring Inverse Variation

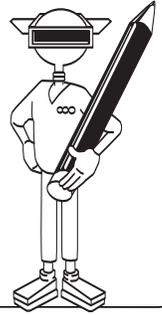
- A closed container contains a certain volume of a gas. If the pressure in the container is increased, the volume of the gas decreases. This is because the volume of a gas is inversely proportional to the pressure.
  - Write a ratio that shows the relationship between the pressure  $P$  and the volume,  $V$ , of a gas in a closed container. \_\_\_\_\_
  - Suppose  $P$  represents the pressure in tank A and  $V$  the volume of tank A, and  $p$  represents the pressure in tank B and  $v$  the volume of tank B. Write a proportion showing the relationship between the pressure and volume in the two tanks.  
\_\_\_\_\_
  - Rewrite the proportion in part b as two equivalent products. \_\_\_\_\_
- The rpm of a sprocket is inversely proportional to the number of teeth on the sprocket. Javier's mountain bike has different-sized sprockets on the wheel. When he shifts from one speed to another, the chain moves to a different sprocket. Javier starts to ride his bike and notices that he is pedaling very fast, but the bike is moving very slowly. He wants the bike to go faster, but he doesn't want to pedal faster.  
What should he do? \_\_\_\_\_
  - Shift the chain to a sprocket with fewer cogs.
  - Shift the chain to a sprocket with more cogs.
  - Shift the chain to a sprocket with the same number of cogs.
  - Wait until he goes downhill.
- Explain your answer to Question 2. \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_





COURSE: **MSC V**  
 MODULE 4: **Ratio & Proportion**  
 UNIT 3: **Direct & Inverse Variation**

# Student Logbook



## Solving Inverse Variation Problems

As you work through the tutorial, complete the following statements and questions.

- The number of \_\_\_\_\_ multiplied by the number of \_\_\_\_\_ is constant for all cogs.
- What do Dijit and Jack know about the speed of the broken cog?  
\_\_\_\_\_
- The number of teeth on the small cog times its rpm should \_\_\_\_\_ the number of teeth on the large cog times its rpm.
- How many teeth should the replacement cog have? \_\_\_\_\_
- Since the large cog turns at one-half the rpm of the small cog, it must have \_\_\_\_\_ the number of teeth.
- In an inverse variation, an \_\_\_\_\_ in one quantity causes a decrease in the other quantity.
- At how many rpm does the third cog turn? \_\_\_\_\_
- Since the third cog turns \_\_\_\_\_ as fast as the small cog, it must have \_\_\_\_\_ times as many teeth.
- At how many rpm does the cog with four teeth turn? \_\_\_\_\_
- An inverse variation with a missing quantity can be written as two \_\_\_\_\_ and solved for the missing \_\_\_\_\_.
- An inverse variation is the \_\_\_\_\_ of a direct variation.

### Key Words:

Inverse variation  
 Inversely proportional  
 Reciprocal  
 Direct variation

### Learning Objectives:

- Solving an inverse relationship for a missing quantity
- Comparing an inverse variation to a direct variation



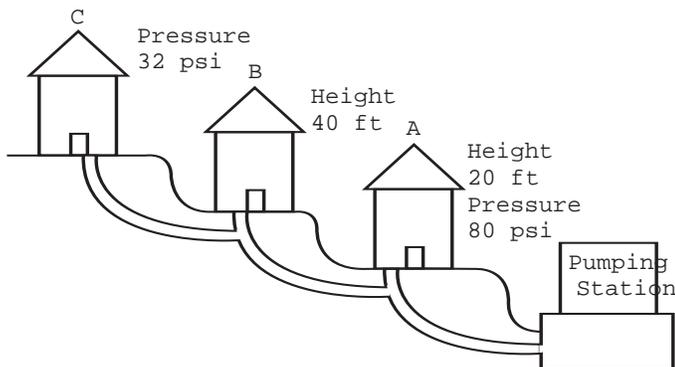
COURSE: **MSC V**  
 MODULE 4: **Ratio & Proportion**  
 UNIT 3: **Direct & Inverse Variation**

Your  
Turn

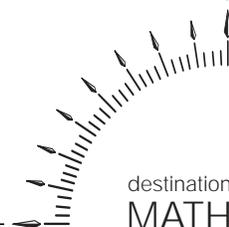


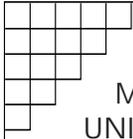
## Solving Inverse Variation Problems

1. The water pressure in these houses, measured in psi, varies inversely with their height in feet above the pumping station.



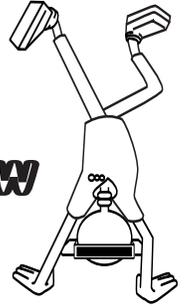
- a. House B is twice as high above the pumping station as house A. Therefore the water pressure in house B is \_\_\_\_\_ the water pressure in house A.
- b. What is the water pressure in house B? \_\_\_\_\_
- c. How high above the pumping station is house C? \_\_\_\_\_
2. Jan Rozetski noticed that the number of butterflies she sees at the Silverwood Golf Course increases when the temperature increases. Is this an inverse variation? \_\_\_\_\_ Explain your answer. \_\_\_\_\_
3. Dijit is at an indoor rock concert. The sound intensity from the speakers on stage varies inversely as a person's distance from the stage.
- a. If the sound intensity 10 m from the stage is 1 unit, what is the sound intensity 20 m from the stage? \_\_\_\_\_
- b. How many meters from the stage would Dijit have to be for the sound intensity to be  $\frac{1}{10}$  unit? \_\_\_\_\_





COURSE: **MSC V**  
 MODULE 4: **Ratio & Proportion**  
 UNIT 3: **Direct & Inverse Variation**

## Unit Review



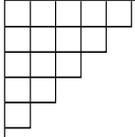
### Exploring & Solving Direct Variation Problems

- Light travels much faster than sound. Therefore, you can estimate the distance  $d$  from a lightning strike by counting the seconds between a lightning flash and the sound of thunder that follows. That distance varies directly with, the number of seconds,  $t$ , between the flash and the corresponding clap of thunder.
  - Use the proportionality symbol,  $\propto$ , and write an expression for the relationship between  $d$  and  $t$ . \_\_\_\_\_
  - The ratio between  $d$  and  $t$  is 0.2 mile : 1 second. During a storm, Jamie sees a lightning flash and counts 15 seconds until he hears the corresponding thunderclap. How many miles is Jamie from the lightning strike? \_\_\_\_\_
- Find the missing values in the following proportions.
  - $2 : 5 = A : 125$       $A =$  \_\_\_\_\_
  - $3 : 16 = 99 : x$       $x =$  \_\_\_\_\_
  - $12 : z = 48 : 4$       $z =$  \_\_\_\_\_

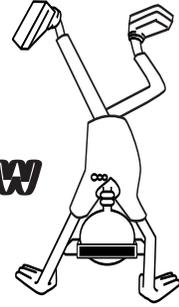
### Exploring Inverse Variation

- A botanist is studying the different kinds of moss that grow on trees in the forests around Rockridge. She noticed that the number of moss covered trees was inversely proportional to the amount of pollution in the air.
  - If  $M$  is the number of moss covered trees, and  $P$  is the amount of air pollution, write an expression that represents the relationship between  $M$  and  $P$ .  
 \_\_\_\_\_
  - If Rockridge reduces the amount of air pollution, what should the botanist observe in the forests around Rockridge? \_\_\_\_\_  
 \_\_\_\_\_





# Unit Review



## Solving Inverse Variation Problems

4. In banking and investing, the Rule of 72 is used to estimate how fast an investment will double. The formula is  $t = \frac{72}{r}$ , where  $t$  is the time in years and  $r$  is the interest rate expressed as a percent. Explain why the Rule of 72 is an inverse variation. \_\_\_\_\_
- \_\_\_\_\_

## Putting It All Together

5. At 19,340 feet above sea level, Mount Kilimanjaro is Africa's tallest mountain. In fact, Kilimanjaro is so tall that it has snow on its peak, even though it lies very near the equator.

- a. Based on what you know about Mount Kilimanjaro, how would you describe the relationship between altitude above sea level and temperature? \_\_\_\_\_
- \_\_\_\_\_

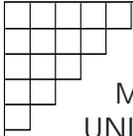
- b. Most jet airliners cruise at altitudes near 30,000 feet. Based on what you know about the relationship between altitude and temperature, would you expect that the equipment on airliners are designed for cruising at very high or very low temperatures? \_\_\_\_\_

Explain your answer. \_\_\_\_\_

\_\_\_\_\_

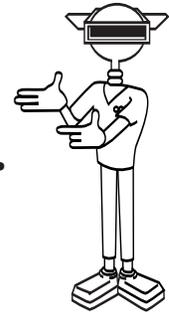
\_\_\_\_\_





COURSE: **MSC V**  
 MODULE 4: **Ratio & Proportion**  
 UNIT 3: **Direct & Inverse Variation**

## Unit Assessment



1. On a clear sunny day, a student observes that the outside air temperature varies directly with the temperature inside his car; when the outside air temperature is  $80^{\circ}\text{F}$ , the temperature inside his car is  $112^{\circ}\text{F}$ .

a. What can you say about the relationship between the outside air temperature and the temperature inside Leo's car? \_\_\_\_\_

b. On the hottest summer day last year, the outside air temperature was  $97^{\circ}\text{F}$ . What was the temperature inside Leo's car to the nearest tenth of a degree? \_\_\_\_\_

c. One day, the student used the temperature inside his car to calculate the outside temperature. If it was  $104^{\circ}\text{F}$  in his car, what was the outside temperature to the nearest tenth of a degree? \_\_\_\_\_

d. Yesterday, when the student left school, the sky was clear. The temperature inside his car was  $92^{\circ}\text{F}$ , and the outdoor temperature was  $69^{\circ}\text{F}$ .

Do you think the sky was clear all day? \_\_\_\_\_

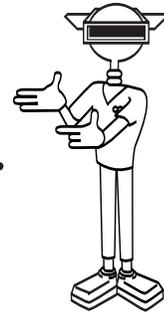
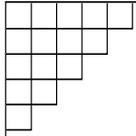
Explain your answer. \_\_\_\_\_

2. Samantha Ray is a marine biologist who studies the animals around the reef in Longhorn Bay. Samantha has noticed that the number of fish she sees is inversely proportional to the number of boats in the bay.

a. If  $F_1$  is the number of fish Samantha sees on the first day, and  $F_2$  is the number of fish on the second day, and  $B_1$  is the number of boats on the first day, and  $B_2$  is the number of boats on the second day, write a proportion that shows the relationship between the fish and boats on the first day and those on the second day. \_\_\_\_\_

b. Rewrite the proportion in part a as two equivalent products. \_\_\_\_\_





# Unit Assessment

3. The intensity,  $I$ , of light falling on an object is inversely proportional to the square of the distance,  $d$ , of the object from the light source.

a. Use the proportionality symbol,  $\propto$ , to write an expression of the relationship between  $I$  and  $d$ . \_\_\_\_\_

b. Light intensity is measured in lumens. Suppose that the intensity of light on an object 3 meters away from the source is 8 lumens. How many meters from the light source would the object be if the intensity doubles to 16 lumens? Round your answer to the nearest tenth. \_\_\_\_\_

4. In this unit, you have learned about direct and inverse variations.

a. Think of a real-world example of each of these kinds of variations and describe it.

Direct variation: \_\_\_\_\_  
 \_\_\_\_\_

Inverse variation: \_\_\_\_\_  
 \_\_\_\_\_

b. Write a ratio that shows the relationship between the variables for each variation.

Direct variation: \_\_\_\_\_  
 \_\_\_\_\_

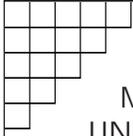
Inverse variation: \_\_\_\_\_  
 \_\_\_\_\_

c. Then, write a proportion to show how to solve for a missing quantity in the variation.

Direct variation: \_\_\_\_\_  
 \_\_\_\_\_

Inverse variation: \_\_\_\_\_  
 \_\_\_\_\_

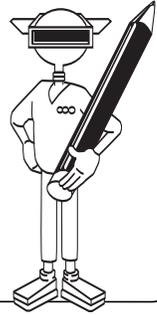




COURSE: **MSC V**  
 MODULE 4: **Ratio & Proportion**  
 UNIT 4: **Similar Polygons**

## Defining Similarity

## Student Logbook



**As you work through the tutorial, complete the following statements and questions.**

1. What does Herman use to make cycle helmets? \_\_\_\_\_
2. What does the molding unit do? \_\_\_\_\_  
\_\_\_\_\_
3. What does the assembly unit do? \_\_\_\_\_  
\_\_\_\_\_
4. How do the helmet casings move from the molding unit to the assembly unit? \_\_\_\_\_
5. By what ratio can the dimensions of the assembly unit be expanded?  
\_\_\_\_\_
6. What are the old dimensions of the assembly unit?  
Length \_\_\_\_\_ Width \_\_\_\_\_
7. What is  $x$  equal to? \_\_\_\_\_
8. To find the new length, you can write the proportion \_\_\_\_\_  
as equivalent fractions \_\_\_\_\_.
9. What are the new dimensions of the assembly unit?  
Length \_\_\_\_\_ Width \_\_\_\_\_
10. A \_\_\_\_\_ can be used to change the dimensions of a figure.
11. When you use a ratio to change the dimensions of a figure, the dimensions \_\_\_\_\_, but the figure retains its \_\_\_\_\_.

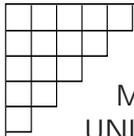
### Key Words:

Ratio  
 Proportion  
 Similarity

### Learning Objectives:

- Recognizing the meaning of similarity
- Writing a proportion that can be used to solve for a variable





COURSE: **MSC V**  
 MODULE 4: **Ratio & Proportion**  
 UNIT 4: **Similar Polygons**

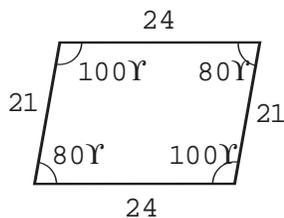
# Your Turn



## Defining Similarity

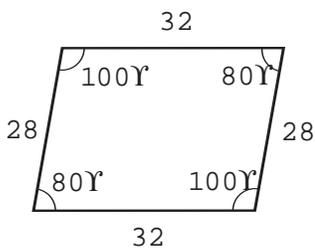
1. Sophie Braxton wants to build a house for her dog, Jeffrey, that matches her house. She wants to reduce the dimensions of her house to design a doghouse that has a similar shape. The ratio that she wants to use is 12 : 2. The width of Sophie's house is 36 feet, and the height is 12 feet. What are the corresponding dimensions of Jeffrey's doghouse? Width \_\_\_\_\_  
 Height \_\_\_\_\_

2.

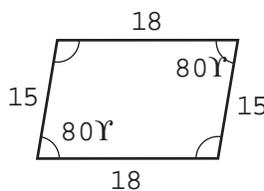


Which of the following polygons is similar to the polygon shown above?

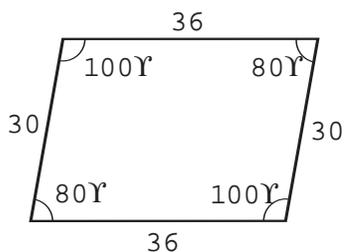
a.



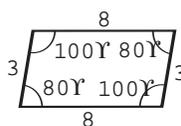
b.



c.



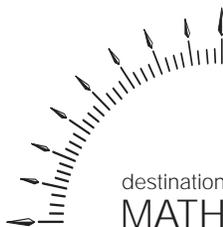
d.

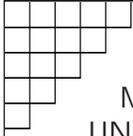


3. Are these two triangles similar? \_\_\_\_\_



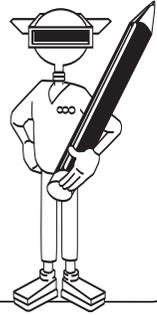
4. Explain your answer to Question 3. \_\_\_\_\_  
 \_\_\_\_\_





COURSE: **MSC V**  
 MODULE 4: **Ratio & Proportion**  
 UNIT 4: **Similar Polygons**

# Student Logbook



## Identifying Equivalent Ratios

As you work through the tutorial, complete the following statements and questions.

- According to the building permit,
  - what must happen to the length of the molding unit? \_\_\_\_\_  
\_\_\_\_\_
  - what must happen to the width of the molding unit? \_\_\_\_\_  
\_\_\_\_\_
- Both dimensions of the new molding unit must be \_\_\_\_\_ to the dimensions of the new assembly unit.
- What is the new length of the molding unit? \_\_\_\_\_
- The ratio of the corresponding widths of the new units must be \_\_\_\_\_ to the ratio of the corresponding lengths.
- How would you describe the shapes of the new molding unit and the new assembly unit? \_\_\_\_\_
- The width of the new molding unit will be \_\_\_\_\_.
- Two polygons are similar if their corresponding angles are \_\_\_\_\_, and their corresponding sides are \_\_\_\_\_.
- What is a polygon? \_\_\_\_\_
- Similar polygons must have the same number of sides. True or False?  
\_\_\_\_\_
- When two polygons are similar, you can use \_\_\_\_\_ to find the length of a missing side.

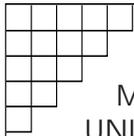
### Key Words:

Ratio  
 Proportion  
 Similar polygons  
 Congruent angles  
 Corresponding sides

### Learning Objectives:

- Applying the definition of similarity to identify equivalent ratios
- Identifying corresponding sides in similar polygons
- Using similarity to set up proportions involving corresponding sides
- Defining "polygon"





COURSE: **MSC V**  
 MODULE 4: **Ratio & Proportion**  
 UNIT 4: **Similar Polygons**

# Your Turn



## Identifying Equivalent Ratios

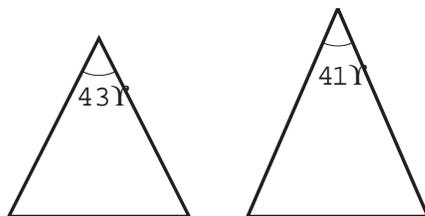
1. Since Herman is going to be able to produce more helmets, he needs to increase the size of his warehouse to hold the extra helmets before they are shipped. His old warehouse is a rectangular prism with a length of 40 meters, a width of 30 meters, and a height of 20 meters. The city will allow Herman to increase the size of the warehouse so that the ratio between the dimensions of the old warehouse and the new warehouse is 2:3. What are the new dimensions of the new warehouse?

Length \_\_\_\_\_ Width \_\_\_\_\_ Height \_\_\_\_\_

2. Are triangles polygons? \_\_\_\_\_ Explain your answer. \_\_\_\_\_

\_\_\_\_\_

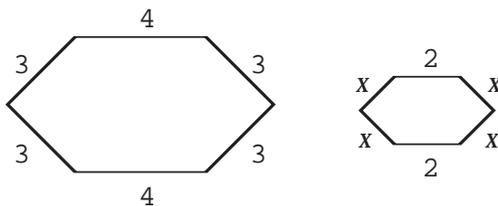
3. Are these two triangles similar? \_\_\_\_\_



4. Explain your answer to Question 3. \_\_\_\_\_

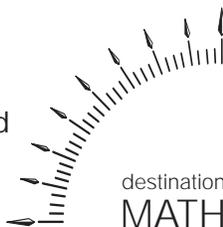
\_\_\_\_\_

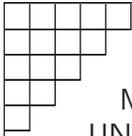
5. The polygons below are similar. Find  $x$  using what you have learned about similar polygons.



$x =$  \_\_\_\_\_

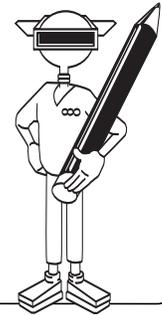
6. What is the ratio between the corresponding sides of the larger polygon and the smaller polygon in Question 5? \_\_\_\_\_





COURSE: **MSC V**  
 MODULE 4: **Ratio & Proportion**  
 UNIT 4: **Similar Polygons**

# Student Logbook



## Setting up & Solving Proportions in Similar Polygons

As you work through the tutorial, complete the following statements and questions.

1. What else did Dijit and Herman find in the factory that needed to be changed? \_\_\_\_\_
2. The distance from the old assembly unit to the molding unit is \_\_\_\_\_.
3. In a right triangle, the hypotenuse is represented by \_\_\_\_\_ the right angle.  
In the factory, the hypotenuse is the \_\_\_\_\_.
4. The \_\_\_\_\_ states that in a right triangle, the square of the \_\_\_\_\_ is equal to the sum of the squares of the two \_\_\_\_\_.
5. What is the length of the old conveyor belt? \_\_\_\_\_
6. What is the length of the new, smaller conveyor belt? \_\_\_\_\_
7. How is the length of the new conveyor belt found? \_\_\_\_\_
8. Just like other similar triangles, Dijit's right triangles have corresponding angles that are \_\_\_\_\_ and corresponding sides that are \_\_\_\_\_.
9. The ratio of the perimeter of Dijit's large right triangle to the perimeter of the small right triangle is \_\_\_\_\_.

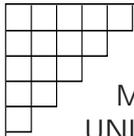
### Key Words:

Ratio  
 Proportion  
 Angle  
 Polygon  
 Triangle  
 Similar polygons  
 Similar triangles  
 Hypotenuse  
 Corresponding sides  
 Right triangle

### Learning Objectives:

- Recognizing a right triangle
- Applying the Pythagorean theorem to find the 3rd side of a right triangle
- Setting up and solving equations based on ratios between corresponding sides
- Using scaling to determine corresponding lengths in similar polygons





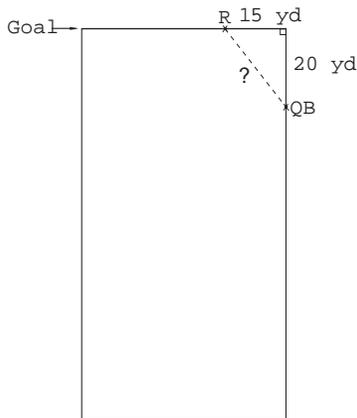
COURSE: **MSC V**  
 MODULE 4: **Ratio & Proportion**  
 UNIT 4: **Similar Polygons**

# Your Turn



## Setting up & Solving Proportions in Similar Polygons

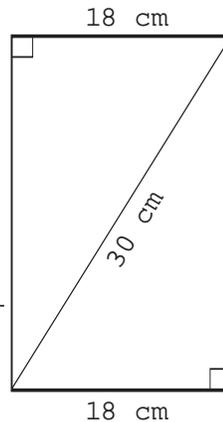
The diagram below shows a pass thrown by the Rockridge High School quarterback to his receiver in the end zone. Officially, this is a 20-yard pass because the ball was put in play 20 yards from the goal line.



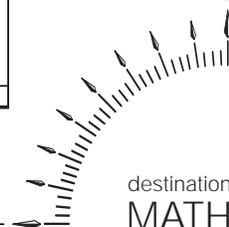
- How far did the ball travel? \_\_\_\_\_  
 a. 5 yd      b. 25 yd      c. 30 yd      d. 35 yd
- The ball was thrown along the \_\_\_\_\_ of a right triangle.  
 a. leg      b. arm      c. hypotenuse      d. Pythagoras

3. Study the following diagram of the rectangle. Then answer the following questions.

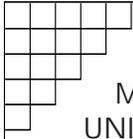
- Find the measure in centimeters of the length of the rectangle. \_\_\_\_\_
- Are the two right triangles similar? \_\_\_\_\_  
 Explain your answer.  
 \_\_\_\_\_



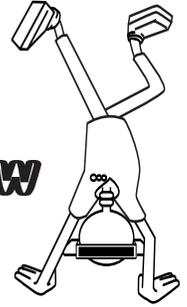
- A rectangular room has a width of 15 ft and a length of 26 ft. Calculate the diagonal distance across the room. Round your answer to the nearest whole number. \_\_\_\_\_



destination  
**MATH**



COURSE: **MSC V**  
 MODULE 4: **Ratio & Proportion**  
 UNIT 4: **Similar Polygons**



## Unit Review

### Defining Similarity

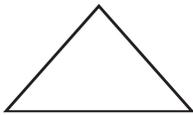
1. The length and width of a rectangular playing field are to be expanded so that the ratio between the corresponding sides is 4 : 5. If the present length of the field is 20 m, and its width is 15 m, what are the dimensions of the new field?

Length \_\_\_\_\_ Width \_\_\_\_\_

### Identifying Equivalent Ratios

2. Which figure(s) are polygons? \_\_\_\_\_

a.



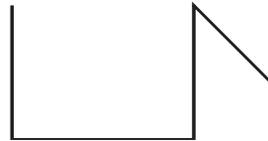
b.



c.

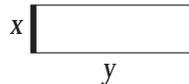
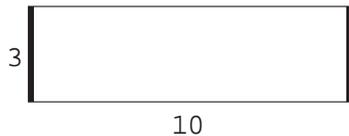


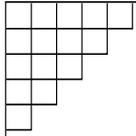
d.



