Name _____ Period _____ Date _____

UNIT 9
STUDENT PACKET

Math Links
GRADE 7

LENGTH, AREA, AND VOLUME

Parent (or Guardian) signature _____

MY WORD BANK

Explain the mathematical meaning of each word or phrase, using pictures and examples when possible. See **Student Resources** for mathematical vocabulary.

circle center of a circle, chord, diameter, radius	
circumference	pi
surface area	volume

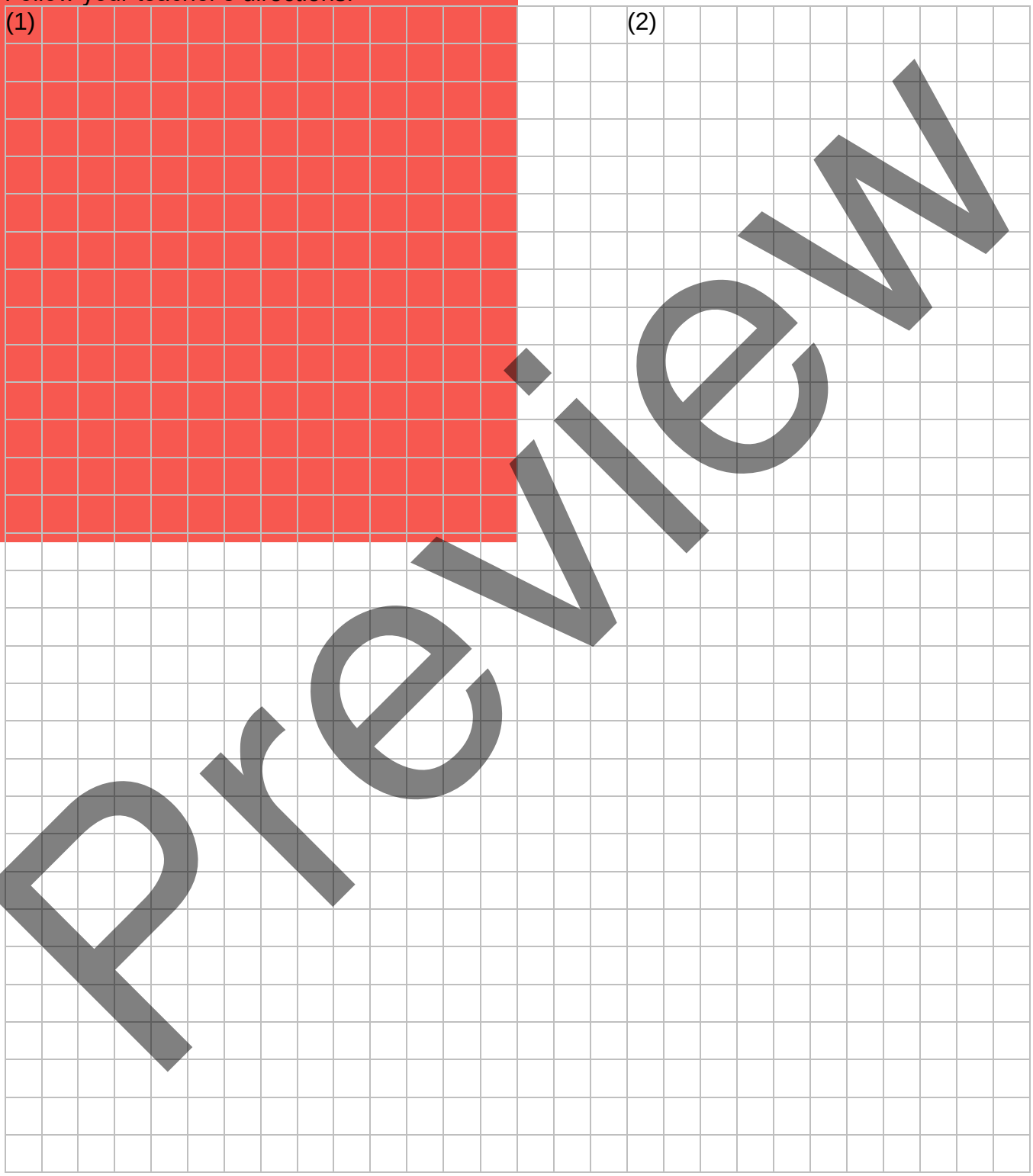
OPENING PROBLEM: FELIX THE SHEEP

[7.NS.3, 7.EE.3, 7.G.4; SMP 1, 2, 4, 5, 7, 8]

Follow your teacher's directions.

(1)

(2)



CIRCLE CIRCUMFERENCE

We will explore the relationship between a circle's diameter and its circumference. We will learn about historical approximations to π. We will use the formula for the circumference of a circle to solve problems.

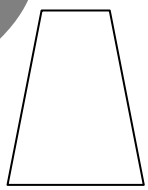
[7.RP.2a, 7.NS.3, 7.G.4; SMP1, 2, 3, 4, 5, 6]

GETTING STARTED

1. _____ millimeter(s) are equal to 1 centimeter.

2. _____ centimeter is equal to 1 millimeter.

Use a cm ruler to measure the sides of each figure below to the nearest mm. Find the perimeter.

3. parallelogram	4. right scalene triangle	5. isosceles trapezoid
		

Solve each equation below for x. In other words, manipulate the equation so that x is "by itself."

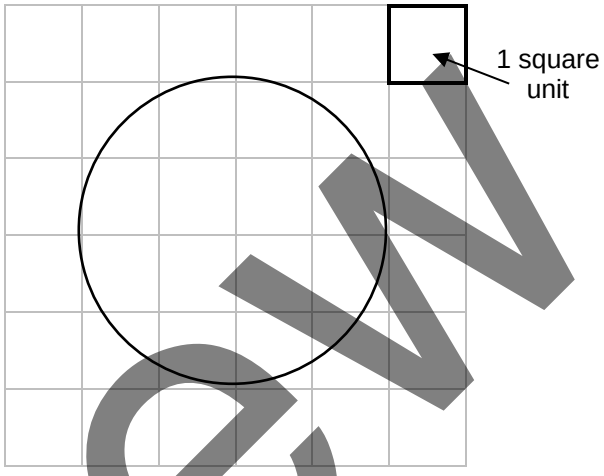
6. $y = 4x$	7. $y = \frac{1