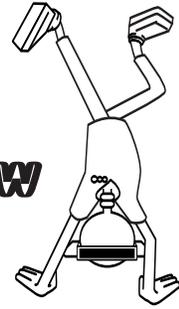
### Setting up & Solving Proportions in Similar Polygons

3. These two rectangles are similar. Find the dimensions of the smaller rectangle if the ratio between the corresponding sides of the rectangles is 2 : 1 are reduced by a ratio. Width \_\_\_\_\_ Length \_\_\_\_\_





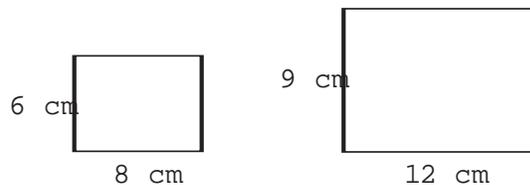
# Unit Review



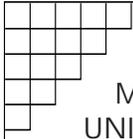
4. Every day Roudy's PE class must run 5 laps around a rectangular practice field that has a width of 40 meters and a length of 60 meters. One day, the marching band was practicing on the field, so the PE class had to run laps around another field. This smaller field is similar to the practice field and the ratio between the corresponding sides is 4 : 3. What are the dimensions of the smaller field? Width \_\_\_\_\_ Length \_\_\_\_\_

## Putting It All Together

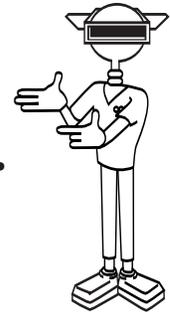
5. The ratio between the corresponding sides of these similar rectangles is 2 : 3.



- a. What is the area of the smaller rectangle? \_\_\_\_\_  
 What is the area of the larger rectangle? \_\_\_\_\_
- b. What is the ratio between these two areas? \_\_\_\_\_
- c. How does it compare to the ratio of the corresponding sides? \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
- d. What is the ratio of the perimeters of these rectangles? \_\_\_\_\_

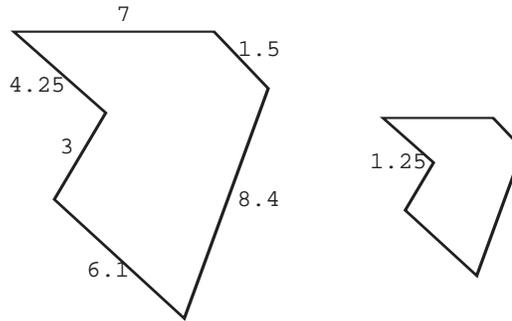


COURSE: **MSC V**  
 MODULE 4: **Ratio & Proportion**  
 UNIT 4: **Similar Polygons**

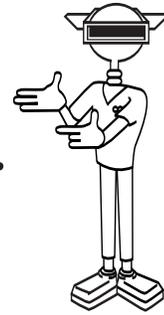
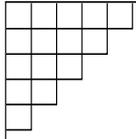


## Unit Assessment

1. These two hexagons are similar.

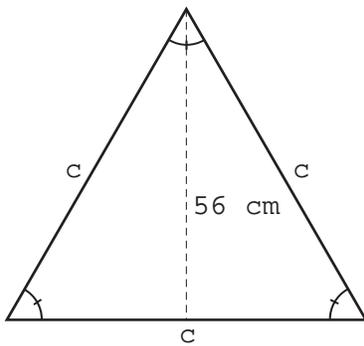


- a. Use the given lengths of the larger hexagon and calculate the lengths of the remaining 5 sides of the smaller hexagon. Round your answers to the nearest hundredths. \_\_\_\_\_
- b. Calculate the ratio between the corresponding sides of the larger and smaller hexagon. \_\_\_\_\_
- c. What is the ratio between the perimeter of the larger hexagon and smaller? Show your work?
2. An architect built a scale model of a new civic center building. Each is the shape of an octagon, and the ratio between the sides of the model and the building is  $2 : 25$ . The length of one side of the model is 3 feet. What will be the length of the side of the new building to the nearest tenth? \_\_\_\_\_



## Unit Assessment

3. This triangle is an equilateral triangle. The height of this triangle is 56 cm and divides the base into 2 equal parts. Use the Pythagorean theorem and find the length of the three sides of this triangle. Round your answer to the nearest tenth.

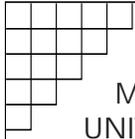


4. Give a real-world example of how the Pythagorean theorem might help you or someone you know solve a problem. Include a diagram that illustrates your example. \_\_\_\_\_

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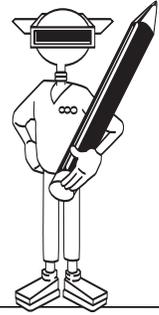
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COURSE: **MSC V**  
 MODULE 5: **Fundamentals of Statistics**  
 UNIT 1: **Interpreting & Constructing Graphs**

# Student Logbook



## Exploring Line Graphs

**As you work through the tutorial, complete the following statements and questions.**

A line graph shows trends or how data change over time.

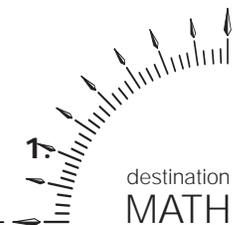
1. Dijit's graph shows Game Grid's \_\_\_\_\_.
2. According to the graph, Game Grid earned the most money during the month of \_\_\_\_\_.
3. Why did Dijit look for the highest point on the line graph? \_\_\_\_\_  
\_\_\_\_\_
4. The horizontal axis is labeled "\_\_\_\_\_". The vertical axis is labeled "Revenue in \_\_\_\_\_ of dollars."
5. Why does Dijit need a higher scale on the line graph? \_\_\_\_\_  
\_\_\_\_\_
6. If sales increase, will the line graph go up or down? \_\_\_\_\_
7. Describe how to locate the point that shows sales for November. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
8. During which month did sales decrease? \_\_\_\_\_
9. Does the line graph show a positive trend or a negative trend? \_\_\_\_\_ line.
10. The line connecting the points on the graph is called a \_\_\_\_\_ line.
11. What is a trend? \_\_\_\_\_
12. What does a negative trend line mean about sales? \_\_\_\_\_

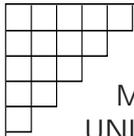
### Key Words:

Data  
 Trend  
 Scale  
 Line graph

### Learning Objectives:

- Interpreting a line graph
- Adding points to a line graph
- Identifying increasing and decreasing trends on a line graph





COURSE: **MSC V**  
 MODULE 5: **Fundamentals of Statistics**  
 UNIT 1: **Interpreting & Constructing Graphs**

# Your Turn



## Exploring Line Graphs

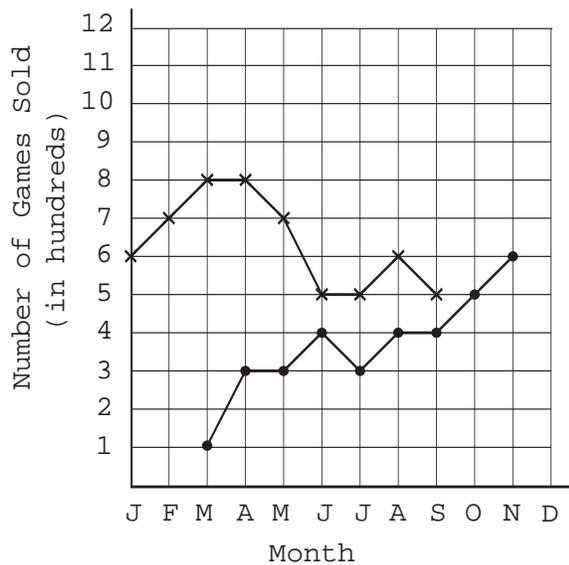
What does the graph show?

\_\_\_\_\_

\_\_\_\_\_

**Space Mission and Paragon:  
 Average number of games  
 sold each month**

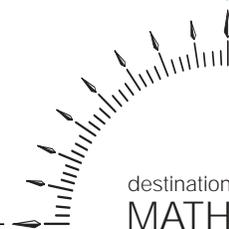
2. Some of the data are missing. Use the legend and graph the points that represent this information:
- a. Space Mission sold 400 games in October and 200 games in November.
  - b. Paragon sold 100 games in January and 200 games in February.

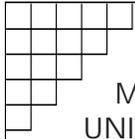


3. Connect the points plotted in 2(a) and (b) for each of the games to complete the line graph.

Legend:  
 x-x Space M:  
 •-• Paragon

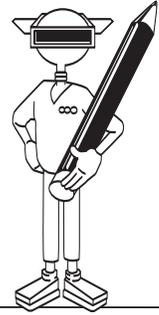
4. Which game had the greater number of sales in any one month? \_\_\_\_\_
5. Which month shows the greater difference in sales between Space Mission and Paragon? \_\_\_\_\_
6. Which of the two games shows the greater range in the average number of units sold? \_\_\_\_\_
7. Describe the trend line for each of the games. \_\_\_\_\_





COURSE: **MSC V**  
 MODULE 5: **Fundamentals of Statistics**  
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# Student Logbook



## Exploring Bar Graphs

**As you work through the tutorial, complete the following statements and questions.**

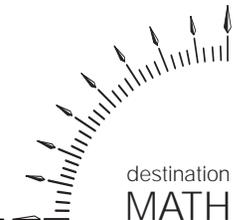
1. What label is used on the horizontal axis? \_\_\_\_\_
2. The vertical axis shows the \_\_\_\_\_  
\_\_\_\_\_ (in thousands).
3. Why did Dijit use a bar graph instead of a line graph to show sales in August? \_\_\_\_\_  
\_\_\_\_\_
4. A data set contains data of one type of information. What does "data" mean? \_\_\_\_\_
5. The horizontal and vertical lines in a graph are called \_\_\_\_\_.
6. A \_\_\_\_\_ is a series of marks along a line at regular intervals.
7. What is the range of values for Game Grid's sales during September?  
\_\_\_\_\_
8. What is the "range" for a set of data? \_\_\_\_\_
9. Why is 1,000 a better division for the scale than 100? \_\_\_\_\_  
\_\_\_\_\_
10. What do you need to consider when you make a graph scale? \_\_\_\_\_  
\_\_\_\_\_
11. How did Dijit reduce the size of the graph? \_\_\_\_\_

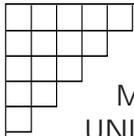
### Key Words:

Data  
 Trend  
 Range  
 Scale  
 Line graph

### Learning Objectives:

- Interpreting a bar graph
- Identifying data sets
- Identifying the horizontal and vertical axes
- Identifying the range of a data set
- Creating a scale along an axis
- Constructing a bar graph
- Using a broken axis to scale data





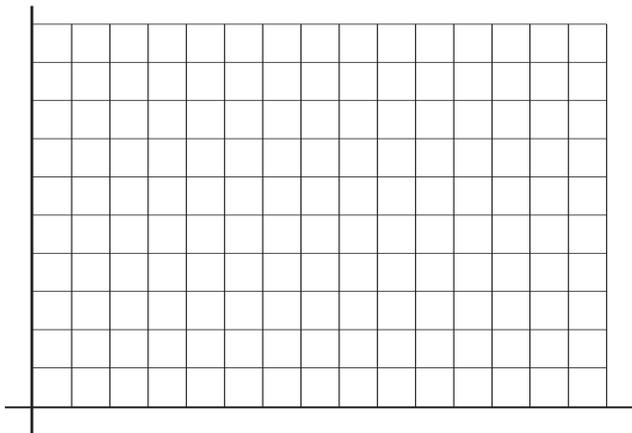
COURSE: **MSC V**  
 MODULE 5: **Fundamentals of Statistics**  
 UNIT 1: **Interpreting & Constructing Graphs**

# Your Turn

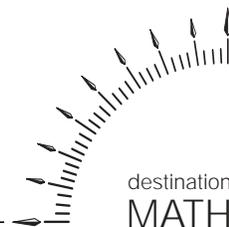


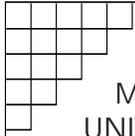
## Exploring Bar Graphs

1. In 1995, there were 18 million personal computers in Japan, 14 million personal computers in Germany, 13 million personal computers in the United Kingdom, and 10 million personal computers in France. Follow steps (a) through (e) given below to create a bar graph.



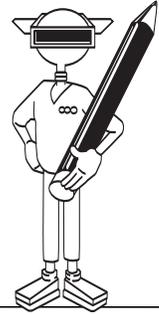
- a. Write a title for the bar graph.
  - b. What is the range along the vertical axis? \_\_\_\_\_
  - c. Use your answers in (b) and mark the scale along the vertical axis.
  - d. Label the horizontal axis of each of the countries.
  - e. Draw the bar for each country.
2. a. How many more personal computers are there in Japan than in Germany? \_\_\_\_\_
- b. Which country had the fewest number of personal computers? \_\_\_\_\_
- c. What percent of the total number of personal computers are in Japan in 1995? Round your answer to the nearest whole number. \_\_\_\_\_





COURSE: **MSC V**  
 MODULE 5: **Fundamentals of Statistics**  
 UNIT 1: **Interpreting & Constructing Graphs**

# Student Logbook



## Interpreting Pie Charts

As you work through the tutorial, complete the following statements and questions.

1. What does the pie chart show? \_\_\_\_\_
2. A pie chart is divided into \_\_\_\_\_.
3. Each sector represents a different \_\_\_\_\_ of the data, and all the sectors add up to \_\_\_\_\_.
4. The total number of degrees in a circle is \_\_\_\_\_ degrees, which makes up \_\_\_\_\_ of a pie chart.
5. To make a pie chart, Dijit needed to divide the pie chart into \_\_\_\_\_ and figure the \_\_\_\_\_ of each sector.
6. To find the degree in the angle that represents 60%, you can write this proportion: \_\_\_\_\_.
7. How did Dijit check the size of the angles? \_\_\_\_\_
8. To figure the percent of total sales for Max Orbit, you can write the proportion \_\_\_\_\_.
9. The value of  $x$  in the proportion in Question 8 is \_\_\_\_\_.
10. To represent the angle that represents 45%, you can write the proportion \_\_\_\_\_. Then  $d$  equals \_\_\_\_\_ degrees.
11. To be sure that your calculations are correct, check that the sum of the percents equals \_\_\_\_\_ percent.
12. The sum of all the angles in a pie chart is always \_\_\_\_\_ degrees.

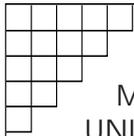
### Key Words:

Data  
Pie chart

### Learning Objectives:

- Interpreting a pie chart
- Converting raw data to percents
- Finding the number of degrees in a sector
- Creating a sector using a protractor
- Constructing a pie chart





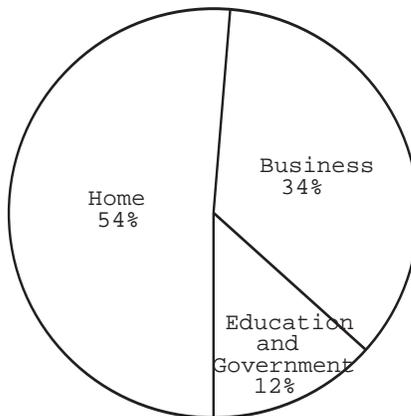
# Your Turn



## Interpreting Pie Charts

This pie chart represents Internet use in 1996.

Internet Users by Segment (1996)



1. Which sectors make up 66% of Internet users?

\_\_\_\_\_

\_\_\_\_\_

2. What percent of users are not home users?

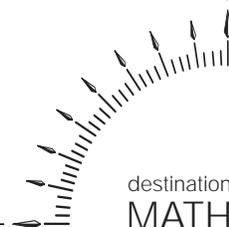
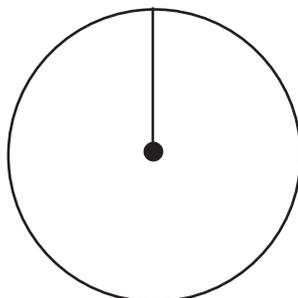
\_\_\_\_\_

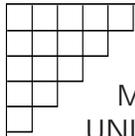
3. Do Business and Education and Government make up more than 80% of users? \_\_\_\_\_

4. How many degrees to the nearest whole number are in the sector that represents Business? Show your work. \_\_\_\_\_

\_\_\_\_\_

5. Conrad is keeping track of the time he spends each week on various computer activities. He spends 10 hours on homework, 6 hours surfing the Internet, 7 hours playing computer games, and 1 hour writing e-mail. Construct and label a pie chart showing Conrad's computer use for a week. (Calculate the percent of time spent on each task and the measure of each sector of the pie chart to the nearest whole number.)





COURSE: **MSC V**  
 MODULE 5: **Fundamentals of Statistics**  
 UNIT 1: **Interpreting & Constructing Graphs**



# Unit Review

## Exploring Line Graphs

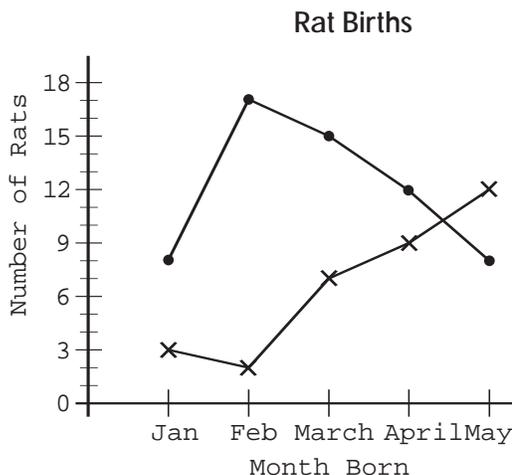
These line graphs show data on rat births at one pet store.

1. Describe the trends in the two line graphs.

a. grey rats (•) \_\_\_\_\_

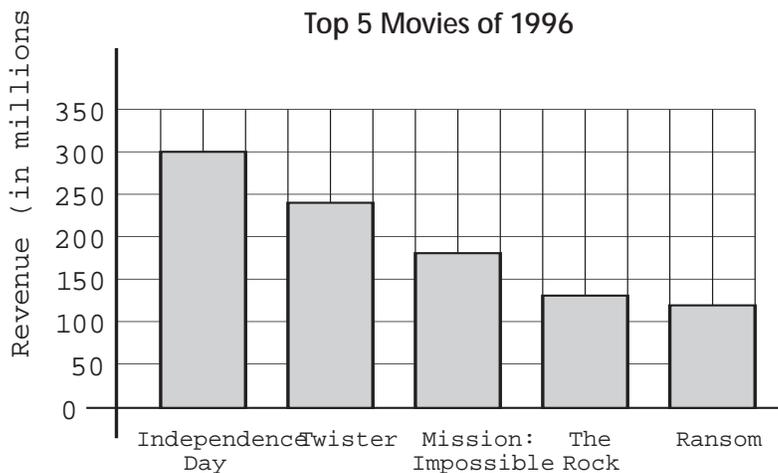
b. white rats (x) \_\_\_\_\_

2. In what month was the difference between the births of grey rats and of white rats the greatest? \_\_\_\_\_



• = grey rat  
 x = white rat

## Exploring Bar Graphs



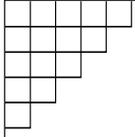
3. Use the bar graph above to answer the following questions.

a. Name the fourth-ranked movie in revenues. \_\_\_\_\_

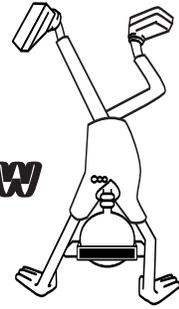
b. What is the range of values? \_\_\_\_\_

c. About what percent of the total yearly revenues for 1996 did *Twister* earn? \_\_\_\_\_





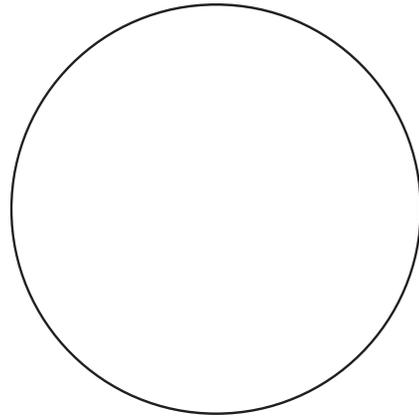
# Unit Review



## Interpreting Pie Charts

Students in Lauren's homeroom voted on their favorite sports. Four students voted for swimming, 6 students voted for tennis, 10 voted for basketball, 8 voted for football, 5 for soccer, and 7 for golf.

4. Use the information above to construct a pie chart. Label your chart and give it an appropriate title. Label each sector and include the measure of each sector to the nearest tenth.



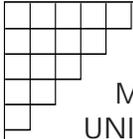
## Putting It All Together

5. Each day an average person spends 8.5 hours working, 1.5 hours eating, 30 minutes commuting, 3.5 hours watching TV, 30 minutes exercising, 8.5 hours sleeping, and 1 hour doing miscellaneous tasks. Display this information using either a line graph, a bar graph, or a pie chart.

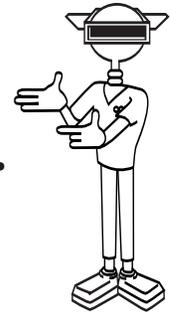
6. Explain why the graph you chose is the best way to display the data. \_\_\_\_\_

\_\_\_\_\_





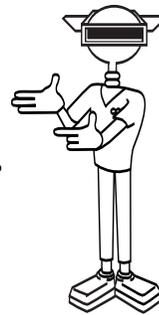
COURSE: **MSC V**  
 MODULE 5: **Fundamentals of Statistics**  
 UNIT 1: **Interpreting & Constructing Graphs**



## Unit Assessment

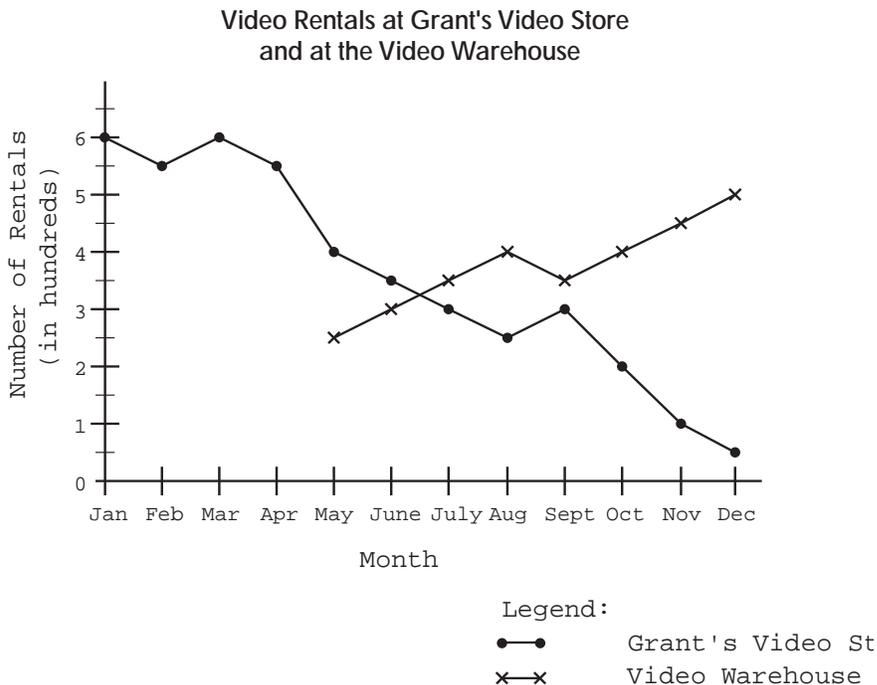
- On what type of graph would you expect to find a trend? \_\_\_\_\_
- A trend is a \_\_\_\_\_.
  - percent
  - comparison
  - tendency or pattern
- A bar graph is used to \_\_\_\_\_.
- Suppose you wanted to determine what percent of your allowance went toward savings, entertainment, and snacks. What type of graph would best display this data? \_\_\_\_\_
- If  $p$  represents a percent and  $d$  represents the measure of the number of degrees in a sector of a pie chart, write a proportion to find the values of  $d$  in terms of  $d$  and  $p$ . \_\_\_\_\_  
 \_\_\_\_\_
- A series of marks drawn at regular intervals along an axis is called \_\_\_\_\_.
  - data
  - the range
  - a scale
- A broken axis can be used to \_\_\_\_\_.
  - reduce the size of a bar graph
  - enlarge the size of a bar graph
- Suppose 11 out of 24 of your collection of music CDs are oldies. Write a proportion to convert the data into a percent  $p$  and then solve for  $p$ . Round your answer to the nearest tenth of a percent. \_\_\_\_\_  
 \_\_\_\_\_
- What is the degree measure of the sector in a pie chart if the sector represents 39% of the chart. \_\_\_\_\_





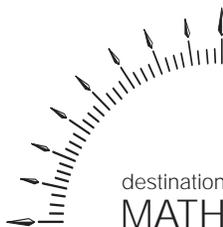
# Unit Assessment

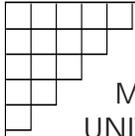
10. Use this line graph to answer the questions below.



- Did the number of rentals at Grant's Video Store increase or decrease during May, June, and July? \_\_\_\_\_
- Which of the two video stores has the greater range in the number of videos rented? \_\_\_\_\_
- Describe the trend lines of both stores. \_\_\_\_\_  
 \_\_\_\_\_

11. In a survey of 301 students at Bingham Middle School, 28 students program computers as a hobby. What percent of the students does this represent? Round your answers to the nearest tenth. \_\_\_\_\_

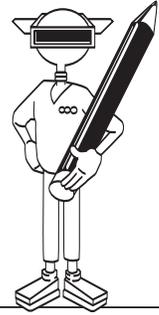




COURSE: **MSC V**  
 MODULE 5: **Fundamentals of Statistics**  
 UNIT 2: **The Mean, Median, & Mode**

## Defining the Mean & Median

## Student Logbook



**As you work through the tutorial, complete the following statements and questions.**

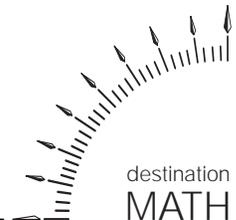
- In statistics, pieces of information collected are called data. Use this definition to define "raw data." \_\_\_\_\_  
\_\_\_\_\_
- The number of people in Dijit's sample is \_\_\_\_\_.
- A group of people selected to represent a whole population is called a \_\_\_\_\_.
- Dijit's sample represented the people who \_\_\_\_\_.
- Central tendency is the \_\_\_\_\_ of a data set.
- The mean is calculated by finding the \_\_\_\_\_ of the values and then \_\_\_\_\_ by the \_\_\_\_\_ of values.
- The \_\_\_\_\_ is the middle value in a data set when the data is arranged in \_\_\_\_\_ or \_\_\_\_\_ order.
- The middle value of the data set has to have the \_\_\_\_\_ number of values on either side of it.
  - When you have two middle values, the median is the \_\_\_\_\_ of the two middle values.
- If there is an odd number of values in a data set, the median is \_\_\_\_\_.
- Why was the median of the data set a better measure of central tendency than the mean? \_\_\_\_\_  
\_\_\_\_\_

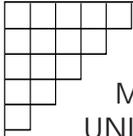
### Key Words:

Raw data  
 Average  
 Sample  
 Central tendency  
 Mean  
 Median  
 Mode

### Learning Objectives:

- Defining raw data
- Defining a sample
- Naming the 3 measures of central tendency
- Defining the mean
- Defining the median
- Defining the mode





COURSE: **MSC V**  
 MODULE 5: **Fundamentals of Statistics**  
 UNIT 2: **The Mean, Median, & Mode**

Your  
Turn



## Defining the Mean & Median

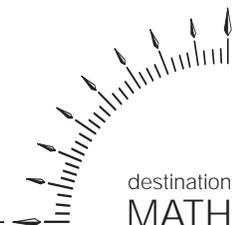
Jules kept a record of his game scores for two weeks.  
 Examine the raw data below and then answer the questions.

Week 1: 78, 27, 59, 101, 93, 115, 88, 95, 93

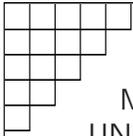
Week 2: 82, 121, 83, 97, 82, 148, 82, 117, 74

- What is the range of the data?
  - Week 1 \_\_\_\_\_
  - Week 2 \_\_\_\_\_
  - Both weeks combined \_\_\_\_\_
- What is the sample size of this data set? \_\_\_\_\_
- Find the mean and the median of these data. Express each statistic to the nearest whole number as necessary.
  - Week 1: Mean \_\_\_\_\_ Median \_\_\_\_\_
  - Week 2: Mean \_\_\_\_\_ Median \_\_\_\_\_
  - Both weeks combined: Mean \_\_\_\_\_ Median \_\_\_\_\_
- Compare the means and the medians of Parts a and b of Question 3.  
 Which value, the mean or the median suggests that Jules' game scores improved during the second week? \_\_\_\_\_  
 \_\_\_\_\_
- Compare the range for Week 1 and the range for Week 2. Jules thinks that his performance improved during the second week. Does the data show such an improvement? \_\_\_\_\_

Explain. \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

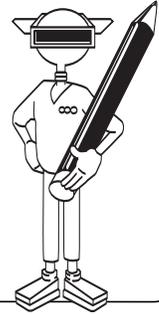


destination  
MATH



COURSE: **MSC V**  
 MODULE 5: **Fundamentals of Statistics**  
 UNIT 2: **The Mean, Median, & Mode**

# Student Logbook



## Defining the Mode

**As you work through the tutorial, complete the following statements and questions.**

- The mode of a data set is the \_\_\_\_\_ frequently occurring \_\_\_\_\_ .
- The age of the customers that occurs most often in the Max Orbit survey is \_\_\_\_\_ .
- Most of the customers surveyed are \_\_\_\_\_ than 9 years.
- Out of the 20 customers surveyed, \_\_\_\_\_ are within 5 years of the mode.
- Dijit has the values for the mean, median, and mode. All three can give different measures. What is the next step? \_\_\_\_\_  
\_\_\_\_\_
- The mean is not the best representation of the customers in Dijit's sample because \_\_\_\_\_ .
- The median is a good representation of the customers in the sample because \_\_\_\_\_ percent of the customers are within 5 years of the median.
- Is the mode or the median the best representation of the customers in the sample? \_\_\_\_\_ Why? \_\_\_\_\_  
\_\_\_\_\_
- Based on the median age of the customers in the sample, Game Grid decided not to sell to \_\_\_\_\_ because the typical game buyer's age was \_\_\_\_\_ .
- The mean, median, and mode depend on the \_\_\_\_\_ in your survey.

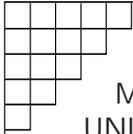
### Key Words:

Mean  
 Median  
 Mode  
 Average  
 Central tendency

### Learning Objectives:

- Defining the mode
- Interpreting which measure best "represents" the average for a given set of data





COURSE: **MSC V**  
 MODULE 5: **Fundamentals of Statistics**  
 UNIT 2: **The Mean, Median, & Mode**

Your  
Turn



## Defining the Mode

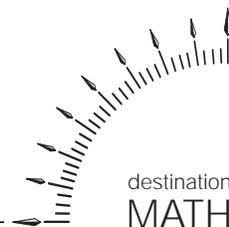
Games Unlimited sponsored a competition to feature their newest product, a game called Robots Amok. The list below shows how many hours it took participants to finish the first level of the game.

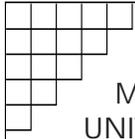
**Answer the questions that follow the list.**

8	6	9	4	5	3
7	7	10	6	5	11
6	8	7	4	7	10
9	4	7	8	8	9
6	7	3	8	7	5

- The data ranges from \_\_\_\_\_ to \_\_\_\_\_ hours.
- How long did it take most participants to finish the first level? \_\_\_\_\_
- Find the mean to the nearest tenth. \_\_\_\_\_
- Explain how to find the median of the data set. \_\_\_\_\_  
\_\_\_\_\_
- What is the median of the data set? \_\_\_\_\_
- What is the mode of the data set? \_\_\_\_\_
- Is one of the three values - the mean, median, or mode - the best representation of these data?  
\_\_\_\_\_

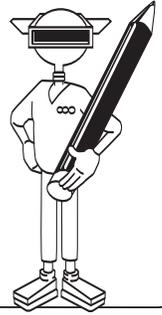
Explain. \_\_\_\_\_  
\_\_\_\_\_





COURSE: **MSC V**  
 MODULE 5: **Fundamentals of Statistics**  
 UNIT 2: **The Mean, Median, & Mode**

# Student Logbook



## Calculating the Mean, Median, & Mode

As you work through the tutorial, complete the following statements and questions.

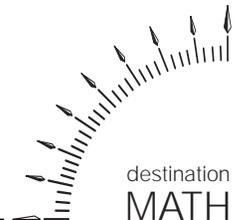
- Each customer rated Max Orbit on a scale of \_\_\_\_\_ to \_\_\_\_\_ .
- The range of marks does not show the typical rating of Max Orbit. However, the central tendency in this data set will describe the \_\_\_\_\_ of customers' ratings of the game.
- You can find the typical value by checking the \_\_\_\_\_ , the \_\_\_\_\_ , and the \_\_\_\_\_ .
- What is the mean in this data set? \_\_\_\_\_
- Dijit arranged the data set in \_\_\_\_\_ order to determine the median. The median is \_\_\_\_\_ . How did Dijit calculate the median? \_\_\_\_\_
- What is the mode in this data set? \_\_\_\_\_
- The mean, median, and mode of the typical marks given to Max Orbit are close because the range is \_\_\_\_\_ . When the range is large, the measures of central tendency may be quite \_\_\_\_\_ from each other.
- The mean, median, and mode of the ages of those who bought Max Orbit were different because \_\_\_\_\_ .
- When is it best to use the mean? \_\_\_\_\_

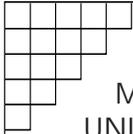
### Key Words:

Mean  
 Median  
 Mode  
 Average

### Learning Objectives:

- Calculating the mean
- Calculating the median
- Determining the mode
- Interpreting which measure best represents the 'average' for a given set of data





COURSE: **MSC V**  
 MODULE 5: **Fundamentals of Statistics**  
 UNIT 2: **The Mean, Median, & Mode**

Your  
Turn

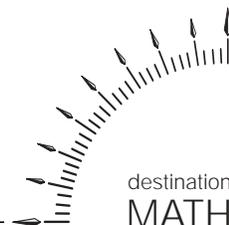


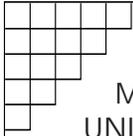
## Calculating the Mean, Median, & Mode

Games Unlimited asked the 30 participants in the competition to rate the skill level of Robots Amok on a scale of 1 to 5. The scale is: 1 = Too easy; 2 = Easy; 3 = Moderately difficult; 4 = Difficult; 5 = Too difficult. The results are shown below.

1	4	3	5	4	3
2	3	4	4	3	2
1	5	5	3	4	3
4	4	3	4	1	2
2	3	5	4	3	4

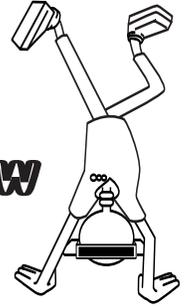
- The range of marks is from \_\_\_\_\_ to \_\_\_\_\_ .
- Using the data in the table, calculate the mean to the nearest tenth.  
\_\_\_\_\_
- What is the median? \_\_\_\_\_
- What is the mode? \_\_\_\_\_
- Explain what the mean, median, and mode indicate about the skill level of Robots Amok. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
- Of the three measures of central tendency, the most representative measure of the skill level of the game is the \_\_\_\_\_ because \_\_\_\_\_ .





COURSE: **MSC V**  
 MODULE 5: **Fundamentals of Statistics**  
 UNIT 2: **The Mean, Median, & Mode**

## Unit Review



The list below shows the time in minutes that 20 customers at Computer Works played a demo game on one of the store's computers.

Time in minutes

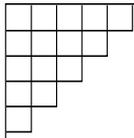
15	10	5	20	15
30	10	10	45	15
20	5	5	25	35
10	5	15	35	40

- The range of data is from \_\_\_\_\_ to \_\_\_\_\_ .
- The median in the set of data is \_\_\_\_\_ .
- The mean to the nearest tenth is \_\_\_\_\_ .

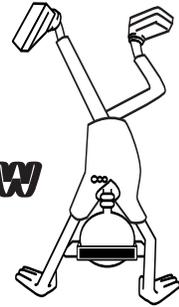
### Defining the Mode

The number of times Roudy sent e-mail messages to his friends during the past 10 days is as follows: 5, 3, 6, 2, 3, 3, 4, 6, 9, 7.

- Arrange the raw data in increasing order. \_\_\_\_\_
- The most frequently occurring value in a data set is the \_\_\_\_\_ .
- Calculate the mean and the median of the raw data. Mean: \_\_\_\_\_  
 Median: \_\_\_\_\_ .



# Unit Review



## Calculating the Mean, Median, & Mode

Paula has been selling boxes of candy to raise money for a local charity.

The number of boxes she sold during the last 10 days are as follows:

80, 65, 80, 47, 98, 80, 115, 30, 85, 77.

7. Find the mean, median, and mode. Round answers to the nearest tenth as necessary. Mean: \_\_\_\_\_ Median: \_\_\_\_\_ Mode: \_\_\_\_\_
8. Which measure of central tendency most accurately represents a typical day for Paula? \_\_\_\_\_ Explain. \_\_\_\_\_

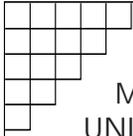
## Putting It All Together

The owner of a game store needs to decide how many copies of the Rocket to Mars game to stock for a one-day sale. The data tells you how many copies of Rocket to Mars sold each day during the past 30 days.

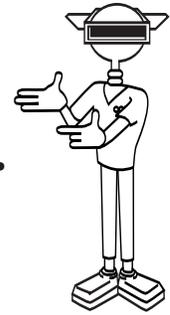
2	15	13	15	15	47
1	15	18	22	115	26
14	13	3	18	98	2
14	15	15	27	83	4
17	33	2	4	4	15

9. The data ranges from \_\_\_\_\_ to \_\_\_\_\_ .
10. Find the mean, median, and mode of the data, rounding each to the nearest tenth where necessary.  
Mean: \_\_\_\_\_ Median: \_\_\_\_\_ Mode: \_\_\_\_\_
11. How many games should the owner stock for the one-day sale? \_\_\_\_\_  
Explain. \_\_\_\_\_  
\_\_\_\_\_





COURSE: **MSC V**  
 MODULE 5: **Fundamentals of Statistics**  
 UNIT 2: **The Mean, Median, & Mode**



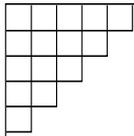
## Unit Assessment

- Find the median of the following numbers:
  - 23, 8, 16, 4, 91, 18, 2, 6, 33 \_\_\_\_\_
  - 17, 2, 1, 93, 45, 6, 47, 17, 47, 10 \_\_\_\_\_
- The numbers 3, 4, 5, 2, 2, 6, and 1 represent the number of hours that Lauren spent online each day during the past 7 days.
  - The mean of these data rounded to the nearest tenth is \_\_\_\_\_ .
  - The number of data most frequently spent online were \_\_\_\_\_ .  
This measure is the \_\_\_\_\_ .
  - The middle value of the time Lauren spent online is \_\_\_\_\_ . This measure is the \_\_\_\_\_ .
- The editor of *Online Times* asked 20 subscribers to rate the quality of the newsletter on a scale from 1 to 5, with 1 representing the highest quality and 5 representing the poorest quality..

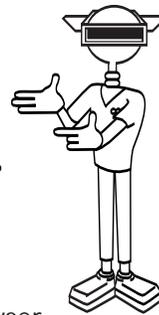
3	4	4	2	1
2	4	3	2	1
5	2	3	3	2
2	2	3	3	4

- The range of the sample is from \_\_\_\_\_ to \_\_\_\_\_ , and the sample size is \_\_\_\_\_ .
- What is the mode of the data? \_\_\_\_\_
- What is the mean, rounded to the nearest hundredth? \_\_\_\_\_
- Use the measures of central tendency to explain why the editor of *Online Times* would decide to improve the newsletter. \_\_\_\_\_  
\_\_\_\_\_





# Unit Assessment



4. The software company Blue Dog test-marketed three products: WipZag, a computer game; Word Power, a word processor; and Rover, a Web browser. The survey data collected for the 3 samples show the ages of customers who used each product. Find the mean, median, and mode, for each set of data, rounded to the nearest whole number where necessary.

14	8	19	23	7
7	9	10	15	12
7	7	9	11	32
17	10	9	30	26

a. WipZag: Mean \_\_\_\_\_ Median \_\_\_\_\_ Mode \_\_\_\_\_

18	23	46	54	63
46	23	23	19	34
35	47	43	45	49
54	19	43	18	49

b. Word Power: Mean \_\_\_\_\_ Median \_\_\_\_\_ Mode \_\_\_\_\_

8	61	49	33	50
7	61	49	49	53
12	50	52	68	81
17	61	50	49	76

c. Rover: Mean \_\_\_\_\_ Median \_\_\_\_\_ Mode \_\_\_\_\_

5. What do the three measures of central tendency for each program tell you?

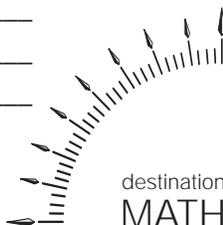
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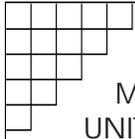


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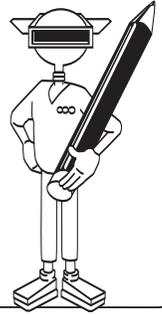
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COURSE: **MSC V**  
 MODULE 5: **Fundamentals of Statistics**  
 UNIT 3: **Frequency Distribution**

# Student Logbook



## Creating and Interpreting a Frequency Table

As you work through the tutorial, complete the following statements and questions.

- What are the three skill levels for Game Grid's Max Orbits Again?  
 \_\_\_\_\_ , \_\_\_\_\_ , \_\_\_\_\_
- How many experienced players' scores have been collected? \_\_\_\_\_
- How many tally marks are recorded for a score of 187? \_\_\_\_\_
- How can you represent a score of 250 using tally marks? \_\_\_\_\_
- Dijit changed the tally marks to \_\_\_\_\_ .
- Dijit labeled the gray row \_\_\_\_\_ , which means \_\_\_\_\_ .
- In the formula  $\bar{x} = \frac{\sum x}{n}$ ,  $\bar{x}$  represents \_\_\_\_\_  $\Sigma$  represents \_\_\_\_\_ , and  $n$  represents \_\_\_\_\_ .
- To find the mean of the data, each score needs to be multiplied by its \_\_\_\_\_ and then \_\_\_\_\_ together.
- Dijit used an abbreviated formula to find the mean of all the scores. Circle the correct formula  $\frac{\sum f(x)}{\sum f}$  or  $\frac{\sum f}{\sum f(x)}$ .
- Dijit divided 11,559 by \_\_\_\_\_ . He rounded 288.975 to \_\_\_\_\_ , which was the cutoff score for \_\_\_\_\_ .
- A frequency table is a way of organizing \_\_\_\_\_ to show how many times \_\_\_\_\_ .

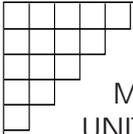
### Key Words:

Data  
 Range  
 Frequency  
 Frequency distribution table

### Learning Objectives:

- Using tally marks to create a frequency table
- Constructing a frequency distribution
- Calculating the mean using the frequency data





COURSE: **MSC V**  
 MODULE 5: **Fundamentals of Statistics**  
 UNIT 3: **Frequency Distribution**

Your  
Turn



## Creating and Interpreting a Frequency Table

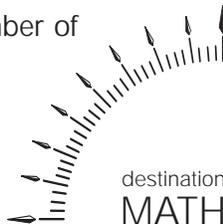
The Protect-A-Head Company manufactures bicycle helmets. The helmets must meet high standards of quality. Any helmet that does not meet the standards is rejected. To determine how many helmets are rejected, the company president counted the number of rejected helmets made by each of 30 employees during one month. He entered the data in the table below.

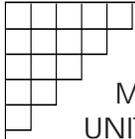
100	95	85	45	60	45	80	60	125	95
87	87	125	87	87	125	87	87	85	123
60	80	95	80	100	123	80	45	95	125

1. Complete the first row of the frequency table below. Arrange the data in increasing order.

No. of rejects									
Frequency									

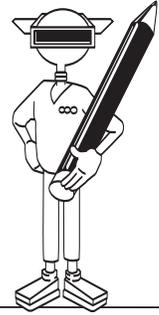
2. Use tally marks to represent the frequency of each value.
3. Complete the third row in the table by converting the tally marks to numbers.
4. Complete the fourth row in the table and list the total frequency of each number of rejected helmets.
5. Calculate the mean number of helmets rejected per month. Round your answer to the nearest whole number. \_\_\_\_\_





COURSE: **MSC V**  
 MODULE 5: **Fundamentals of Statistics**  
 UNIT 3: **Frequency Distribution**

# Student Logbook



## Defining a Histogram

As you work through the tutorial, complete the following statements and questions.

1. To make a bar graph, Dijit first decided to group the data into intervals of one hundred. He made a new frequency distribution table, which he called a \_\_\_\_\_ .

2. Fill in the table for each interval.

Score	1-100	101-200	201-300	301-400	401-500	501-600	601-700
Frequency							

3. A \_\_\_\_\_ is a \_\_\_\_\_ graph that shows the \_\_\_\_\_ of an occurrence.

4. On the axes, fixed data goes on the \_\_\_\_\_ axis. Measured data goes on the \_\_\_\_\_ axis. Is frequency fixed or measured data? \_\_\_\_\_

5. You can find the mean of a grouped frequency table by using the \_\_\_\_\_-\_\_\_\_\_ value for each group. You find this value by \_\_\_\_\_ the \_\_\_\_\_ and \_\_\_\_\_ numbers in the group or interval and dividing by \_\_\_\_\_ .

6. Dijit then used a formula to find the mean. He multiplied the \_\_\_\_\_ times the mid-interval values ( $x$ ) and then calculated their \_\_\_\_\_. He next divided this number by the total number of \_\_\_\_\_ , to get a mean of \_\_\_\_\_ .

7. Is the mean from the data after grouping *more* or *less* accurate than the mean from the data before grouping? \_\_\_\_\_

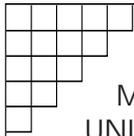
### Key Words:

Data  
 Range  
 Frequency  
 Frequency distribution table  
 Grouped frequency  
 Interval  
 Mid-interval  
 Histogram

### Learning Objectives:

- Dividing data into equal intervals to create a grouped frequency table
- Defining a histogram
- Creating a histogram for the frequency data
- Finding the mean of a grouped frequency





COURSE: **MSC V**  
 MODULE 5: **Fundamentals of Statistics**  
 UNIT 3: **Frequency Distribution**

# Your Turn



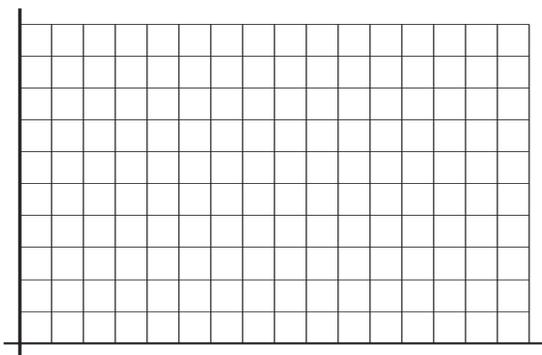
## Defining a Histogram

Below is the data on how many helmets employees of a bicycle helmet manufacturer had rejected during one month. Use the data in this frequency table to make a grouped frequency table.

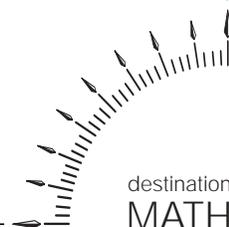
Number of rejects	45	60	80	85	87	95	100	123	125
Frequency	3	3	4	2	6	4	2	2	4

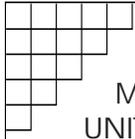
Number of rejects	1-20								
Frequency ( $f$ )									
Mid-Interval Values ( $x$ )									

1. Complete the first row of the table. The first interval, 1-20, has been entered for you.
2. Calculate mid-interval values ( $x$ ). Place them in the table above.
3. Calculate the frequency of each value in the data..
4. Draw a histogram of the data on the grid below. Label each axis, show divisions, label each bar, and provide a title for your histogram.



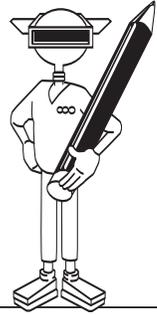
5. What is the mean in tenths of the grouped frequency table? \_\_\_\_\_





COURSE: **MSC V**  
 MODULE 5: **Fundamentals of Statistics**  
 UNIT 3: **Frequency Distribution**

# Student Logbook



## Exploring Cumulative Frequency Graphs

As you work through the tutorial, complete the following statements and questions.

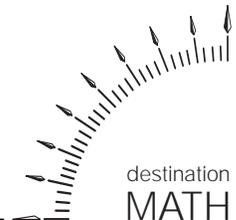
1. What percentile value is used for the entry score for Level 3? \_\_\_\_\_
2. To find a percentile value, make a \_\_\_\_\_ table, plot the data on a graph, and draw a smooth \_\_\_\_\_.
3. What does "cumulative frequency" mean? \_\_\_\_\_
4. What observation did Dijit make when the last cumulative frequency value, 40, was recorded in the table? \_\_\_\_\_
5. Dijit used divisions of \_\_\_\_\_ to identify the \_\_\_\_\_ along the horizontal axis and divisions of \_\_\_\_\_ to identify the \_\_\_\_\_ along the vertical axis.
6. After Dijit plotted the points on the graph, he connected them with \_\_\_\_\_ .
  - a. straight lines
  - b. a smooth curve
  - c. more dots
7. You chose the curve that \_\_\_\_\_ fits the plotted points.
8. Thirty-two (32) players scored \_\_\_\_\_ or \_\_\_\_\_ the 80th percentile.
9. The score of 425 is an approximate value. Explain. \_\_\_\_\_
10. The cutoff score rounded to the nearest hundred is \_\_\_\_\_ .
  - a. 425
  - b. 300
  - c. 400

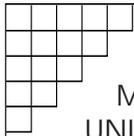
### Key Words:

Data  
 Range  
 Frequency  
 Frequency distribution table  
 Grouped frequency  
 Interval  
 Mid-interval  
 Histogram  
 Percentile

### Learning Objectives:

- Calculating and plotting cumulative frequencies on a graph
- Identifying a best-fit curve for the points on a cumulative frequency graph
- Finding a specified percentile using a cumulative frequency graph





COURSE: **MSC V**  
 MODULE 5: **Fundamentals of Statistics**  
 UNIT 3: **Frequency Distribution**

Your Turn

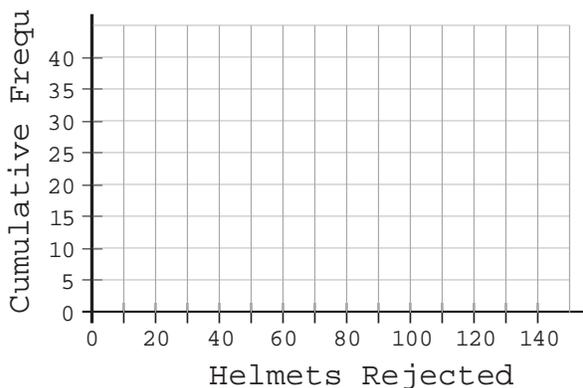


## Exploring Cumulative Frequency Graphs

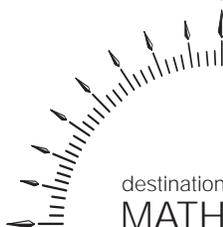
The president of Protect-A-Head has decided that any employee who is at or below the 20th percentile will receive a commendation and any employee who is at or below the 10th percentile will be given a bonus and a commendation. The data in this table represent the number of rejected helmets made by 30 employees in the company during one month.

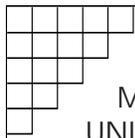
Number of rejects	45	60	80	85	87	95	100	123	125
Frequency ( $f$ )	3	3	4	2	6	4	2	2	4
Cumulative frequency									

1. Calculate the cumulative frequencies and enter them into the table.
2. The last value in the cumulative frequency row is \_\_\_\_\_ because \_\_\_\_\_.
3. Use the grid below and plot the points that represent the number of rejected helmets and the value of corresponding cumulative frequency.



4. Draw a line of best fit through the points on the graph above.
5. How many employees were at or below the 10th percentile and how many employees were at or below the 20th percentile?
  - a. 10th percentile \_\_\_\_\_
  - b. 20th percentile \_\_\_\_\_





COURSE: **MSC V**  
 MODULE 5: **Fundamentals of Statistics**  
 UNIT 3: **Frequency Distribution**



# Unit Review

## Creating and Interpreting a Frequency Table

Zack surveyed 30 of his classmates and gathered information about the ages of their grandfathers. His results are shown in the table below.

78	90	67	88	90	72	72	76	90	78
85	82	78	75	69	88	87	78	73	75
78	77	82	84	94	77	78	63	96	85

- Use the data in the table and construct a frequency distribution table. Arrange the ages in ascending order, starting with the least value, 63.

Ages (yrs)	63																		
Frequency (f)																			

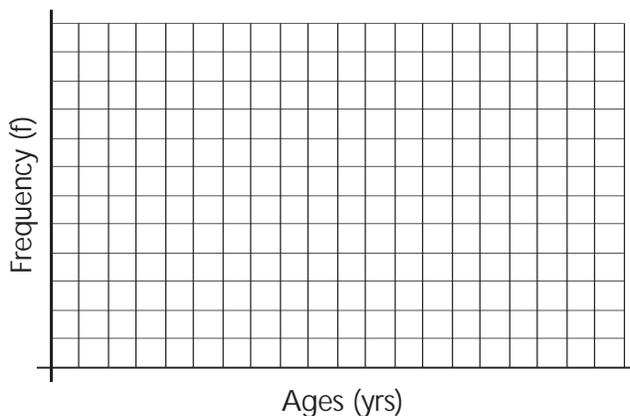
- Use the formula  $\bar{x} = \frac{\sum(f)x}{\sum f}$  to calculate the mean of these data. Round your answer to the nearest whole number.

\_\_\_\_\_

## Defining a Histogram

- Create a grouped frequency table using the frequency distribution table you constructed, Group the ages in the table into intervals of 10 years, starting with 60-69.

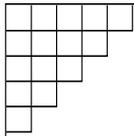
- Use the grouped frequency table and construct a histogram on this grid.



- Calculate the mean of the data using mid-intervals. Round your answer to the nearest whole number.

\_\_\_\_\_





# Unit Review

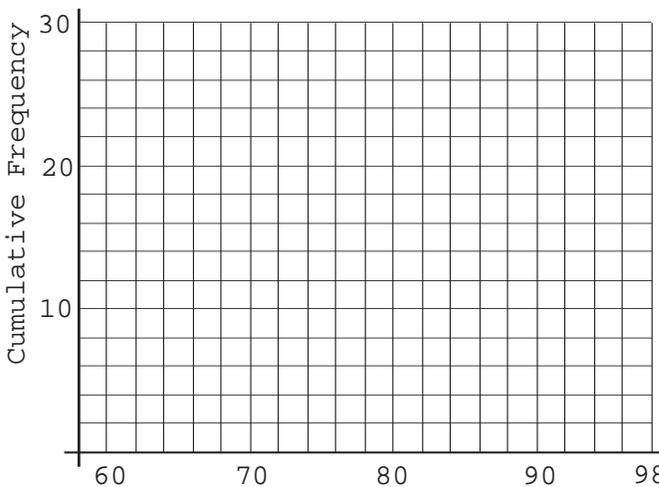
## Exploring Cumulative Frequency Graphs

6. Complete the cumulative frequency table based on the age data in problem 1.

Age ( $x$ ):	63	67	69	72	73	75	76	77	78
Frequency ( $f$ ):	1	1	1	2	1	2	1	2	6
Cumulative frequency:									

Age ( $x$ ):	82	84	85	87	88	90	94	96
Frequency ( $f$ ):	2	1	2	1	2	3	1	1
Cumulative frequency:								

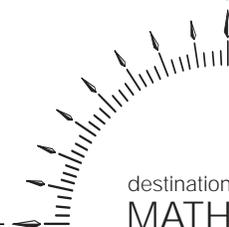
7. Plot the points that represent the ages and cumulative frequencies on the grid. Draw a line of best fit through the points.

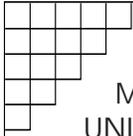


8. Use the graph to estimate the value that represents the age that lies at the 70th percentile of the scores. \_\_\_\_\_

## Putting It All Together

9. Use the graph you created in Question 7 to determine the age that represents the 50th percentile (the median). \_\_\_\_\_  
 Compare the value of the 50th percentile to the mean values that you calculated in Questions 2 and 5. What is the relationship between these numbers? \_\_\_\_\_





COURSE: **MSC V**  
 MODULE 5: **Fundamentals of Statistics**  
 UNIT 3: **Frequency Distribution**

## Unit Assessment



1. Super Nova Soda asked its customers to rate its new soda on a scale of 1 to 10, with 1 representing poor and 10 representing excellent. The raw data is: 9, 3, 5, 5, 4, 9, 1, 3, 2, 6, 7, 6, 9, 3, 2, 1, 5, 4, 6, 7, 7, 3, 4, 6, 9, 7, 2, 3, 5, 6.

- a. Complete this frequency distribution table for the data.

Ratings (r)	1	2	3	4	5	6	8	9	10
Frequency (f)									

- b. Find the total number of points for each rating.

1: \_\_\_\_\_ 2: \_\_\_\_\_ 3: \_\_\_\_\_ 4: \_\_\_\_\_ 5: \_\_\_\_\_

6: \_\_\_\_\_ 7: \_\_\_\_\_ 8: \_\_\_\_\_ 9: \_\_\_\_\_ 10: \_\_\_\_\_

- c. Calculate the mean  $\bar{x}$  of the ratings, using the formula  $\bar{x} = \frac{\sum f(x)}{\sum f}$ , where  $\sum f(x)$  represents the sum of all the ratings, and  $\sum f$  equals the number of ratings. Round your answer to the nearest whole number. \_\_\_\_\_

- d. Based on the mean, would it be reasonable for Super Nova Soda to make and sell the new soda? \_\_\_\_\_ Explain. \_\_\_\_\_

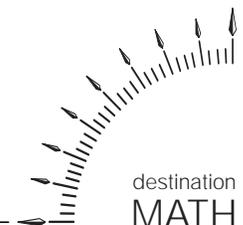
2. a. Create a grouped frequency table, using intervals of 2 for each rating.

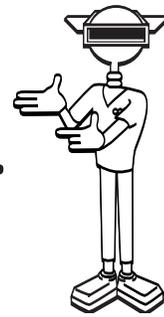
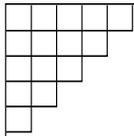
Ratings (r)	1 - 2	3 - 4	5 - 6	7 - 8	9 - 10
Frequency (f)					

- b. Calculate the mid-interval values for the data. \_\_\_\_\_

- c. If  $x$  is a mid-interval value, calculate the frequency of  $x$  in each interval. \_\_\_\_\_

- d. Calculate the mean of the grouped data, rounding your answer to the nearest whole number. \_\_\_\_\_



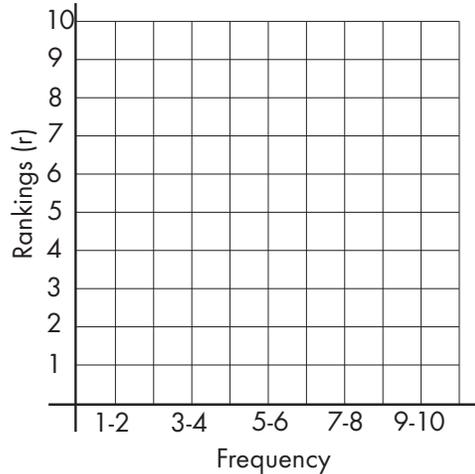


# Unit Assessment

3. Construct a histogram for the grouped frequency table.

4. Use the histogram to answer the following questions.

- a. What ratings did most customers ranked the new soda? \_\_\_\_\_ .
- b. How many customers rated the new soda 5 or above? \_\_\_\_\_
- c. What percentage of the customers rated the soda 5 or more? Round your answers to the nearest whole number. \_\_\_\_\_



5. Fill in the cumulative frequency table below.

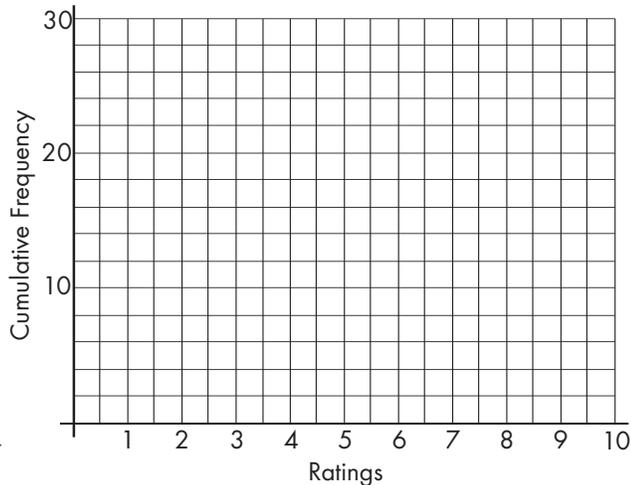
Ratings (r)	1	2	3	4	5	6	7	9
Frequency (f)	2	3	5	3	4	5	4	4
Cumulative frequency								

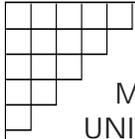
6. Use the data in the table and create a cumulative frequency graph. Draw a line of best-fit through the points you plot.

7. a. What is the rating at the 80th percentile? \_\_\_\_\_

b. Explain what the rating at the 80th percentile means.  
\_\_\_\_\_

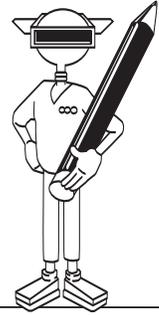
c. What percentage of the customers rated the soda higher than the 80th percentile? \_\_\_\_\_





COURSE: **MSC V**  
 MODULE 6: **Fundamentals of Probability**  
 UNIT 1: **Simple Probability**

# Student Logbook



## Defining & Expressing Probability

As you work through the tutorial, complete the following statements and questions.

1. When players are selected at \_\_\_\_\_, everybody has a(n) \_\_\_\_\_ chance of being selected.
2. When there is a choice between \_\_\_\_\_ options, you can toss a \_\_\_\_\_ to leave the decision to chance.
3. A result can also be described as a(n) \_\_\_\_\_.
4. A result you want is called a(n) \_\_\_\_\_.
5. In the fraction  $\frac{1}{2}$ , the 1 represents the number of \_\_\_\_\_ outcomes, while the 2 represents the number of \_\_\_\_\_ outcomes.
6. In the expression  $P = \frac{\text{Number of desired outcomes}}{\text{Number of possible outcomes}}$ ,  $P$  is called the \_\_\_\_\_.
7. When tossing a coin, the probability of getting heads is \_\_\_\_\_. The probability of getting tails is \_\_\_\_\_.
8. When something is certain to happen, it has a probability of \_\_\_\_\_.
9. The probability of an impossible event, is \_\_\_\_\_.
10. The set of all possible outcomes is called the \_\_\_\_\_.
11. Is it true that Zack and Dijit each have a 50% chance to win the coin toss? \_\_\_\_\_ Explain your answer. \_\_\_\_\_

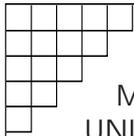
### Key Words:

Possible outcome  
 Desired outcome  
 Impossible outcome  
 Probability

### Learning Objectives:

- Defining the probability of an outcome in an experiment
- Recognizing that the sum of the probabilities of all possible outcomes in an experiment is 1
- Recognizing that the probability of an impossible outcome is 0
- Defining the sample space for an experiment
- Expressing probabilities as fractions and percents





COURSE: **MSC V**  
 MODULE 6: **Fundamentals of Probability**  
 UNIT 1: **Simple Probability**

Your Turn



## Defining & Expressing Probability

1. Alison’s training program includes swimming, lifting weights, and working out with her racing wheelchair. She selects one exercise each day. She made tokens to help her decide which type of exercise to do each day. One said “Swim,” one said “Lift,” and one said “Race.” She keeps the tokens in a box. Each day, she draws a token, looks at it, then returns it to the box.

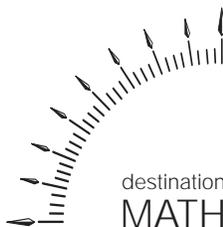
- a. What is the total number of possible outcomes? \_\_\_\_\_
- b. Could Alison use a coin toss to decide which type of exercise to do? \_\_\_\_\_ Explain your answer. \_\_\_\_\_
- c. If Alison wants to swim today, what is the number of desired outcomes of choosing the swimming token? \_\_\_\_\_
- d. What is the probability that Alison will draw a token that says “swim?” \_\_\_\_\_
- e. If Allison draws a token from the box, what is the probability that she will exercise? \_\_\_\_\_

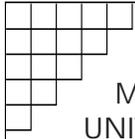
2. Alison sometimes does the same exercise two days in a row. She wondered how likely this was to happen. To calculate this, she made a chart like the one below, where S = “Swim”, L = “Left”. and R = “Race”.

a. Complete the chart by filling in the missing letters.

		Second Day		
		S	L	R
First Day	S	S,S		
	L			L,R
	R	R,S		

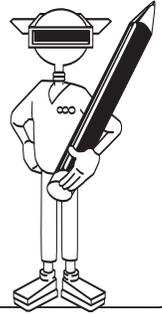
b. What is the probability that Alison will do the same exercise two days in a row? \_\_\_\_\_





COURSE: **MSC V**  
 MODULE 6: **Fundamentals of Probability**  
 UNIT 1: **Simple Probability**

# Student Logbook



## Calculating Probabilities on a Color Wheel

As you work through the tutorial, complete the following statements and questions.

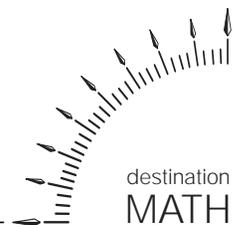
1. a. Probability = \_\_\_\_\_
  - b. Each colored region on the color wheel is called a \_\_\_\_\_.
  - c. How many sectors are on the wheel? \_\_\_\_\_
  - d. How many different colors does the wheel have? \_\_\_\_\_
2. Is the total number of possible outcomes equal to the number of colors or to the number of sections? \_\_\_\_\_ Explain your answer. \_\_\_\_\_
3. What is the number of desired outcomes that are red? \_\_\_\_\_.
4. What is the probability of spinning red? \_\_\_\_\_
5. What are the number of desired outcomes that are yellow? \_\_\_\_\_
6. What is the probability of spinning yellow? \_\_\_\_\_
7. What is the probability, in lowest terms, of spinning blue? \_\_\_\_\_
8. Which outcome has the highest probability when you spin the wheel? \_\_\_\_\_ Explain your answer. \_\_\_\_\_
9. By choosing the outcome with the highest probability, was Dijit guaranteed to win the first round? \_\_\_\_\_ Explain. \_\_\_\_\_

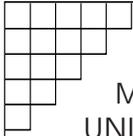
### Key Words:

Possible outcome  
 Desired outcome  
 Impossible outcome  
 Probability

### Learning Objectives:

- Determining the sample space on a color wheel
- Calculating the probabilities of different outcomes when spinning a color wheel





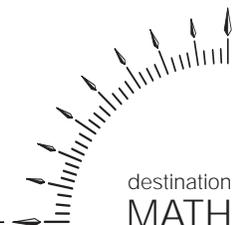
COURSE: **MSC V**  
 MODULE 6: **Fundamentals of Probability**  
 UNIT 1: **Simple Probability**

Your  
Turn

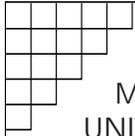


## Calculating Probabilities on a Color Wheel

1. Dijit is investigating probability with a plastic game piece in the form of a cube. The cube has six sides. Each side is a different color: red, orange, yellow, blue, green, and purple. When the cube is rolled, it comes to rest with one of its sides on top. How many possible outcomes are there?  
\_\_\_\_\_
2. What is the probability that the cube will come to rest with the red side on top? \_\_\_\_\_
3. For the cube to land with a red or orange side on top, how many desired outcomes are there? \_\_\_\_\_
4. What is the probability that the cube will land with a red or an orange side up? \_\_\_\_\_
5. If blue, green, and purple are considered cool colors, how many ways can the cube land with a cool color up? \_\_\_\_\_
6. What is the probability that the cube will land with a cool color up? \_\_\_\_\_
7. What is the probability that the cube will land with any color up? \_\_\_\_\_
8. What is the probability that the cube will land with a pink side up? \_\_\_\_\_
9. Suppose a yellow cube has been marked with letters A, B, C, D, E, F, one letter on each side. Write three probability questions (and the answers!) for the possible outcomes when rolling this cube.
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_
  - c. \_\_\_\_\_

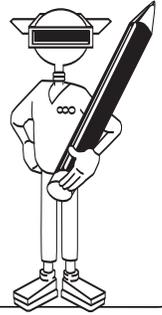


destination  
MATH



COURSE: **MSC V**  
 MODULE 6: **Fundamentals of Probability**  
 UNIT 1: **Simple Probability**

# Student Logbook



## Determining Probabilities of Complementary Events

As you work through the tutorial, complete the following statements and questions.

1. According to the game rules, if the wheel stops on 4, who will win the point? (Circle one.)

Zack

Dijit

Nobody

2. What is the probability of spinning 4? \_\_\_\_\_

3. What is the probability of a certain event? \_\_\_\_\_

4. What expression can you use to show that the probability that not spinning 4 is equal to  $\frac{5}{6}$ ? \_\_\_\_\_

5. How many sectors on the wheel have numbers that are greater than 4? \_\_\_\_\_

6. The probability that you will open a number less than 4 is \_\_\_\_\_ .

7. An odd number is a number that is not divisible by \_\_\_\_\_ .

8. What is the probability that you will spin an even number? \_\_\_\_\_

9. Is it possible that neither Zack nor Dijit could win the "Odds and Evens" round? \_\_\_\_\_ Explain. \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

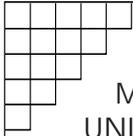
### Key Words:

Possible outcome  
 Desired outcome  
 Impossible outcome  
 Probability

### Learning Objectives:

- Calculating the probabilities of different outcomes when spinning a color wheel





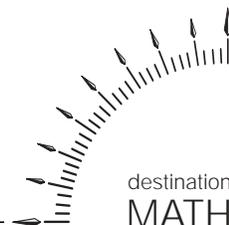
COURSE: **MSC V**  
 MODULE 6: **Fundamentals of Probability**  
 UNIT 1: **Simple Probability**

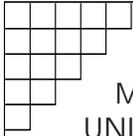
Your  
Turn



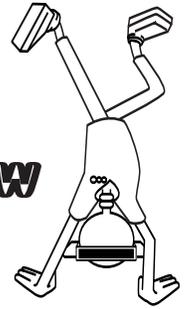
## Determining Probabilities of Complementary Events

- Suppose a color wheel has seven sectors, numbered 1 through 7.
  - How many possible outcomes are there? \_\_\_\_\_
  - What is the probability of spinning 3? \_\_\_\_\_
  - What is the probability of spinning a number greater than 3?  
\_\_\_\_\_
  - How many desired outcomes are there for spinning a number that is less than 5 \_\_\_\_\_
  - What is the probability of spinning an even number? \_\_\_\_\_
  - What is the probability of spinning an odd number? \_\_\_\_\_
  - What is the probability of spinning is a prime number? \_\_\_\_\_
  - What is the probability of spinning is a multiple of 3? \_\_\_\_\_
- Dijit continues to experiment with probability, this time using a cube with each side a different color. The colors are red, orange, yellow, blue, green, and purple.
  - How many different ways can the cube land without a red side on top? \_\_\_\_\_
  - What is the probability that the red side will not be on top? \_\_\_\_\_
  - What is the sum of the probability of getting red and the probability of not getting red? \_\_\_\_\_





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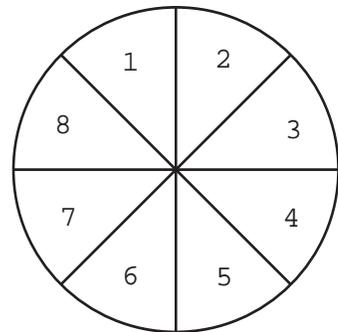
# Unit Review

## Defining & Expressing Probability

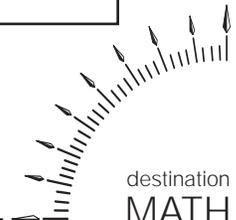
1. Alison decided she might be overdoing it by exercising every day. So she put seven tokens in the box. Two said "Swim," two said "Lift," two said "Race," and one said "Rest."
  - a. When Alison draws a token from the box, what is the total number of possible outcomes? \_\_\_\_\_
  - b. What is the probability that Alison will draw the "Rest" token? \_\_\_\_\_
  - c. How many tokens represent exercising?
  - d. What is the probability that Alison will draw an exercise token? \_\_\_\_\_

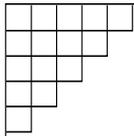
## Calculating Probabilities on a Color Wheel

2. Zack decides to make a wheel similar to the one in the game, with eight equal sectors. Complete the table below by calculating the probability of each event, and expressing the results as a fraction in simplest form and as a percent.



	P(2)	P(odd number)	P(9)	P(prime number)	P(\$3)	P(number)
Fraction						
Percent						





# Unit Review

## Determining Probabilities of Complementary Events

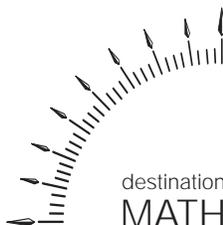
3. People who are color blind cannot tell the difference between certain colors. For example, 8 out of 100 males, and 1 out of 1,000 females are unable to tell the difference between red and green. This is called red-green color blindness (r-g).
  - a. If a male is chosen at random from a population, what is the probability that he has red-green color blindness? \_\_\_\_\_
  - b. The probability of a male having red-green color blindness can be represented as  $P(r-g)$ . The probability of his not having this trait can be represented as  $P(\text{not } r-g)$ . What is  $P(r-g) + P(\text{not } r-g)$ ? \_\_\_\_\_
  - c. What is  $P(\text{not } r-g)$ ? \_\_\_\_\_
  - d. What is the probability that any female chosen at random from the population will not have red-green color blindness? \_\_\_\_\_

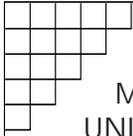
## Putting It All Together

4. In biology a Punnet square is used to represent the possible genetic outcomes in the offspring of two parents. In pea plants, for example, there is a gene for green pods (G) and a gene for yellow pods (g). These two genes can be combined in four ways, as shown in this Punnet square of a cross between two green pea pods. If at least one gene is G, the pod is green.

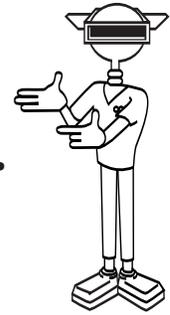
		Parent 2	
		G	g
Parent 1	G	GG	Gg
	g	Gg	gg

- a. What is the probability that a pea plant offspring will have a green pod? \_\_\_\_\_
- b. What is the probability that a pea plant offspring will have a yellow pod? \_\_\_\_\_





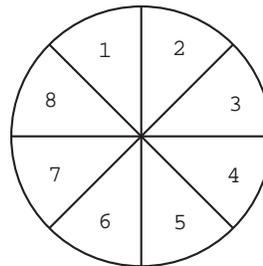
COURSE: **MSC V**  
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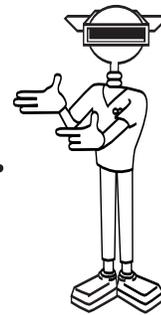
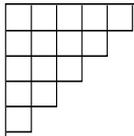


## Unit Assessment

- There are 5 marbles in a bag. One is blue and 4 are yellow. You are to reach into the sack and draw out one marble.
  - What is the total number of possible outcomes? \_\_\_\_\_
  - What is the number of desired outcomes that are yellow? \_\_\_\_\_
  - What is the probability of drawing a yellow marble expressed as a fraction? \_\_\_\_\_
  - Express the probability of drawing a yellow marble as a percent. \_\_\_\_\_
  - What is the probability of drawing a blue marble? \_\_\_\_\_
  - What is the probability of drawing an orange marble? \_\_\_\_\_
  - What is the probability of drawing a blue or a yellow marble? \_\_\_\_\_
- You want to call your friend, but are not sure of the last digit in the number. You do remember that the last digit is one of the numbers in the top two rows of buttons, so it must be 1, 2, 3, 4, 5, or 6. If you pick one of these numbers at random, what is the probability that you will pick the correct digit? \_\_\_\_\_

- A wheel is divided into eight equal sectors, number 1 through 8, as shown.
  - What is the probability of spinning an odd number? \_\_\_\_\_
  - What is the probability of spinning a prime number? \_\_\_\_\_ Explain.  
 \_\_\_\_\_  
 \_\_\_\_\_





# Unit Assessment

4. The rock-group The Sub-Tractors have 24 songs on their play list. Dreadly Kool likes 6 of their songs better than the others. If they choose their songs at random, what is the probability that the first song they play will be one of Dreadly's favorites? Write your answer as a:

a. fraction \_\_\_\_\_ b. percent \_\_\_\_\_

5. During a one-hour TV show, 18 minutes consists of commercial time. If a TV set is turned on during the time slot for this show, what is the probability that you would not tune into a commercial? Express the result as a fraction in lowest terms \_\_\_\_\_ and as a percent. \_\_\_\_\_

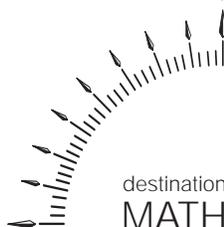
6. In biology, a Punnet square is used to represent the possible genetic outcomes in the offspring of two parents. For example, if two pink snapdragons are crossed, their offspring can be red, pink, or white. Biologists use the symbol  $F^r$  for the red gene and  $F^W$  for the white gene. A red snapdragon has the genes  $F^r F^r$ , a white snapdragon has the genes  $F^W F^W$ , and a pink snapdragon has the genes  $F^r F^W$ . This Punnet square shows the genetic outcomes of offspring of two pink snapdragons.

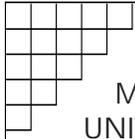
a. What is the probability that an offspring snapdragon will be red? \_\_\_\_\_

b. What is the probability that an offspring snapdragon will be pink? \_\_\_\_\_

c. What is the probability that an offspring snapdragon will be white? \_\_\_\_\_

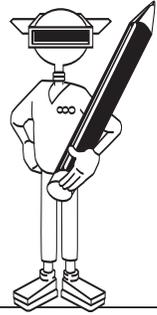
		Parent 2	
		$F^r$	$F^W$
Parent 1	$F^r$	$F^r F^r$	$F^r F^W$
	$F^W$	$F^r F^W$	$F^W F^W$





COURSE: **MSC V**  
 MODULE 6: **Fundamentals of Probability**  
 UNIT 2: **Probability of Combined Events**

# Student Logbook



## Calculating the Probability of Independent Events

As you work through the tutorial, complete the following statements and questions.

- How many choices does Dijit have for the first leg of the ski run? \_\_\_\_\_  
 How many choices does Dijit have for the second leg? \_\_\_\_\_
- If the first leg is Bernooli, how many choices are there for the second leg?  
 \_\_\_\_\_
- List all the possible ways Dijit can ski down the mountain. \_\_\_\_\_  
 \_\_\_\_\_
  - How many different combinations are there in all? \_\_\_\_\_
- Because the slope Dijit chooses for the second leg does not depend on the slope he chooses for the first leg, these are called \_\_\_\_\_ events.
- What is the formula for finding the probability of an event? \_\_\_\_\_
- What is the total number of outcomes in the ski-run sample space? \_\_\_\_\_
- The probability of choosing any complete run is  $\frac{1}{6}$ . What sign must you use to complete this number sentence?  $\frac{1}{2} ? \frac{1}{3} = \frac{1}{6}$  \_\_\_\_\_  
  - +
  - 
  - x
  - ÷
- List three pairs of independent events.
  - \_\_\_\_\_
  - \_\_\_\_\_
  - \_\_\_\_\_

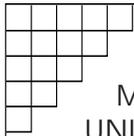
### Key Words:

Probability  
 Independent events

### Learning Objectives:

- Identifying independent events
- Determining the sample space of an experiment using a table
- Calculating the probability of an event
- Calculating the probability of independent events





COURSE: **MSC V**  
 MODULE 6: **Fundamentals of Probability**  
 UNIT 2: **Probability of Combined Events**

Your Turn



## Calculating the Probability of Independent Events

1. Alison likes to vary her workouts as she prepares for marathons. She can swim in three different pools,  $P_1$ ,  $P_2$ , and  $P_3$  and she can safely train in her racing wheelchair along five different routes  $R_1$ ,  $R_2$ ,  $R_3$ , and  $R_4$ . Alison can follow any route in her racing wheelchair regardless of the pool she chooses.

a. Alison chooses a pool and then a route. Are these independent events? \_\_\_\_\_

b. Complete the sample space showing which pool and racing route Alison can use.

		Route				
		R1	R2	R3	R4	R5
Pool	P1					
	P2					
	P3					

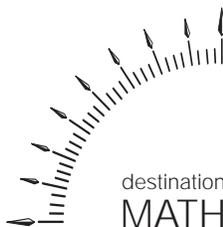
c. If Alison chooses Pool 1, how many choices does she have for her racing route? \_\_\_\_\_

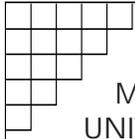
d. How many different combination workout possibilities does Alison have?

e. If Alison chooses a pool at random, what is the probability she will choose Pool 2? \_\_\_\_\_

f. If Alison chooses a route at random, what is the probability she will choose Route 1? \_\_\_\_\_

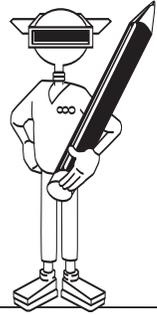
g. What is the probability of any combination workout? \_\_\_\_\_





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# Student Logbook



## Determining the Sample Space of an Experiment

As you work through the tutorial, complete the following statements and questions.

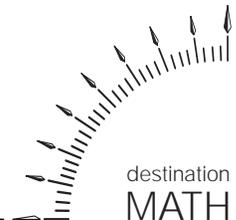
1. What information does Dijit have to consider in deciding whether the two-day pass is worth buying? \_\_\_\_\_
2. A probability of 1 indicates that an event is certain to happen. True or False? \_\_\_\_\_
3. Events that cannot happen together are said to be \_\_\_\_\_ .
4. A table showing all possible outcomes of an experiment is known as a \_\_\_\_\_ .
5. The probability that it will be clear both days is \_\_\_\_\_ .
6. What is the probability that it will be clear at least one day? \_\_\_\_\_
7. How many squares are marked either CC, CS, or SC? \_\_\_\_\_
8. What outcome is represented by the four remaining squares in the sample space? \_\_\_\_\_
9. List three pairs of mutually exclusive events.
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_
  - c. \_\_\_\_\_

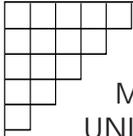
### Key Words:

Probability  
 Certainty  
 Mutually exclusive events

### Learning Objectives:

- Determining the probability of a certainty
- Recognizing mutually exclusive events
- Determining the sample space of an experiment using a table





COURSE: **MSC V**  
 MODULE 6: **Fundamentals of Probability**  
 UNIT 2: **Probability of Combined Events**

Your  
Turn



## Determining the Sample Space of an Experiment

1. The quarterback for the Rockridge Rockets football team successfully completes  $\frac{6}{10}$  of the passes he throws, and he has never had a pass intercepted. In a recent game, the game plan called for him to throw a pass on two consecutive plays.

a. There are two possible outcomes when passing the football; either completing pass or not completing the pass. Are these two events mutually exclusive?  
\_\_\_\_\_

b. What is the sum of the probabilities for a complete pass or an incomplete pass? \_\_\_\_\_

c. What is the probability of this quarterback not completing a pass? \_\_\_\_\_

d. What is the probability the quarterback will be successful in completing a pass on the second attempt? \_\_\_\_\_ Does this depend on whether he completed a pass on the first attempt? \_\_\_\_\_

e. Calculate the probability of the quarterback completing a pass on two successive attempts. \_\_\_\_\_  
 Calculate the probability of his not completing either pass in two successive attempts. \_\_\_\_\_

f. What is the probability of the quarterback completing only one pass in two successive attempts? \_\_\_\_\_

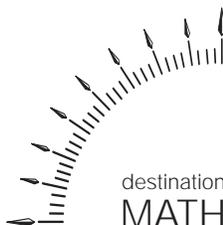
g. What is the probability of completing at least one pass in two successive attempts? \_\_\_\_\_

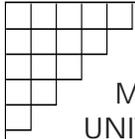
2. A quality control inspector at Herman's Helmets finds defects in only 2 out of every 100 helmets inspected.

a. What is the percent probability a helmet will pass inspection? \_\_\_\_\_

b. What is the percent probability two helmets in a row will be rejected?  
\_\_\_\_\_

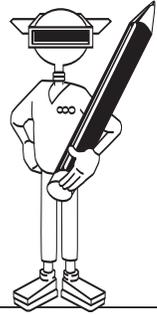
c. What is the percent probability the first three helmets will pass but the fourth will be rejected? \_\_\_\_\_





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 MODULE 6: **Fundamentals of Probability**  
 UNIT 2: **Probability of Combined Events**

# Student Logbook



## Calculating the Probability of Dependent Events

As you work through the tutorial, complete the following statements and questions.

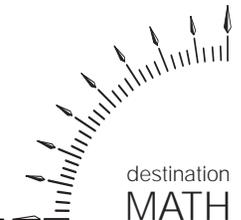
1. If it snows on day 1, does this change the probability of its snowing on day 2? \_\_\_\_\_.
2. When two events cannot happen together, they are called \_\_\_\_\_ events.
3. Why is a probability diagram called a tree diagram? \_\_\_\_\_
4. Each new level of branches on a tree diagram represents the possible outcomes for a new \_\_\_\_\_.
5. When events are independent, the probabilities of different combinations of those events are calculated by \_\_\_\_\_ the probabilities of the individual events.
6. Zack and Dijit each toss a coin. Are these two events dependent or independent? \_\_\_\_\_.
7. Events whose outcomes affect each other are called \_\_\_\_\_ events.
8. Draw a tree diagram to show all the possible two-scoop ice cream cones if you can select from your three favorite flavors. If the order of flavors does not matter (vanilla on top and chocolate on bottom is the same as chocolate on top and vanilla on bottom, for example), then how many different ice cream cones are possible? \_\_\_\_\_

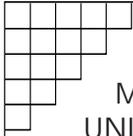
### Key Words:

Probability  
 Dependent events  
 Combined events  
 Tree diagram

### Learning Objectives:

- Using a tree diagram to determine probabilities
- Identifying dependent events
- Calculating the probability of dependent events
- Verifying the probability formulas using a tree diagram





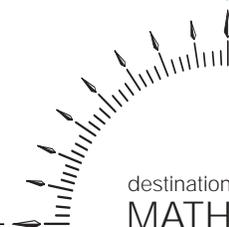
COURSE: **MSC V**  
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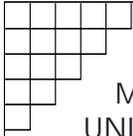
Your  
Turn



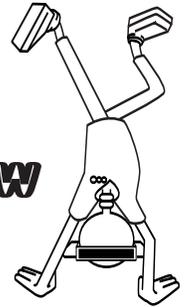
## Calculating the Probability of Dependent Events

- Tennis players are allowed two chances to serve. If they miss the first serve, they can try again. A top-notch tennis player completes her first serve about  $\frac{3}{4}$  of the time. If she misses the first serve, she plays the second more cautiously and is successful about  $\frac{9}{10}$  of the time.
  - The player either makes one or two serves. Are these events mutually exclusive? \_\_\_\_\_
  - If the first serve is successful, there is no second serve. What is the probability that there will be a second serve? \_\_\_\_\_ Explain your answer. \_\_\_\_\_
  - If the first serve misses, the player makes a second serve. What is the probability that the second serve will miss? \_\_\_\_\_ Explain your answer. \_\_\_\_\_
  - What is the probability that the tennis player will miss both serves? \_\_\_\_\_ Explain your answer. \_\_\_\_\_
  - Use what you know about the probability of a certainty to calculate the probability that the player will serve successfully on either the first or second serve. \_\_\_\_\_ Explain your answer. \_\_\_\_\_
- One glass of raspberry lemonade and two glasses of regular lemonade are sitting on the counter. You are thirsty, so you drink two glasses of lemonade, choosing at random each time.
  - Are your two choices independent or dependent events? That is, did your first choice affect the outcome of the second? \_\_\_\_\_
  - What is the probability of choosing two glasses of regular lemonade? \_\_\_\_\_





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## Unit Review

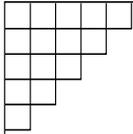
### Calculating the Probability of Independent Events

- Assume that the probability of a newborn baby being a boy or a girl is equal. Suppose that a family has two children.
  - What is the probability that both children are girls? \_\_\_\_\_
  - What is the probability that at least one of the children is a girl?  
\_\_\_\_\_
  - Suppose both children are boys. The family decides to have a third child. What is the probability that it will be a girl? \_\_\_\_\_

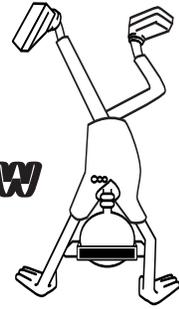
### Determining the Sample Space of an Experiment

- This table represents the 36 possible outcomes for two rolls of Dijit's six-sided game cube. The colors of the sides of the cube are red (R), orange (O), yellow (Y), green (G), blue (B), and violet (V). Red, orange, and yellow are "warm" colors. The rest are "cool" colors. Express each outcome in the table so that the first letter represents the first roll, and the second letter represents the second roll. One is already done as an example.

		SECOND ROLL					
		R	O	Y	B	G	V
FIRST ROLL	R						
	O						
	Y						
	B						
	G			G,Y			
	V						



# Unit Review



- a. What is the probability of tossing the same color on two rolls? \_\_\_\_\_
- b. What is the probability of tossing blue on the first roll OR tossing a warm color on the second roll? \_\_\_\_\_
- c. What is the probability of tossing blue on the first roll AND tossing a warm color on the second roll? \_\_\_\_\_
- d. What is the probability of tossing cool colors on two rolls? \_\_\_\_\_

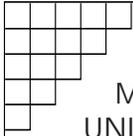
## Calculating the Probability of Dependent Events

3. Clarence Bosque approaches a tollbooth on the turnpike. The toll is \$.50. He has 5 nickels, 9 dimes, and 10 quarters in his glove compartment.
  - a. Clarence grabs two coins from the glove box. Are these two events independent or dependent? \_\_\_\_\_ Explain. \_\_\_\_\_
  - b. What is the probability that Clarence grabbed 2 quarters? \_\_\_\_\_  
Show your work. \_\_\_\_\_

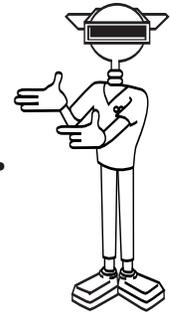
## Putting It All Together

4. Aaron Fox has improved his free-throw average to 0.600, so that  $P(\text{score}) = \frac{6}{10}$ . In one game, Aaron gets two free throws.
  - a. Are the two free throws independent events? \_\_\_\_\_
  - b. What is the probability that Aaron will not score on his first free throw? \_\_\_\_\_
  - c. What is the probability that he will score on both? \_\_\_\_\_
  - d. What is the probability that he will not score on either throw?  
\_\_\_\_\_



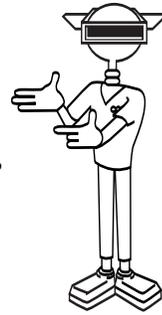
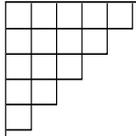


COURSE: **MSC V**  
 MODULE 6: **Fundamentals of Probability**  
 UNIT 2: **Probability of Combined Events**



## Unit Assessment

1. Suppose you decide to make a sandwich. You can choose whole wheat bread, white bread, or a sliced bagel. For fillings, you have peanut butter, cream cheese, or pimento cheese.
  - a. Does the choice of bread have any effect on the choice of filling? \_\_\_\_\_
  - b. If random choices are made, what is the probability of choosing a particular kind of bread? \_\_\_\_\_
  - c. Given random choices, what is the probability of choosing any particular filling? \_\_\_\_\_
  
2. Rockridge High School sells sweatshirts. They come in gray or white and in sizes small, medium, or large.
  - a. You can choose a size and a color. As long as supplies last, are these two events independent? \_\_\_\_\_
  - b. If random choices are made, what is the probability of choosing a particular color? \_\_\_\_\_
  - c. Given random choices, what is the probability of choosing any particular size? \_\_\_\_\_
  - d. Draw a tree diagram showing all possible combinations of sweatshirt sizes and colors.
  
- e. How many possible size and color combinations are there? \_\_\_\_\_



## Unit Assessment

3. Two traffic lights operate independently of each other. In the direction you are driving, the first light is green 60% of the time and the second light is green 40% of the time. What is the probability of both lights' being green? \_\_\_\_\_
4. In the United States, 60% ( $\frac{6}{10}$ ) of all households have at least one pet, and approximately  $\frac{1}{3}$  of all households have at least one child. What is the probability that a particular household has both a pet and a child?  
\_\_\_\_\_
5. In a bag, there are three blue marbles, two red marbles, and a yellow marble. After being drawn, marbles are not replaced.
- a. Find the probability of drawing a blue marble, then a red marble.  
\_\_\_\_\_
- b. Find the probability of drawing three blue marbles in a row.  
\_\_\_\_\_
- c. Find the probability of drawing three red marbles in a row.  
\_\_\_\_\_
- d. Are these independent or dependent events?  
\_\_\_\_\_



# Course V Answer Key

## 1.1 Algebra Fundamentals

### Introducing Variables

#### Student Logbook

1. 7,000 kg
2. 2,500 kg
3. cubic
4.  $v = l \times w \times h$
5. rectangular prism
6. length; 4 m
7.  $w = 8(h) + 0.5$
8.  $h = \frac{1}{16} \times l$
9. variables
10.  $v = 4 \times [8(h) + 0.5] \times \frac{1}{16}(l)$

#### Your Turn

1. rectangular prism
2. length, width, height
3. length
4. width, height
5. Answers will vary but should be similar to:  
length =  $l$ ; height =  $h$ ; width =  $w$
6.  $h = \frac{1}{2}(l) - 15$
7.  $w = \frac{4}{5}(h)$
8.  $v = 90 \times [\frac{1}{2}(l) - 15] \times \frac{4}{5}(h)$

### Identifying Components of Algebraic Expressions

#### Student Logbook

1. width
2. Answers will vary. Sample: a number that multiplies a variable in an expression
3. 8
4. 1, because multiplying by 1 does not change the value of a variable
5. Answers will vary. Sample: a fixed quantity or numerical quantity
6.  $8 \times h$ ;  $8 \cdot h$ ;  $8(h)$

7. a number, a variable, or a product or quotient of one or more numbers and variables
8. Answers will vary but should be similar to: a mathematical combination of algebraic terms
9. yes
10. variable; numbers; variables

#### Your Turn

1. a. Coefficients: 3, 18 Constants: 21  
Number of terms: 3  
b. Coefficients:  $-2, -7, 1$  Constants: none  
Number of terms: 3  
c. Coefficients: 1 Constants: none Number of terms: 1
2.  $C = 3.14d$
3. 3.14
4.  $C = 3.14 \times 5$
5. 15.7 m

### Replacing Variables in a Formula

#### Student Logbook

1.  $\frac{1}{16}(4)$
2.  $h = \frac{1}{16}(4) = \frac{1}{16}(\frac{4}{1}) = \frac{4}{16} = \frac{1}{4}$
3.  $w = 8(\frac{1}{4}) + 0.5$
4. 2.5
5.  $v = 4 \times 2.5 \times \frac{1}{4}$
6.  $v = 2.5 \text{ m}^3$
7. cubic meters
8. weight of concrete section =  $2.5 \text{ m}^3 \times 2,500 \text{ kg/m}^3 = 6,250 \text{ kg}$
9. Yes, the lifting capacity of the helicopter is 7,000 kg, and the section weighs only 6,250 kg.
10. An algebraic formula can be worked out by substituting known values for variables.
11. Dijit did not know the weight of the section but did know the weight of a section of concrete with a volume of  $1 \text{ m}^3$ . By finding the volume of the concrete section, Dijit could find its weight.

### Your Turn

- $v = l \times w \times h$
- $l = \frac{1}{2}h$
- $w = l + 5$
- $h = 50$  cc
- $v = \frac{1}{2}(h) \text{ cm} \times (l + 5) \times 50$
- $l = \frac{1}{2}(50)$
- 25 cc
- $w = 25 + 5$
- 30 cc
- $v = 25 \times 30 \times 50$
- 37,500
- 37.5 L
- number of cans needed =  $175 \div 37.5$

### Unit Review

- width
  - height; length
  - $v = l \times w \times h = 2(w) \times 180 \times [2(w) - 318]$
  - $v$ ;  $w$
- 1; 1
  - none
  - 36 in.
- $l = 2w = 2(180) = 360$
  - $h = 2(w) - 318 = 2(180) - 318 = 360 - 318 = 42$
  - $v = 360 \times 180 \times 42$
  - 2,721,600  $\text{cm}^3$
- $v = 50 \times [\frac{1}{5}(l) + 5] \times (w - 8)$
  - $v$ ;  $l$ ,  $w$
  - $w = \frac{1}{5}l + 5$
  - $h = (w - 8)$
  - 15

- 7
- 5,250  $\text{m}^3$

### Unit Assessment

- $l = w + 3.5$
  - $h = \frac{1}{2}w$
  - $v = l \times w \times h = (w + 3.5) \times w \times \frac{1}{2}w$
  - cost =  $0.18 [(w + 3.5) \times w \times \frac{1}{2}w]$
- $4\pi$
  - $\frac{4}{3}\pi$
  - $A = 4 \times 3.14 \times 6,380 \times 6,380$
  - 511,000,000  $\text{km}^2$
  - $v = \frac{4}{3} \times 3.14 \times 6,380 \times 6,380 \times 6,380 \text{ km}$
  - 1,087,252,500,000  $\text{km}^3$
- $8x + 11x$
  - $8x + 11x + 3x$
  - $\frac{1}{3}(8x) + \frac{1}{4}(11x)$
  - the number of CDs in each rack
- $v = \frac{1}{3}(A) \times h = \frac{1}{3}(230)^2 \times h$
  - $h = v \div \frac{1}{3}(230)^2$
  - 147 m

## 1.2 Evaluating an Algebraic Expression

### Representing the Dimensions & Area of a Rectangle

#### Student Logbook

- $w$
- $w + 5$
- $\frac{1}{2}[(w + 5) + 2w] - \frac{5}{2}$
- larger
- length,  $l$ ; width,  $w$

### Your Turn

- $w \times (w + \frac{2}{3})$
- a.**  $2(w + 5) + \frac{4}{3}$   
**b.**  $[2(w + 5) + \frac{4}{3}] \times (w + 5)$
- a.**  $(w + 5) - w$   
**b.**  $[2(w + 5) + \frac{4}{3}] - (w + \frac{2}{3})$
- a.**  $l + 20$   
**b.**  $w - (75 - 53\frac{1}{3})$  or  $w - 21\frac{2}{3}$

## Combining Like Terms

### Student Logbook

- length  $\times$  width
- $(w + 5) \times w$
- $w(w + 5)$ ;  $w^2 + 5w$
- $(w + 5 + 2w) \times \{\frac{1}{2}[(w + 5) + 2w] - \frac{5}{2}\}$
- $3w + 5$
- Write  $(w + 5) + 2w$  as  $3w + 5$ .
- $\frac{3}{2}w$
- distributive
- $\frac{9}{2}w^2 + \frac{15}{2}w$
- like; order; operations

### Your Turn

- $4w + 3$
- $21x - 28$
- distributive property
- a.**  $5x + 10$    **b.**  $x^2 + x$    **c.**  $4x^2 + 6x$
- $-10x - 9$
- $3x + 8$
- $-4t - 7$
- $5x^2 + 3x$
- a.**  $2\frac{1}{4}w$   
**b.**  $1\frac{2}{5}w$   
**c.**  $A = 2\frac{1}{4}w \times 1\frac{2}{5}w$ ;  $A = 3\frac{3}{20}w$

## Evaluating Expressions Using Substitution

### Student Logbook

- $(\frac{9}{2}w^2 + \frac{15}{2}w) - (w^2 + 5w)$

- $-1(w^2 + 5w)$ ;  $-w^2 - 5w$
- $\frac{7}{2}w^2 + \frac{5}{2}w$
- 36
- 6
- 141; 141 meters<sup>2</sup>
- the number of square meters of overhanging branches and foliage to be cut back for the new landing pad
- The signs of the terms being subtracted are changed to their opposites.

### Your Turn

- $\frac{1}{2}x^2 + \frac{1}{4}x$
- a.** 6  
**b.**  $10\frac{1}{2}$   
**c.** 16  
**d.**  $1\frac{1}{8}$
- a.**  $(2w + \frac{3}{8}) \times w$   
**b.**  $(2w + 1) \times 2w$   
**c.**  $[(2w + 1) \times 2w] - [(2w + \frac{3}{8}) \times w]$   
**d.**  $2w^2 + 1\frac{5}{8}w$   
**e.**  $1,290\frac{5}{8}\text{ft}^2$

## Unit Review

- a.**  $w + \frac{1}{80}$   
**b.**  $l + \frac{1}{120}$   
**c.**  $(l + \frac{1}{120})(w + \frac{1}{80})$
- $6w - 3$
- $3w + 14$
- a.** Remove parentheses and combine like terms.  
**b.**  $[(3w + 5) + 4w + (2w - 6)] = 3w + 5 + 4w + 2w - 6 = 9w - 1$   
**c.**  $4 \times [9w - 1] = 36w - 4$   
**d.** the distributive property
- a.**  $w \times 10w$   
**b.**  $(w + \frac{1}{5}w) \times 10w$   
**c.**  $[(w + \frac{1}{5}w) \times 10w] - (w \times 10w)$   
 $12w^2 - 10w^2 = 2w^2$

d.  $800 \text{ cm}^2$

6. a.  $-48$     b.  $-y^3z^3 + 3y^3z^2$

Rectangle	Length	Simplify length	Length x width	Expression for area	Area ( $m^2$ ) ( $w = 11$ )
1	$\frac{1}{2}(w + 26)$	$\frac{1}{2} + 13$	$w \times (\frac{1}{2} + 13)$	$w^2 + 13w$	$264 \text{ m}^2$
2	$14 \times (\frac{1}{2}w - 4)$	$6w - 56$	$w \times (6w - 56)$	$6w + 56w$	110

### Unit Assessment

1. a.  $21 \text{ m}$     b.  $2.38w$

2.  $(l_U \times w_U) - (l \times w)$

3. a.  $1 \frac{69}{100} \times w$

b.  $1 \frac{69}{100} \times w^2$

c.  $7,140$

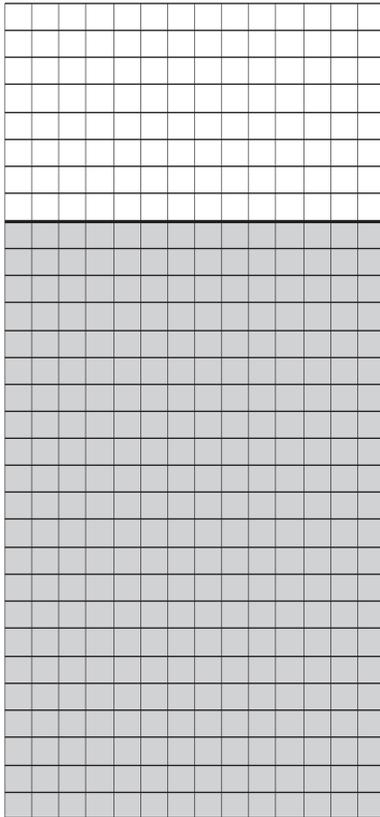
d.  $110$

4. a.  $l = 200,000 \text{ cm}^2 / 12\frac{1}{2} \text{ cm}$

b.  $16,000 \text{ cm}$

c.  $(\frac{2}{5}) \times (16,000)$  or  $6,400$

5. a.



b.  $2w - 12$

c.  $44$

d.  $(w - 12)w$

e.  $448$

## 1.3 Simple Equations

### Using Variables to Express Relationships

#### Student Logbook

1.  $102$

2.  $102$ ; The ship is balanced, so both sides have equal weight.

3.  $t, b, d$

4.  $t, b$

5.  $\frac{1}{2}b - 2$

6.  $2.5t - 1$

7.  $\frac{1}{2}(2.5t - 1) - 2$

8.  $c$

9. unknown quantities

#### Your Turn

1. a.  $a + b + c$

b.  $a + b + c = 2,856$  miles

2.  $b = \frac{1}{2}a + 58$

3.  $c = 4b - 241$

4.  $a + (\frac{1}{2}a + 58) + [4(\frac{1}{2}a + 58) - 241] = 2,856$

### Simplifying Algebraic Expressions

#### Student Logbook

1. a.  $\frac{5}{2}$

b.  $34 + 2(\frac{5}{2}t - 1) + 2[\frac{1}{2}(\frac{5}{2}t - 1) - 2] = 102$

2. the weight of the machinery

3. a.  $5t - 2$

b. the weight of two bulldozers

4. a.  $\frac{5}{2}t - 5$

b. the weight of two trucks

5. a.  $34 + 5t - 2 + (\frac{5}{2}t - 5)$   
 b. 102 tons  
 c.  $34 + 5t - 2 + (2.5t - 5)$   
 d.  $7.5t + 27$   
 e.  $7.5t + 27 = 102$   
 f. The weight of seven-and-a-half trucks plus 27 tons equals 102 tons.

Your Turn

1.  $\frac{a}{2} + 58$  or  $\frac{1}{2}a + 58$   
 2.  $2a + 23$   
 3.  $2a - 9$   
 4.  $a + (\frac{a}{2} + 58) + (2a - 9) = 2,856$   
 5. a.  $\frac{7a}{2} + 49$   
 6. b.  $\frac{7a}{2} + 49 = 2,856$

**Solving Simple Equations**

Student Logbook

1. a.  $1d + 2b + 2t + 1t$  or  $1d + 2b + 3t$   
 b. The same amount  $t$  has to be added to the right side.  
 2. a. Subtract 27 from both sides.  
 b. Multiply both sides by 10.  
 c. Divide both sides by 75.  
 d. 10  
 3. a. Substitute 10 for  $t$  in the equation.  
 b.  $7.5(10) + 27 \stackrel{?}{=} 102$   
 c.  $75 + 27 \stackrel{?}{=} 102$   
 $102 = 102$

Your Turn

1. Subtract 49 from both sides.  
 2.  $\frac{7a}{2} + 49 - 49 = 2,856 - 49$  or  $\frac{7a}{2} = 2,807$   
 3. Multiply or divide by  $\frac{1}{2}$ .  
 4.  $7a = 5,614$   
 5. Divide by 7 or multiply by  $\frac{1}{7}$   
 6. 459  
 7. 1,595

**Unit Review**

1. a.  $m = \frac{1}{4}j - 2$   
 b.  $s = 8m + 2$   
 c.  $j + (\frac{1}{4}j - 2) + [8(\frac{1}{4}j - 2) + 2] = 36$   
 2. a.  $\frac{8j}{4} - 16$   
 b.  $13\frac{1}{4} - 16$   
 c. 16  
 3. a.  $12c + 2f - 5c = -c - 44$   
 $7c + 28 = -c - 44$   
 $8c = 72$   
 $c = -9$   
 b.  $4(3(-9) + 7) - 5(-9) = -(-9) - 44$   
 $4(-27 + 7) + 45 = -(-9) - 44$   
 $-80 + 45 = 9 - 44$   
 $-35 = -35$   
 4. a.  $\frac{13j}{4} = 52$   
 $13j = 208$   
 $j = 16$   
 b.  $m = \frac{1}{4}j - 2$   
 $m = \frac{1}{4} \times 16 - 2$   
 $m = 4 - 2 = 2$   
 c.  $s = 8 \times 2 + 2$   
 $s = 8$

5.

Equation	Simplified 2nd term	Simplified 3rd term	Simplified equation	Value of variable
$6 + 3(a+6) + \frac{2}{3}(10a-7.5) = 91$	$3a + 18$	$4a - 3$	$7a + 21 = 91$	10
$34 - [\frac{1}{2}(6k-2) + 8] + 2(2k+12) = 68$	$3k + 7$	$4k + 24$	$k + 51 = 68$	17
$66 + [\frac{7}{3}(f+54)] - [4(\frac{1}{3}f-16)] = 277$	$\frac{7}{3}f + 126$	$\frac{4}{3}f - 64$	$f + 256 = 277$	21

6. a. Solving the first equation results in an identity,  $x = x$  or  $1 = 1$ . So any value of  $x$  is a solution. Solving the second equation results in a false statement, such as  $0 = 12$  or  $x = 4 + x$ . (The result depends on how the student attempts to solve the equation.) Because no value of  $x$  will result in a true statement, there is no solution.  
 b. A linear equation with one variable may have exactly one solution, an infinite number of solutions, or no solution.

## Unit Assessment

- a.  $Fe = 3 \times O + 2$   
b. (3)
- a.  $CA = \frac{1}{2}Fe + 7$   
b. (2)
- $O + Fe + Ca = 54$
- $Fe + (\frac{1}{3}Fe - \frac{2}{3}) + (\frac{1}{2}Fe + 7) = 54$   
 $(\frac{1}{2}Fe + 7) = 54$
- 26
- a.  $2d + 5$   
b.  $2d + 5 + d = 47$ , or  $3d + 5 = 47$   
c. Clarence, 14; Katie, 33

## 1.4 Variable on Both Sides of the Equation

### Writing Equations

#### Student Logbook

- \$24,000
- 50% of what's left over after Mary gets her share is the same amount as Mary's share plus  $\frac{1}{4}$  of the total check.
- $x$ ; Mary's share of the check
- what's left over after Mary gets her share
- $0.50(24,000 - x)$
- $x + \frac{1}{4}(24,000)$
- $12,000 - \frac{1}{2}x$ ;  $x + 6,000$
- variable; both; equals

#### Your Turn

- $\frac{1}{2}(100 + n)$
- $2a = a + 20$  or  $a + 20 = 2a$
- $\frac{1}{2}m = m - 10$  or  $m - 10 = \frac{1}{2}m$
- a.  $5 + x$     b.  $3x + 8$
- a.  $2x + 10$ ;  $4 - \frac{1}{2}x$   
b.  $2x + 12$ ;  $12x + 28$   
c.  $3x + 9$ ;  $6x + 17$

## Simplifying Both Sides of an Equation

#### Student Logbook

- Mary's share of the check
- subtract; subtraction; inverse or opposite
- add
- mixed
- $12,000 = \frac{3x}{2} + 6,000$
- $6,000 = \frac{3x}{2}$
- multiply; 2
- $12,000 = 3x$
- inverse; isolate; both

#### Your Turn

- $2x = 3$
- $4 = 4x$
- Answers may vary. A common response maybe to combine the like terms  $-2x$  and  $6x$  on the left-hand side to get  $4x$ . Then subtract  $3x$  from both sides to obtain  $x$  on the left-hand side and no  $x$  terms on the right-hand side. Finally, subtract 5 from both sides to get  $x = 5$ .
- b
- c
- $19,500 = \frac{3x}{2} - 7,800$
- Multiply both sides by 2.

## Checking the Solution to an Equation

#### Student Logbook

- $12,000 = 3x$ ;  $x$
- \$4,000
- 4,000; divided; 3
- b
- Answers will vary. Sample: When the solution is substituted for the variable, the left-hand side (LHS) and the right-hand side (RHS) of the equation will be equal.
- subtracted; total value \$20,000
- a. isolate  
b. substitution; original  
c. solution; conditions

### Your Turn

- $x = 1$
- $x = 6$
- $y = -3$
- $w = 3$
- $x = 3$ ; Check:  $3(3 + 2) = 3 + 12$ , or  $15 = 15$ , which is true, so  $x = 3$  is correct.
- a.**  $2a = a + 30$   
**b.** 30
- \$15,000

### Unit Review

- $\frac{3}{5}w = w - 10$
- a.**  $28x + 84$ ;  $8 - \frac{1}{4}x$  or  $8 - \frac{x}{4}$   
**b.**  $\frac{1x}{6} + 6$  or  $\frac{x}{6} + 6$ ;  $3x + 6$
- a.**  $184 = \frac{5x}{3} - 14$  or  $184 - \frac{5x}{3} = -14$   
**b.**  $9,650 = \frac{7x}{2} + 870$  or  $9,650 - \frac{7x}{2} = 870$   
**c.**  $123 = 3x - 87$  or  $123 - 3x = -87$
- c
- $225 - \frac{1}{2}x = x + 30$   
 $225 = \frac{3x}{2} + 30$   
 $195 = \frac{3x}{2}$   
 $390 = 3x$   
 $130 = x$   
Check:  $225 - \frac{1}{2}(130) \stackrel{?}{=} 130 + 30$   
 $225 - 65 \stackrel{?}{=} 160$   
 $160 \stackrel{?}{=} 160$
- a.** \$24   **b.** \$96
- a.** 3  
**b.** no greater than 3  
**c.** 1, 21, 22

### Unit Assessment

- a
- a.**  $\frac{1}{3}x + 40$    **b.**  $x + 1.90$
- c

- a.**  $23,720 = \frac{1}{3}x - 645$  or  $23,720 - \frac{1}{3}x = -645$   
**b.**  $93 = 4x + 141$  or  $93 - 4x = 141$   
**c.**  $884 = x - 25$  or  $884 - x = -25$
- $4,636 = x$
- $485 - \frac{1}{2}x = 2x - 45$   
 $485 = \frac{5x}{2} - 45$   
 $485 + 45 = \frac{5x}{2}$   
 $530 = \frac{5x}{2}$   
 $1,060 = 5x$   
 $212 = x$   
Check:  $485 - \frac{1}{2}(212) = 2(212) - 45$   
 $485 - 106 = 424 - 45$   
 $379 = 379$

**7. a.** \$3.80

**b.** \$24.70

work:

$$0.50(28.50 - x) = x + 0.30(28.50)$$

$$14.25 - \frac{1}{2}x = x + 8.55$$

$$14.25 = \frac{3x}{2} + 8.55$$

$$5.70 = \frac{3x}{2}$$

$$11.40 = 3x$$

$$\$3.80 = x = \text{Tom's share}$$

$$\$28.50 - \$3.80 = \$24.70 = \text{Geena's share}$$

$$\text{Check: } 14.25 - \frac{1}{2}(3.80) = 3.80 + 8.55$$

$$14.25 - 1.90 = 12.35$$

$$12.35 = 12.35$$

## 1.5 Solving Literal Equations

### Identifying the Variables in a Given Formula

#### Student Logbook

- frustum
- a.** height  
**b.** radius of the bottom base  
**c.** radius of the top base  
**d.** volume

- radius; circle
- A radius is one-half the diameter or a diameter is twice a radius).
- top; bottom
- substitution; variables; like

### Your Turn

- $d = \text{distance}; r = \text{rate}; t = \text{time}$
  - $r = \frac{d}{t}$
- sample:  $A = l \times w$
- 15 cm
- 10
- multiplication
- $v = 4\pi(r^2 + 4r + 16)$

## Rewriting a Formula in Terms of a Different Variable

### Student Logbook

- $v = 660 \text{ m}^3$  and  $\pi = \frac{22}{7}$
- $r$
- $h$
- Multiply both sides by 3.
- Divide both sides by  $\pi$  or multiply by  $\frac{1}{\pi}$ .
- $\frac{1}{7r^2}$
- $b$
- inverse; only; equation

### Your Turn

- $p = \text{perimeter}; l = \text{length}; w = \text{width}$
  - $l = \frac{p-2w}{2}$ , or  $l = \frac{p}{2} - w$
  - $w = \frac{p-2l}{2}$ , or  $w = \frac{p}{2} - l$
- $d = \frac{C}{\pi}$
  - $r = \frac{C}{2\pi}$
- $r = \sqrt{\frac{A}{\pi}}$
- $r = 0.29$
  - $r = 0.14$
  - 24.1
  - 14.3
  - 3.48
  - 6.30 or 6.3

## Substituting Values & Solving an Equation

### Student Logbook

- $660 \text{ m}^3$
  - 3 m
  - $\frac{22}{7}$
- $h = \frac{3(660)}{(\frac{22}{7})7(3^2)}$
- 10 m
- by substituting all the values into the formula and checking that the equation is balanced
- substitute; variables
  - order; operations
- substitute; balance

### Your Turn

- $2.7 \text{ g/cm}^3$
- $m = dv$
  - 2,219.5 g or 2.22 kg
- 60
  - 376.8
  - 11,304
- $h = \frac{3v}{\pi^2}$
  - 15

## Unit Review

- $R = 8r$
  - $v = \frac{1}{3}\pi h(73r^2)$
- $A = \frac{9}{25}\pi R^2$
  - 40
  - 1,809
  - 1,600
  - 3,409
- $r = \frac{L}{2\pi h}$
  - 9.80 m
- $v = \pi r^2 h$
  - $h = \frac{v}{\pi^2}$
  - $h = 10$

## Unit Assessment

- $r = \frac{C}{2\pi}$
- $s = \frac{p}{2}$
  - $s = 9 \text{ cm}$
- $\frac{1}{pt} = r$

4. Multiply both sides by 2, and then divide both sides of the equation by  $h$ ;  $b = \frac{2A}{h}$ .
5. **a.**  $v = 33.49$  cubic inches    **b.**  $r^3 = \frac{3v}{4\pi}$
6. **a.**  $h = \frac{V}{l \times w}$     **b.**  $h = 20$  cm
7. **a.**  $h = \frac{3V}{B}$     **b.**  $h = 73$

## 2.1 Geometry Fundamentals

### Naming & Measuring Angles

#### Student Logbook

- find the measure of angles
- degrees
- right
- perpendicular
- $\perp$
- quadrilateral; opposite sides; parallel
- 180
- $\angle$
- $\circ$
- 90; 180
- right; measure is equal to 90 degrees

#### Your Turn

- parallelogram
- 90
- The segments are perpendicular.
- obtuse
- protractor
- $\angle AEC$  or  $\angle CEA$
- a line segment; a line extends indefinitely

### Defining Complementary & Supplementary Angles

#### Student Logbook

- 90; 180
- $45^\circ$
- 0; 90
- 180
- 90

6. No, they add up to either 90 or 180. They cannot add up to both.

#### Your Turn

- $30^\circ$
- $\angle AOB$  and  $\angle COD$
- obtuse; the angle measure is greater than  $90^\circ$  and less than  $180^\circ$
- $\angle DOE$
- a.**  $3x + 30 = 180$   
**b.**  $x = 50$

### Recognizing Congruent Angles

#### Student Logbook

- supplementary
- measure of angle a
- vertical angles
- $\cong$
- $\angle c$ ;  $\angle d$
- yes
- They are between the parallel lines and on alternate sides of the line represented by the cue.
- The measures are the same.
- a.** vertical  
**b.**  $\angle h$   
**c.** alternate exterior angles  
**d.** Their measures are equal.

#### Your Turn

- $\angle b$ ,  $\angle d$ ,  $\angle f$ , and  $\angle h$
- Yes, they are vertical angles.
- $\angle a$ ,  $\angle c$ ,  $\angle g$
- $\angle e$
- They are equal.
- $\angle d$  and  $\angle f$ ;  $\angle c$  and  $\angle e$
- No, they are not on alternate sides.

## Unit Review

1.  $\angle MOP$ ,  $\angle TOP$
2.  $\angle MOR$
3.  $\angle TOM$
4.  $\overline{RO}$  and  $\overline{SM}$
5.  $\overline{PO}$  and  $\overline{TM}$
6.  $\angle AOB$ ,  $\angle BOC$
7.  $\angle COD$  or  $\angle DOE$
8.  $\angle COA$
9.  $\angle 1$  and  $\angle 3$ ,  $\angle 2$  and  $\angle 4$ ,  $\angle 5$  and  $\angle 7$ , and  $\angle 6$  and  $\angle 8$
10.  $\angle 3$  and  $\angle 5$ ,  $\angle 4$  and  $\angle 6$
11.  $\angle 7$  and  $\angle 1$ ,  $\angle 8$  and  $\angle 2$
12.  $\angle 7$ ,  $\angle 1$ ,  $\angle 3$
13. If Rose Ave were perpendicular to Oak Street,  $\angle d$  would be a right angle, not an acute angle.
14. obtuse
15. alternate exterior
16. Answers may vary. Sample:  $\angle g$  and  $\angle a$  are congruent (alternate exterior) and  $\angle a$  and  $\angle d$  are supplementary (straight angle), so  $\angle g$  and  $\angle d$  must be supplementary.

## Unit Assessment

1. parallelogram
2.  $\angle BAD$  or  $\angle BCD$
3. acute
4. See students' work.
5. a.  $90^\circ$ ; right  
b.  $\angle AFD$  and  $\angle BFD$
6.  $\angle DBA$
7. They are equal.
8.  $x + 80 = 180$
9.  $x = 100$
10. No. They are not the angles formed by a pair of intersecting lines.
11. a. alternate interior angles  
b.  $180^\circ$   
c.  $180^\circ$

d.  $180^\circ$

e.  $360^\circ$

## 2.2 Triangles

### Classifying Triangles by Sides

#### Student Logbook

1. 168
2. 168
3. 4; 4
4. 15 feet; 24 feet
5. right;  $90^\circ$
6. isosceles
7. yes;  $90^\circ$
8. by drawing like marks on each of the equal sides
9. no
10. yes
11. by sides and by angles

#### Your Turn

1. No, it has 5 sides.
2. c
3.  $\triangle ABF$
4.  $\triangle AFE$
5. c
6. d
7.  $\triangle FED$

### Exploring the Area of a Triangle

#### Student Logbook

1. triangles; equal
2. base  $\times$  height; (right) triangle
3. perpendicular; vertex
4. He multiplies the area he found by 2.
5.  $180 \text{ ft}^2$
6.  $180^\circ$

7. three; 60
8. three equal
9. No.

Your Turn

1. Area =  $\frac{1}{2}(\text{base} \times \text{height})$
2. d
3.  $90^\circ$
4. scalene right triangle
5. 23
6. 12
7. 138 square units
8. 42 square units
9. 96 square units
10.  $42 + 96 = 138$  or area  $\triangle BCD + \text{area } \triangle BDA = \triangle ABC$

### Classifying Triangles by Angles

Student Logbook

1. a protractor
2.  $0^\circ$ ;  $90^\circ$
3.  $180^\circ$
4. one
5.  $180^\circ$
6. no
7. A triangle cannot contain a straight angle because a triangle has 3 angles whose measures have a sum of  $180^\circ$ .
8. 3 acute
9.  $90^\circ$ ;  $180^\circ$
10. obtuse
11. No; two or more obtuse angles have a total measure greater than  $180^\circ$  and a triangle has no more than  $180^\circ$ .

Your Turn

1.  $\triangle AFB$ ,  $\triangle AFE$
2.  $\triangle AFB$ ,  $\triangle AFE$
3.  $\triangle BFC$ ,  $\triangle DFE$
4.  $\triangle BFC$ ,  $\triangle DFE$
5.  $\triangle CFD$

6.  $\triangle CFD$
7.  $\angle BFE$
8. a.  $\triangle ABF$  and  $\triangle AFE$   
b.  $\triangle ABF$  is an isosceles right triangle and  $\triangle AFE$  is a scalene right triangle.

### Unit Review

1. isosceles and obtuse
2. scalene
3.  $90^\circ$
4. a right triangle
5.  $A = \frac{1}{2}(8 \times 5) = 20$
6.  $BE$
7. No; at least two of its sides have different lengths.
8.  $\frac{1}{2}(180^\circ - 110^\circ) = \frac{1}{2}(70^\circ) = 35^\circ$
9. obtuse
10. It could be acute, right, or obtuse, depending on the location of  $E$ .

11.

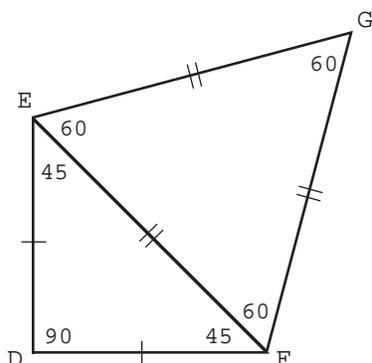
Triangles			
	Scalene	Isosceles	Equilateral
Acute			
Right			not possible
Obtuse			not possible

### Unit Assessment

1. a triangle with 3 unequal sides
2. No; an isosceles triangle has 2 equal sides.
3.  $\triangle ABC$
4.  $\triangle ADC$
5. 3.3 units
6.  $A = \frac{1}{2}(6.6 \times 3.8) = 12.5$  square units
7.  $A = \frac{1}{2}(3.3 \times 3.8) = 6.3$  square units
8.  $A = \frac{1}{2}(3.3 \times 3.8) = 6.3$  square units

9. The areas are the same. Both triangles have equal same bases ( $BD = DC$ ) and the same height ( $AE$ ).

- 10.a-d. Drawings will vary. Here is one possibility.



- e. Students should observe that the 3 angles of  $\triangle EFG$  each measure  $60^\circ$ .

## 2.3 Volume & Surface Area

### Calculating the Volume of a Right Triangular Prism

#### Student Logbook

1. volume
2. volume; space
3. his new apartment
4.  $B \times l$
5.  $B$  = area of the rectangular base of the prism and  $b$  = width of the base
6. rectangular prism
7. right rectangular prism
8. right triangular prism
9. volume =  $\frac{1}{2}(b \times h) \times l$
10. 4,500 ft<sup>3</sup>

#### Your Turn

1. right triangular prism
2. volume; marbles fill space, so she needs to find the volume because volume is a three-dimensional measure of space
3. volume =  $B \times l$ , or volume =  $\frac{1}{2}(b \times h) \times l$
4. area =  $\frac{1}{2}(b \times h)$
5. area =  $\frac{1}{2}(b \times h) = \frac{1}{2}(24 \text{ in.} \times 16 \text{ in.})$

$$= 192 \text{ in}^2$$

$$\begin{aligned} 6. \text{ volume} &= B \times l = 192 \text{ in}^2 \times 50 \text{ in} \\ &= 9,600 \text{ in}^3 \end{aligned}$$

### Calculating the Surface Area of a Right Triangular Prism

#### Student Logbook

1. the surface area of the walls of his new apartment
2. surface area; faces
3. because they will not put aluminum foil on the floor
4. by multiplying its length and its width;  $l \times w$
5. by finding the product of one-half times the base times the height;  $\frac{1}{2}(b \times h)$
6. faces

#### Your Turn

1. surface area; Sophie is not going to fill the table, only put film around it.
2. 5
3. The two triangular ends have the same area; the three rectangular sides have the same area.
4. 50 in.  $\times$  24 in.
5. 1,200 in<sup>2</sup>
6. 50 in.  $\times$  20 in.
7. 1,000 in<sup>2</sup>
8. base = 24 in. and height = 16 in.
9. 192 in<sup>2</sup>
10.  $1,200 + 1,000 + 1,000 + 192 + 192 = 3,584$

### Calculating the Volume & Surface Area of a Right Cylinder

#### Student Logbook

1. perpendicular
2.  $A = \pi r^2$
3. area of base  $\times$  height of cylinder
4. radius =  $\frac{1}{2}$  of the diameter
5. circumference
6.  $C = 2\pi r$  or  $\pi d$

7. The circumference of the circles equals the width.
8. 3.14
9. the radius of the circle

### Your Turn

1.  $V = B \times h$  or  $\frac{1}{2} \pi r^2 h$
2. 9
3. 254.3 in<sup>2</sup>
4. 4,577.4 in<sup>3</sup>
5. No, Dijit needs 5,022.6 in<sup>3</sup> more.

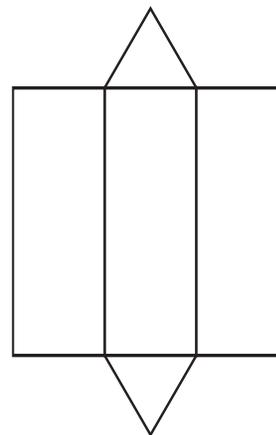
### Unit Review

1. a. 100  
b. 500 in<sup>3</sup>
2. a. 6  
b. 25 in<sup>2</sup>  
c. 100 in<sup>2</sup>  
d. 450 in<sup>2</sup>
3. a. 314 in<sup>2</sup>  
b. 7,536 in<sup>3</sup>
4. a. Divide the volume by the height to find the area of the base.  
b. 12.6 ft<sup>2</sup>  
c. Divide the area by  $\pi$  and take the square root to find the radius.  
d. 2 ft  
e. Surface area =  $2\pi(2) \times 18 + 2(12.6)$   
=  $(12.6 \times 18) + 2(12.6)$   
=  $226.8 + 25.2 = 252$  ft<sup>2</sup>

### Unit Assessment

1. Both are prisms, but a right triangular prism has a triangular base while a right rectangular prism has a rectangular base.
2. area =  $\pi r^2$
3. volume = area of the base  $\times$  height of the cylinder
4. diameter =  $2 \times$  radius
5. circumference =  $2\pi \times$  radius or  $\pi d$

6. 5
7. The friend has confused the variables  $B$  and  $b$ . The correct formula is volume =  $B \times l$ , where  $B$  represents the area of the base, and  $b$  represents one side of the base.
8. a circle
9. You need the dimensions of the base and its height.
10. Answers will vary, but should be reasonably similar to the figure below.



11. The height of the right triangular prism should be 16 in.

## 3.1 Introduction to Radicals & Pythagorean Theorem

### Exploring the Pythagorean Theorem

#### Student Logbook

1. solar panels
2. 9 ft<sup>2</sup>; 16 ft<sup>2</sup>; 25 ft<sup>2</sup>
3. 36; 64
4. side  $\times$  side, or length  $\times$  width
5. a. 4  
b. 5
6. 3 ft, 4 ft, 5 ft
7. square
8.  $3^2 + 4^2 = 5^2$
9. b. Pythagoras
10. a. the side opposite the right angle

b. It is longer than either leg.

11. a number raised to the second power

### Your Turn

1. Check to see whether  $13^2$  plus  $14^2$  is equal to  $15^2$ .
2. 365
3. 225
4. No, it is not a right triangle because  $13^2 + 14^2$  is not equal to  $15^2$ .
5.  $5^2 + 12^2 = 13^2$
6. 169
7. 169
8. Yes, it is a right triangle because the the sum of the squares equals the square of the hypotenuse.
9. side  $c$ , 13 meters (the longest side)

## Investigating Squares & Square Roots

### Student Logbook

1. second
2. 64
3.  $x$  times  $x$
4. square numbers
5. by itself
6. 8
7. radical symbol
8. a. the number under the radical symbol  
b. 64
9. 3 ft
10. closer to 5, because  $5^2 = 25$  and  $6^2 = 36$  and 30 is closer to 25 than 36.
11. side  $\times$  side  $\times$  side
12. radical; 3
13.  $\sqrt[3]{27} = 3$

### Your Turn

- |        |    |    |    |    |
|--------|----|----|----|----|
| Number | 6  | 7  | 8  | 9  |
| Square | 36 | 49 | 64 | 81 |
1. 49 and 64
  2. 7 and 8
  3. 8 because 60 is closer to 64 than to 49, and  $\sqrt{64} = 8$ .
  4. 36 and 49
  5. 6 and 7
  7. (4) 6.6; the number must be closer to 7 because 44 is closer to 49 than to 36, which is the square of 6.

## Defining Irrational Numbers

### Student Logbook

1. 12 ft and 20 ft
2. 8 ft
3. right angle; longest
4. 12; 20
5. a. 144  
b. 400
6.  $b^2 = 400 - 144$  or  $b^2 = 256$
7.  $b = \sqrt{256} = 16$
8. a nonterminating, nonrepeating decimal
9. forever
10.  $2\sqrt{3}$
11. a number that can be expressed in the form  $\frac{a}{b}$ , where  $b$  is not equal to 0; it is also a terminating or repeating decimal.
12. If that were possible, the number would be rational.

### Your Turn

1.  $a^2 + b^2 = c^2$
2.  $48^2 + b^2 = 50^2$
3.  $2304 + b^2 = 2500$   
 $2304 - 2304 + b^2 = 2500 - 2304$   
 $b^2 = 196$
4. 1, 2, 4, 7, 14, 28, 49, 98, 196
5. 1, 4, 49, 196

6. 196
7.  $\sqrt{4 \times 49} = \sqrt{4} \times \sqrt{49} = 2 \times 7 = 14$
8. 14 meters
9. a rational number, because it can be written as a fraction whose numerator and denominator are whole numbers, and the denominator is not 0. Ex.  $\frac{14}{1}$ ,  $\frac{28}{2}$ , etc.

## Unit Review

1. a. 35  
b. It is opposite the right angle.  
c. 1,225  
d. 1,225
2. a. 7  
b. 12  
c. 8  
d. 27  
e. 2
3. 12 and 13
4. 13 feet
5. 40  
 $a^2 + 75^2 = 85^2$   
 $a^2 = 85^2 - 75^2$   
 $a^2 = 7225 - 5625$   
 $a^2 = 1600$   
 $a = \sqrt{1600} = 40$  m

6.

Number	Rational/Irrational	Fractional/Decimal Form
0.3333...	rational	$\frac{1}{3}$
$\sqrt{15}$	irrational	
$\sqrt{6}$	irrational	
$\frac{1}{7}$	rational	0.142857
$\sqrt{5^2}$	rational	5
$\sqrt{289}$	rational	17

7. 1, 8, 27, 64, 125

## Unit Assessment

1. a. 10  
b. 11  
c. 64  
d. 64  
e. 1

2. a. Pythagorean theorem  
b. Answers will vary. Sample: In a right triangle, the square of the hypotenuse equals the sum of the squares of the other two sides.  
c. Side  $c$  represents the hypotenuse;  $a$  and  $b$  represent the legs.
3.  $\sqrt{225} = 15$
4.  $3^2$
5.  $\sqrt{25}$
6. for  $n = 0$  or  $n = 1$
7. 530 is much closer to 529 than to 576, so  $\sqrt{530}$  is much closer to 23 than to 24.
8. yes;  $18^2 + 24^2 = 30^2$
9. 7 in.
10. Answers will vary. Sample rational square roots:  $\sqrt{4}$ ,  $\sqrt{9}$ ,  $\sqrt{16}$ .
11. Sample irrational square roots:  $\sqrt{3}$ ,  $\sqrt{5}$ ,  $\sqrt{7}$ .

## 3.2 Introduction to Scientific Notation

### Writing Numbers using Scientific Notation

#### Student Logbook

1.  $10^4$
2. a.  $10 \times 10 \times 10 \times 10$     b. 10,000
3. 23,700
4. zeros in the power of 10 by which you are multiplying
5. 4
6. the number of places to the right to move the decimal point
7. 1; 10; 10

#### Your Turn

1. a. 10,000,000    b. 7  
c. 93000000.0000    d. 93,000,000 miles

2. c

Scientific Notation	Standard Form
$7.5 \times 10^9$	7,500,000,000
$4.3 \times 10^4$	43,000
$9.2 \times 10^3$	9,200
$2.8 \times 10^{12}$	2,800,000,000
$1.6 \times 10^9$	1,600,000,000

## Comparing Numbers in Scientific Notation

### Student Logbook

- there is only one nonzero digit in front of the decimal point
- 1,000
- 1,000
- For every 1,000 meters there is 1 kilometer, so you divide the total number of meters by 1,000 to get the total number of kilometers.
- $1.36 \times 10^9$  km
- 1,360,000,000 km
- Answers will vary. Sample: The exponent shows the number of places that the decimal point moves. The greater the exponent, the greater the number.
- $2.3 \times 10^6$ ; when written in correct scientific notation, a number with an exponent of 6 is greater than one with an exponent of 5

### Your Turn

- 36,000,000
  - The first is a number at least 1 but less than 10 and the second is a power of 10.
  - 3.6
  - 7
  - 7
  - $3.6 \times 10^7$
  - Mercury
  - $10^6$  is less than  $10^8$
- 33,000,000,000,000,000,000; easier to read and less prone to errors
- $3.5 \times 10^{11}$

## Writing Numbers Between 0 & 1 in Scientific Notation

### Student Logbook

1. 0.00000000002 m

Power of 10	Standard form	Exponent	Number of zeros
$10^3$	1,000	3	3
$10^2$	100	2	2
$10^1$	10	1	1
$10^0$	1	0	0
$10^{-1}$	$\frac{1}{10}$	-1	1

3. The value is divided by 10.

4. because  $\frac{10}{10} = 1$

5. the fraction bar

6.  $2 \times 10^{-10}$  m

7.  $3 \times 10^{-10}$  m

8. 0.00000000003 m

### Your Turn

Standard form	Scientific notation	
0.23	$2.3 \times 10^1$	$2.3 \times 10^{-1}$
0.0006	$6 \times 10^{-4}$	correct
0.0081	$8.1 \times 10^{-3}$	correct
0.9	$0.9 \times 10^{-1}$	$9 \times 10^{-1}$
0.00000007	$7 \times 10^{-7}$	$7 \times 10^{-8}$

Scientific notation	Standard form	
$4.3 \times 10^1$	43	correct
$7 \times 10^{-3}$	0.0007	0.007
$3.9 \times 10^{-5}$	0.0000039	0.000039
$6.65 \times 10^{-2}$	0.0665	correct
$1.2 \times 10^{-6}$	$\frac{1}{1,200,000}$	0.0000012

## Unit Review

- 55,700,000 km
  - $5.57 \times 10^7$  km
- 399,000,000 km
  - $3.99 \times 10^8$  km
- $5.57 \times 10^{10}$  m
- $3.99 \times 10^{11}$  m
- Venus
- $1 \times 10^{-6}$  m
  - $1 \times 10^{-4}$  cm
- Students should write 1, followed by 100 zeros
  - $1 \times 10^{100}$
  - Answers will vary. Sample: It is much easier to write very large and very small numbers in scientific notation because you do not have to write so many digits. Without scientific notation, we would have

to write large numbers like a googol in standard form, which is difficult because a googol has so many zeros, and it would be very easy to have too few or too many zeros.

## Unit Assessment

- $2 \times 10^{-2}$
  - $1.453 \times 10^6$
  - $1.058 \times 10^1$
  - $6 \times 10^{-6}$
  - $7.67 \times 10^{11}$
  - $1.2 \times 10^7$
- 0.000136
  - 93,000,000
  - 0.02
  - 0.0017
  - 0.000000809
  - 0.00000005602
- $1 \times 10^{-4}$  m
  - $8 \times 10^1$  m
  - $6.3 \times 10^{11}$  m
  - $9.045 \times 10^{-1}$  m
- least to greatest:  $6.023 \times 10^{-9}$  km; 6 mm; 60.23 mm;  $6.023 \times 10^{-4}$  km; 6,023 m; 6,023,000 cm

## 4.1 Ratio

### Defining Ratio

#### Student Logbook

- paper, glass, plastics
- compost
- 16 : 24
- ratio; two
- a colon or a fraction bar
- terms
- 8 : 12
- Divide the terms by the greatest common factor.
- 8

10. 2 : 3

#### Your Turn

- 36 : 48
  - 12
  - 3 : 4
- 5 : 17 : 2
- $9 : 27 = 1 : 3$
  - 4
- 9 boys, 12 girls
- yes
  - 2 : 1

## Expressing Ratios as Equivalent Fractions & Decimals

#### Student Logbook

- add the terms
- $\frac{2}{5}, \frac{3}{5}$
- 0.4, 0.6
- 40%, 60%
- 300 tons
- 120 tons
- 180 tons
- Add the terms to get the whole. Express each term as a fraction.  $1 + 2 = 3, \frac{1}{3}$  of 99 kg = 33 kg.

#### Your Turn

- $\frac{3}{8}$
  - $\frac{5}{8}$
  - 37.5%
  - 62.5%
- 3,092 recycle and 5,154 do not.
- 3 : 1
- 29%
  - yes, barley

## Forming Ratios Between Unlike Quantities

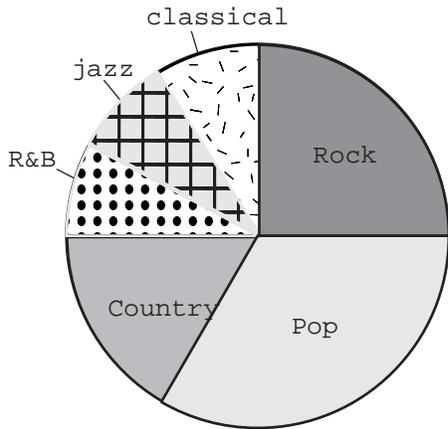
#### Student Logbook

- paper, plastic, glass, metal
- 10
- paper
- 1
- 100%
- 36 tons
- pie chart or circle graph
- because there are 10 total parts
- 5

10. It may change, depending on the amounts in each category.

Your Turn

1. a. 12    b. Pop    c.  $\frac{2}{12}$   
 d. 25%    e. 2,000 CDs
2. a.



- b. 12  
 c. 2/12

**Unit Review**

1. a. 56 : 32    b. d (8)    c. 7 : 4
2. a.  $\frac{7}{9}, \frac{2}{9}$   
 b. 78% in land, 22% in water  
 c. Write the ratio as fractions, then decimals, then multiply the decimals by 100 to get the percents.
3. a. 3 : 2 : 1  
 b. (1) 3 : 2 : 1  
 c. The ratio stays the same, no matter how many people enter the race.  
 d. 6 sectors

4. a.

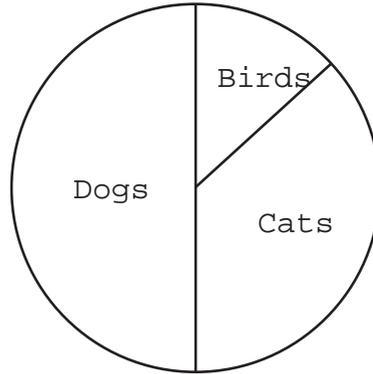
Dimensions	Actual Stadium	Scale Model
Length	225 m	75 cm
Width	75 m	25 cm
Height	30 m	10 cm

- b. 1 : 300

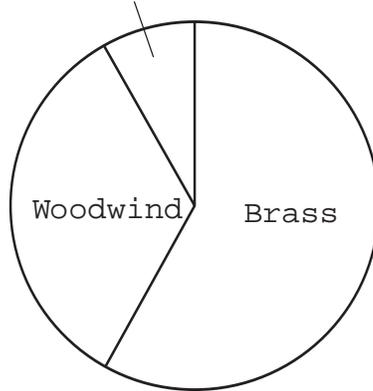
**Unit Assessment**

1. a. 5 : 3    b. 5 and 3

2. a. dogs  $\frac{1}{2}$ , cats  $\frac{5}{14}$ , birds  $\frac{1}{7}$   
 b. dogs 50%, cats 36%, birds 14%  
 c. 86 dogs, 62 cats, 24 birds  
 d.



3. a. 6 : 3 : 1  
 b. woodwind ( $\frac{3}{10}$ )  
 c. Percussion



- d. 67 brass players, 34 woodwind players, 11 percussion players

**4.2 Proportion**

**Defining a Proportion**

Student Logbook

- security, police, doctors, and paramedics
- 37,500 people
- 2
- 2 : 250
- 4
- They are equivalent ratios.
- $\frac{2}{250}, \frac{4}{500}$
- equal; equal

9. equality; two ratios
10. increase
11. 1 : 4
12. ratios; fractions

### Your Turn

1. 3 : 1,125
2. d
3.  $3 : 1,125 = 6 : 2,250$
4. b
5. a. 10 : 40  
b.  $\frac{10}{40} = \frac{30}{120}$

## Solving for a Variable in a Proportion

### Student Logbook

1.  $2 : 250 = c : 37,500$
2. the total number of race officials required
3. 300
4. means; extremes or vice-versa
5. its middle or inner terms, which are its second and third terms
6. extremes; outside
7. 75,000; 75,000
8. The product of the means equals the product of the extremes
9. If a variable
10. If  $a : b = c : d$ , then  $ad = bc$ .

### Your Turn

1.  $3 : 1,125 = r : 37,500$  or any correct variation
2.  $\frac{3}{1,125} = \frac{r}{37,500}$  or any correct variation for each statement
3. b
4. 100 recycling bins
5. 22,500
6. a

## Applying the Means/Extremes Property

### Student Logbook

1. 2,667
2. 0.45
3. the weight of the mobile first-aid unit in kg
4.  $1 \text{ lb} : 0.45 \text{ kg} = 2,667 \text{ lb} : d$  or any correct variation
5. units; units
6. multiply the means and extremes, the second and third terms and the first and fourth terms
7. 1,200 kg
8. same order
9. the variable term

### Your Turn

1. 60
2. a.  $\frac{5}{2}$  does not equal  $\frac{4}{2}$ .  
b.  $5 : 2 = 4 : 1.6$  or any correct variation
3. 135

## Unit Review

1. a. 4 : 7  
b. 8 : 14
2. a. 21 feet  
b. 4 feet 3 inches
3. a. No; Eight people would weigh  $8 \times 150$  or 1,200 pounds, and the unit can only carry 1,143 pounds.  
b. 520 kg
4. d

## Unit Assessment

1. a. 320 : 80  
b. 640 : 160  
c.  $320 : 80 = 640 : 160$  or any correct variation  
d.  $\frac{320}{80} = \frac{640}{160}$  or any correct variation
2. a. 108  
b. Answers may vary: for example,  $4 : 9 = 108 : 243$ ; means are 9 and 108; extremes are 4 and 243

c. 194

3. No; the cross-products in the proportion  $2 : 75 = 344 : 37500$  are not equal. There are only enough hotel rooms for 12,900 spectators in 344 rooms.

4.

Place	Time	Miles/Hour	Kilometers/Hour
1	30 min	24 mi/hr	38.4 km/hr
2	32 min	22.5 mi/hr	36.0 km/hr
3	38 min	18.9 mi/hr	30.2
4	41 min	17.6 mi/hr	28.2 km/hr
5	46 min	15.7 mi/hr	25.1 km/hr

## 4.3 Direct & Inverse Variation

### Exploring & Solving Direct Variation Problems

#### Student Logbook

- more than 1,000 feet
- weight
- deeper; shallow
- increase; decrease
- constant; directly proportional
- $\infty$
- you cannot change one without affecting the other
- 53.4 psi; 120 ft
- $P : D = p : d$
- 350 feet

#### Your Turn

- d
- a. 12 miles  
b. 42 miles  
c. answers may vary: for example, 5 min : 1 mile = 210 min : 42 miles

### Exploring Inverse Variation

#### Student Logbook

- inversely proportional
- the number of times a cog makes a complete turn in one minute
- $R \propto \frac{1}{T}$
- reciprocal

5.  $\frac{1}{T}$

6. decrease; slower

7.  $R : \frac{1}{T}$

8. equivalent ratios

9.  $\frac{r}{t} = \frac{R}{T}$

10.  $rt = RT$

#### Your Turn

1. a.  $V = \frac{1}{p}$  or  $P = \frac{1}{V}$

b.  $P : \frac{1}{V} = p :$

c.  $PV = pv$

2. a

3. Javier wants the wheel, but not the pedals, to turn faster. Because his speed (rpm) is inversely proportional to the number of cogs on the sprocket, he should shift the chain to a sprocket with fewer cogs because a sprocket with fewer cogs turns faster.

### Solving Inverse Variation Problems

#### Student Logbook

- revolutions; teeth
- The cog turns at 30 rpm.
- equal
- 24 teeth
- twice
- increase
- 20
- $\frac{1}{3}$ ; 3
- 180 rpm
- equivalent products; quantity
- opposite

#### Your Turn

- a. half  
b. 40 psi  
c. 50 feet
- No. If it were an inverse variation, the number of butterflies would decrease as the temperature increased, or vice versa.

3. a.  $\frac{1}{2}$  unit  
b. 100 m

## Unit Review

1. a.  $d \propto t$  or  $t \propto d$   
b. 3 miles
2. a. 50  
b. 528  
c. 1
3. a.  $M \propto \frac{1}{p}$  or  $P \propto \frac{1}{m}$   
b. an increase in the number of trees with moss on them
4. As the interest rate  $r$  increases, the time required to double an investment decreases.
5. a. Temperature must be inversely proportional to altitude.  
b. The equipment on airliners is most likely designed for very low temperatures, because temperature decreases as altitude increases.

## Unit Assessment

1. a. They are directly proportional.  
b.  $135.8^\circ\text{F}$   
c.  $74.3^\circ\text{F}$   
d. No, because the proportion is not correct. If it had been sunny all day, the temperature in the car should have been  $96.6^\circ\text{F}$ .
2. a.  $F_1 : \frac{1}{B_1} = F_2 : \frac{1}{B_2}$   
b.  $F_1 B_1 = F_2 B_2$
3. a.  $I \propto \frac{1}{d^2}$   
b. 2.1 meters
4. a–c. Answers will vary, depending on the relationships students choose as examples.

## 4.4 Similar Polygons

### Defining Similarity

#### Student Logbook

1. recycled plastic

2. The molding unit heats recycled plastic and molds it into cycle helmet casings.
3. The assembly unit puts the cycle helmet casing parts together and packages the helmets.
4. by way of a conveyor belt
5. 2 : 3
6. 12 m; 10 m
7. the new length
8.  $2 : 3 = 12 : x$ ;  $\frac{2}{3} = \frac{12}{x}$
9. 18 m; 15 m
10. ratio
11. change; shape

#### Your Turn

1. 6 feet; 2 feet
2. a
3. impossible to tell
4. They look similar, but there is no information about their sides, angles and other two sides.

## Identifying Equivalent Ratios

#### Student Logbook

1. a. The length of the molding unit stays the same. The width may be increased.  
b. It is to be expanded so that both dimensions are proportional to the dimensions of the new assembly unit.
2. proportional
3. 18 m
4. equal
5. They are similar rectangles.
6. 20 m
7. congruent; in proportion
8. a closed figure having 3 or more sides
9. True
10. proportions

#### Your Turn

1. 60 meters; 45 meters; 30 meters.
2. Yes; triangles are closed figures that have 3 sides.

3. impossible to tell
4. In order to be similar, triangles must have congruent angles and congruent sides. It is not possible to determine whether these triangles are similar because the measures of all the angles are unknown, and the measures of the sides is unknown.
5.  $1\frac{1}{2}$
6. 2 : 1

## Setting up & Solving Proportions in Similar Polygons

### Student Logbook

1. the conveyor belt
2. 10 m
3. opposite; conveyor belt
4. Pythagorean theorem; hypotenuse; legs
5. 16 m
6. 8 m
7. Divide the length of the old hypotenuse by 2 because the two triangles are similar, and the ratio between their sides is 2 : 1.
8. congruent; in proportion
9. 2 : 1

### Your Turn

1. b
2. c
3. a. 24
  - b. Yes; their corresponding angles are congruent and the ratio between their corresponding sides is 1 : 1.
4. 30 ft

## Unit Review

1. 25 m; 18.75 m
2. a, c
3. 1.5 units; 5 units
4. 30 meters; 45 meters
5. a. 48 square units; 108 square units
  - b. 4 : 9
  - c. The ratio of the areas is equal to the ratio of the sides squared.
  - d. 2 : 3

## Unit Assessment

1. a. Going counterclockwise from the given length of 1.25 the lengths of the remaining sides are 0.88, 1.79, 2.47, 0.44, 2.05
  - b. 17 : 5
  - c. About 17 : 5; the perimeter of the large hexagon is 30.25 and the perimeter of the smaller hexagon is about 8.88. The ratio between them is 3.4 and the ratio 12 : 5 equals 3.5.
2. 37.5 feet
3. 64.7 cm (Note: Explain to students that the dotted line divides the triangle into 2 right triangles. It also splits the bottom side in half. That means that the length of the bottom segment, from the angle to the dotted line is  $\frac{1}{2}c$ . Substituting this into the Pythagorean theorem gives you  $(\frac{1}{2}c)^2 + 56^2 = c^2$ , which can then be solved for c.)
4. Answers will vary. For example, a carpenter might need to determine the height of a triangular roof.

## 5.1 Interpreting & Constructing Graphs

### Exploring Line Graphs

#### Student Logbook

1. global monthly revenues for 6 months
2. September
3. He wanted to find the month with the highest revenue.
4. Month; millions
5. to show a higher predicted revenue
6. up
7. Draw a line up from November and a line across from \$12 million. The point where the two lines intersect shows the sales for November.
8. July
9. positive trend
10. trend
11. a tendency or a pattern

12. They are decreasing.

### Your Turn

1. the average number of games sold each month
2. Points should have been added for October and November for Space Mission and January and February for Paragon.
3. All points should be connected for both lines.
4. Space Mission
5. March
6. Paragon
7. Sales of Space Mission seem to show a negative trend, and Paragon show a positive trend.

### **Exploring Bar Graphs**

#### Student Logbook

1. city
2. number of units sold
3. to compare sales in different cities during the same time period
4. Data are pieces of information.
5. axes
6. scale
7. 5,500 to 13,500
8. The range is the difference between the greatest value and the least value in a data set.
9. if 100 were used, the scale would be too large to fit on the graph.
10. the range of values and the scale
11. He used a broken axis.

### Your Turn

1. **a.** A computer in four countries (1995)  
**b.** Answers may vary, one answer is 0 to 20 (million)  
**c.** Scale b should be drawn on the vertical axis; axis should be labeled Number of Personal Computers (in millions).  
**d.** "Country"  
**e.** Bars for the four countries should reflect the data given and should have the same width and be spaced an equal distance

apart.

5. **a.** 4 million    **b.** France    **c.** 33%

### **Interpreting Pie Charts**

#### Student Logbook

1. game sales in August
2. sectors or regions
3. percent; 100 percent
4. 360; 100 percent
5. sectors; size
6. (answers may vary)  $\frac{60}{100} = \frac{x}{360}$
7. He used a protractor.
8. (answers may vary)  $\frac{90,000}{200,000} = \frac{x}{100}$
9. 45
10.  $\frac{45}{100} = \frac{d}{360}$ ; 162
11. 100
12. 360°

### Your Turn

1. Home and Education and Government
2. 46%
3. no
4.  $\frac{34}{100} = \frac{x}{360}$ ;  $x = 122^\circ$
5. Homework: 42%; 151°  
Surfing the Net: 25%; 90°  
Playing Computer Games: 29%; 104°  
Writing E-mail: 4%; 14°

### **Unit Review**

1. **a.** negative trend    **b.** positive trend
2. February
3. **a.** *The Rock*  
**b.** The range is approximately 300–125 or 175.  
**c.** about 25%
4. Check pie chart for correct labels and correct percentages. Percents and angles should be: swimming 10% and 36°, tennis 15% and 54°, basketball 25% and 90°, football 20% and 72°, soccer 12.5% and 45°, and golf 17.5% and 63°.

5. Check that the graph is titled and labeled, that the calculations are correct, and, if a scale is used, that it is appropriate.
6. Answers will vary. The student should give a reasonable explanation for choosing a particular graph.

## Unit Assessment

- a line graph
- c
- make comparisons
- a pie chart
- Write a proportion:  $\frac{p}{100} = \frac{d}{360}$   
Then solve for d.
- c
- a
- $\frac{11}{24} = \frac{x}{100}$ ;  $1100 = 24x$ ;  $x = 45.8\%$
- $140.4^\circ$  ( $39\% \times 360^\circ$ )
- a. Rentals decreased.  
b. Grant's Video Store  
c. Grant's: negative trend line; Video Warehouse: positive trend line
- 9.3%

## 5.2 The Mean, Median, & Mode

### Defining the Mean & Median

#### Student Logbook

- "raw data" means pieces of information that have not been analyzed or processed
- 20
- sample; group of people; whole
- bought Max Orbit
- typical value
- sum; dividing; number
- median; increasing; decreasing
- a. same    b. mean or average
- the middle value in the data set

10.  $\frac{14}{20}$ , or 70%, of people are within a 5-year range of the median, so it gives a good indication of the typical age of the game buyer

#### Your Turn

- a. 27 to 115 or 88    b. 74 to 148 or 74  
c. 27 to 148 or 121
- 18
- a. 83; 93    b. 98; 83  
c. 91; 90.5
- The mean. The mean for Week 1 is 83 and for Week 2 it is 98, which shows an improvement. The median shows a decline from Week 1 to Week 2.
- Yes. The range for Week 1 is 27 to 115 and for Week 2 it is 74 to 148, which shows that both the lowest and highest scores improved the second week.

### Defining the Mode

#### Student Logbook

- most; value
- 9
- older
- 12
- Find out which value most accurately represents the typical age.
- most of the people in the sample are less than 24 years of age
- 70
- median; Because most of the people surveyed are more than 9 years old.
- adults; 13
- data

#### Your Turn

- 3; 11
- 7 hours
- 6.8 hours
- Arrange the values in increasing or decreasing order, then find the middle value.
- 7 hours

6. 7 hours
7. No, all three are good representations of the data tendency. Because all three measures are approximately 7 hours.

## Calculating the Mean, Median, & Mode

### Student Logbook

1. 1; 10
2. typical value
3. mean; median; mode
4. 6.5 marks
5. increasing; 6; he found the mean of the 2 middle values in the data set
6. 9
7. small; different
8. there were a few extreme values in the sample
9. when there is a narrow range of values

### Your Turn

1. 1 to 5
2. 3.3
3. 3
4. 4
5. The mode 4 shows that most players thought the game was difficult, though the mode only represents  $\frac{10}{30}$  players, or about 33%. The median shows that the game is moderately difficult. The median 3 is close to the mean of 3.3. The mean shows that players thought the game was a bit more than moderately difficult.
6. mean; the range is narrow

## Unit Review

1. 20
2. 5; 45
3. 15
4. 18.5
5. 2, 3, 3, 3, 4, 5, 6, 6, 7, 9
6. mode
7. 4.8; 4.5
8. 75.7; 80; 80

9. The median and mode of 80 most typically represent Paula's sales. 50% of the days are within a 5-point range of the median and mode. Only 40% of the days fall within a 5-point range of the mean, so of the three the mean is not the best measure of central tendency.

10. 1; 115

11. 22.8; 15; 15

12. The owner should stock 15 games for the sale. The mean is about 23 games, and the range is 114. But only 5 games sold within a 5-point range of the mean. Which is about 17% of the total number of games. The median and mode are both 15, and 14 games sold within a 5-point range of that value. That represents about 47% of the total number of games. Therefore, the median and mode represent the most typical value of games sold.

## Unit Assessment

1. a. 16  
b. 17
2. a. 3.3 hours    b. 2; mode    c. 3; median
3. a. 1; 5; 20  
b. 2  
c. 2.75  
d. A mode of 2 indicates that most subscribers think the newsletter is of fair quality. It was rated less than good by  $\frac{9}{20}$  or 45% of the subscribers. The mean and the median are nearly equal and are both 2 points less than the highest possible rating.
4. a. 14.1; 10.5; 7  
b. 37.55, or about 38; 43; 23  
c. 46.8, or about 47; 50; 49
5. The data show that Wip Zap mostly appeals to pre-teens, and that the buyers of Word Power are younger adults than the buyers of Rover.

## 5.3 Frequency Distribution

### Creating and Interpreting a Frequency Table

#### Student Logbook

1. Beginners; Intermediate; Expert
2. 40
3. 3
4. III
5. numerals
6. frequency; the number of times that each score occurred
7. the mean; the sum of the scores; number of scores
8. frequency; added
9.  $\frac{\sum f(x)}{\sum f}$
10. 40; 300; Level 2
11. data; each item in a data set occurs.

### Your Turn

1. 

Number of rejects	45	60	80	85	87	95	100	123	125
Frequency									
2. 

No. rejects	45	60	80	85	87	95	100	123	125
Frequency	III	III	IIII	II	IIII	IIII	II	II	IIII
4. 

Number of rejects	45	60	80	85	87	95	100	123	125
Frequency	3	3	4	2	6	4	2	2	4
f x 12									
5. 

Number of rejects	45	60	80	85	87	95	100	123	125
Frequency	3	3	4	2	6	4	2	2	4
f x 12	135	180	320	170	522	380	200	246	500

6.  $88 \left( \frac{2653}{30} \approx 88.4 \right)$

### Defining a Histogram

#### Student Logbook

1. grouped frequency table
2. Frequency: 2, 14, 7, 11, 4, 1, 1
3. histogram; bar; frequency
4. horizontal; vertical; measured data
5. mid-interval; adding; highest; lowest; 2
6. frequency; sum; scores; 270.5
7. less

### Your Turn

No. rejects	1-20	21-40	41-60	61-80	81-100	101-120	121-140
Frequency (f)	0	0	6	4	14	0	6
Mid. Interval Values			50.5	70.5	90.5	110.5	130.5

### 1, 2, 3: Table

4. Answers may vary. Bars should be next to each other. Divisions should be 2 or 3. Nothing should be graphed in the intervals 0–20 and 21–40. The horizontal axis should be labeled *Rejects*, and the vertical axis should be labeled *Frequency*. The bars should be drawn according to the frequency. The title should indicate that the histogram display data about the number of rejected helmets during 1 month.

5.  $87 (303 + 282 + 1267 + 221 + 522 = \frac{2595}{30} = 86.5)$

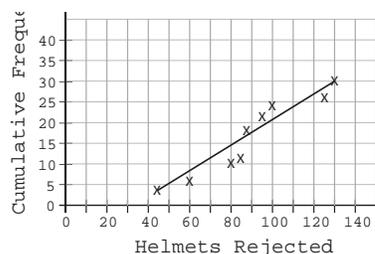
### Exploring Cumulative Frequency Graphs

#### Student Logbook

1. 80th
2. cumulative frequency; plot; curve
3. The total of all the frequencies in a set taken in succession
4. The last number is 40 because there were 40 scores to begin with.
5. 50; game scores; 5; cumulative frequency
6. b
7. best
8. at; below
9. The curve is approximate.
10. c

### Your Turn

1. Cumulative frequency: 3, 6, 10, 12, 18, 22, 24, 26, 30
2. 30; there were 30 employees in all
3. Points: (45, 3), (60, 6), (80, 10), (85, 12), (87, 18), (95, 22), (100, 24), (123, 26), (125, 30)



4. Answers will vary. Check students' graphs.

5. a. 3  
b. 6

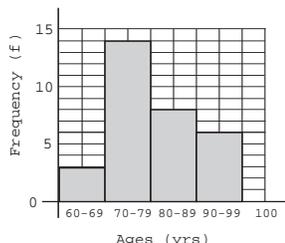
### Unit Review

1. The table should contain the following numbers and tally marks: (63, 1), (67, 1), (69, 1), (72, 2), (73, 1), (75, 2), (76, 1), (77, 2), (78, 6), (82, 2), (84, 1), (85, 2), (87, 1), (88, 2), (90, 3), (94, 1), (96, 1).

2.  $80 \frac{24.05}{30} \approx 80.2$

3. Intervals and values: 60–69, 3; 70–79, 14  
80–89, 8; 90–99, 5

4.



5.  $80 \left( \frac{23.85}{30} \right) = 79.5$

6. Cumulative frequency values: 1, 2, 3, 5, 6, 8, 9, 11, 17  
Cumulative frequency: 19, 20, 22, 23, 25, 28, 29, 30

7. (63, 1) (67, 2) (69, 3) (72, 5) (73, 6) (75, 8) (76, 9) (77, 11) (78, 17) (82, 19) (84, 20) (85, 22) (87, 23) (88, 25) (90, 28) (94, 29) (96, 30). Check students' graphs to see their lines of best-fit.

8. approximately 84

9. 78; 78 is close to 80, so the 50th percentile and the two mean values are approximately equal.

### Unit Assessment

1. a. 1

Frequencies:  
2, 3, 5, 3, 4, 5, 4, 0, 4, 0.

b.  $\sum(x)$ : 2, 6, 15, 12, 20, 30, 28, 36

c.  $x$ :  $\frac{149}{30} = 4.96 \approx 5$

d. No; The new soda with an average rating of 5 of 10 was not very popular.

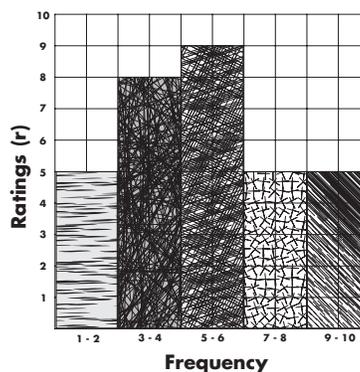
2. a. Frequency (f): 5, 8, 9, 4, 4

b. 1.5, 3.5, 5.5, 7.5, 9.5

c. 7.5, 28.0, 49.5, 30.0, 38.0

d.  $5.1 \approx 5$

3.



4. a. 5–6

b. 17

c.  $\frac{17}{30}$  or  $56.6\% \approx 57\%$

5. Cumulative frequency: 2, 5, 10, 13, 17, 22, 26, 30

6. Ratings. Points are: (1,2) (2,5) (3, 10) (4,13) (5, 17) (6, 22) (7, 26) (9, 30)

Check students' graph.

7. a. approximately 6

b. 80% of the customers rated Super Nova Soda at about 6 or below.

c. 20%

## 6.1 Simple Probability

### Defining & Expressing Probability

#### Student Logbook

- random; equal
- two; coin
- outcome
- desired outcome
- desired; possible
- probability
- $\frac{1}{2} ; \frac{1}{2}$
- 1
- 0

10. sample space

11. Yes. There is a 50% chance that the coins will match, and Dijit will win. There is also a 50% chance that the coins will not match, and Zack will win.

### Your Turn

1. a. 3

b. No; a coin toss works only when there are two choices.

c. 1

d.  $\frac{1}{3}$

e. 1

2. a. Alison's chart:

	S	S,S	S,L
S	S,S	S,L	S,R
L	L,S	L,L	L,R
R	R,S	R,L	R,R

b.  $\frac{3}{9}$  or  $\frac{1}{3}$

## Calculating Probabilities on a Color Wheel

### Student Logbook

1. a.  $\frac{\text{Number of desired outcomes}}{\text{Number of possible outcomes}}$

b. sector

c. 6

d. 3

2. number of colors (or numbers in each section). There are 3 colors, so the outcomes are red, yellow, or blue. (If number, there are 6 outcomes: 1, 2, 3, 4, 5 or 6.)

3. 1

4.  $\frac{1}{6}$

5. 2

6.  $\frac{1}{3}$  ( $\frac{2}{6}$ )

7.  $\frac{1}{2}$

8. Blue; the probability of blue is  $\frac{1}{2}$ , which is greater than the probabilities for red and for yellow.

9. No; it is still possible to spin one of the other colors.

### Your Turn

1. 6

2.  $\frac{1}{6}$

3. 2

4.  $\frac{2}{6}$  or  $\frac{1}{3}$

5. 3

6.  $\frac{3}{6}$  or  $\frac{1}{2}$

7.  $\frac{6}{6}$  or 1

8.  $\frac{0}{6}$  or 0

9. a-c. Answers will vary. Check students' work.

## Determining Probabilities of Complementary Events

### Student Logbook

1. Nobody

2.  $\frac{1}{6}$

3. 1

4.  $1 - \frac{1}{6} = \frac{5}{6}$

5. 2

6.  $\frac{1}{2}$

7. 2

8.  $\frac{1}{2}$

9. No; The numbers on the wheel are either odd or even, so the probability of spinning a number that is neither even nor odd is 0.

### Your Turn

1. a. 7

b.  $\frac{1}{7}$

c.  $\frac{4}{7}$

d. 4

e.  $\frac{3}{7}$

f.  $\frac{4}{7}$

g.  $\frac{4}{7}$

h.  $\frac{2}{7}$

2. a. 5

b.  $\frac{5}{6}$

c.  $\frac{1}{6} + \frac{5}{6} = \frac{6}{6}$  or 1

## Unit Review

- 7
  - $\frac{1}{7}$
  - 6
  - $\frac{6}{7}$

2.

	P(2)	P(odd number)	P(9)	P(prime number)	P( 3)	P(number)
Fraction	$\frac{1}{8}$	$\frac{1}{2}$	0	$\frac{4}{8}$	$\frac{6}{8}$	1
Percent	12.5%	50%	0%	50%	75%	100%

- $\frac{8}{100}$  or 8%
  - 1 or 100%
  - $100\% - 8\% = 92\%$  or  $\frac{92}{100}$
  - $\frac{999}{1000}$  or 99.9%
- $\frac{3}{4}$
  - $\frac{1}{4}$

## Unit Assessment

- 2; blue and yellow
  - 4
  - $\frac{4}{5}$
  - 80%
  - 20%
  - 0
  - 1
- $\frac{1}{6}$
- $\frac{4}{8}, \frac{1}{2}$ , or 50%
  - The probability is  $\frac{4}{8}$ , or 50%. The prime numbers are 2, 3, 5, and 7, so the number of possible outcomes is 4.
- $\frac{6}{24}$ , or  $\frac{1}{4}$ , 25%
- $\frac{7}{10}$ , 70%
- $\frac{1}{4}$
  - $\frac{1}{2}$
  - $\frac{1}{4}$

## 6.2 Probability of Combined Events

### Calculating the Probability of Independent Events

#### Student Logbook

- 3; 2
- 2

- AD, AE, BD, BE, CD, CE
  - 6 possible combinations
- independent
- Probability =  $\frac{\text{Number of desired outcomes}}{\text{Number of possible outcomes}}$
- 6
- $\frac{1}{2} \times \frac{1}{3} = \frac{1}{6}$
- Answers will vary. Check students' work.

### Your Turn

- Yes

b.

		Route				
		R1	R2	R3	R4	R5
Pool	P1	P1R1	P1R2	P1R3	P1R4	P1R5
	P2	P2R1	P2R2	P2R3	P2R4	P2R5
	P3	P3R1	P3R2	P3R3	P3R4	P3R5

- 5
- 15
- $\frac{1}{3}$
- $\frac{1}{5}$
- $\frac{1}{15}$

## Determining the Sample Space of an Experiment

### Student Logbook

- the probability that it will be clear one or both days
- True
- mutually exclusive
- sample space
- $\frac{25}{49}$
- $\frac{45}{49}$
- 45
- snow on both days
- Answers will vary. Check students' work.

### Your Turn

- yes
  - 1
  - $\frac{4}{10}$
  - $\frac{6}{10}$ , no
  - $\frac{36}{100}, \frac{16}{100}$
  - $(\frac{6}{10} \times \frac{4}{10}) + (\frac{4}{10} + \frac{6}{10}) = \frac{24}{100} + \frac{24}{100} = \frac{48}{100}$
  - $(1 - \frac{16}{100}) = \frac{84}{100}$

2. a. 98%      b. 0.04%
- c.  $(0.98 \times 0.98 \times 0.98 \times .02) = 0.0188 \approx 1.88\%$

## Calculating the Probability of Dependent Events

### *Student Logbook*

- No, they are independent events.
- mutually exclusive
- because it branches like a tree
- event
- multiplying
- independent
- dependent
- Answers will vary. The tree should show two events with three branches for each event. If order of flavors does not matter, then there are six different ice cream cones.

### *Your Turn*

- a. yes

b.  $\frac{1}{4}$ ; The probability the first serve will be successful is  $\frac{3}{4}$ . A serve is either successful or not. So the total probability is 1 and  $1 - \frac{3}{4} = \frac{1}{4}$

c.  $\frac{1}{10}$ ; The probability the second serve will be successful is  $\frac{9}{10}$ . A serve is either successful or not. So the total probability is 1 and  $1 - \frac{9}{10} = \frac{1}{10}$ .

d.  $\frac{1}{40}$ ;  $\frac{1}{4} \times \frac{1}{10} = \frac{1}{40}$

e. Since the total probability must be 1, the probability a top notch player will serve successfully is  $1 - \frac{1}{40} = \frac{39}{40}$
- a. The choices are dependent events, because the first choice does affect the outcome of the second choice.

b.  $\frac{1}{3}$

## Unit Review

- a.  $\frac{1}{4}$

b.  $\frac{3}{4}$

c.  $\frac{1}{2}$

		SECOND ROLL					
		R	O	Y	B	G	V
F I R S T	R	R,R	R,O	R,Y	R,B	R,G	R,V
	O	O,R	O,O	O,Y	O,B	O,G	O,V
	Y	Y,R	Y,O	Y,Y	Y,B	Y,G	Y,V
R O L L	B	B,R	B,O	B,Y	B,B	B,G	B,V
	G	G,R	G,O	G,Y	G,B	G,G	G,V
	V	V,R	V,O	V,Y	V,B	V,G	V,V

- a.  $\frac{1}{6}$       b.  $\frac{21}{36}$  or  $\frac{7}{12}$       c.  $\frac{3}{36}$  or  $\frac{1}{12}$       d.  $\frac{9}{36}$  or  $\frac{1}{4}$
- a. dependent; the number of coins left in the glove compartment was 1 less than in the first grab.

b.  $\frac{10}{24} \times \frac{9}{23} = \frac{90}{552} = \frac{15}{92}$
- a. yes

b.  $\frac{4}{10}$  or 40%

c.  $\frac{6}{10} \times \frac{6}{10} = \frac{36}{100} = \frac{9}{25}$

d.  $\frac{4}{10} \times \frac{4}{10} = \frac{16}{100} = \frac{4}{25}$

## Unit Assessment

- a. no

b.  $\frac{1}{3}$

c.  $\frac{1}{3}$
- a. yes

b.  $\frac{1}{2}$

c.  $\frac{1}{3}$

d. Check students' diagrams. There should be two events, one with two branches and one with three branches, for a total of six outcomes.

e.  $2 \times 3 = 6$
- $\frac{24}{100}$  or 24%
- a.  $\frac{6}{10} \times \frac{1}{3} = \frac{6}{30}$  or  $\frac{1}{5}$

b.  $\frac{3}{6} \times \frac{2}{5} = \frac{6}{30} = \frac{1}{5}$

c.  $\frac{3}{6} \times \frac{2}{5} \times \frac{1}{4} = \frac{6}{120} = \frac{1}{20}$

d. 0
- a. 0

b. dependent

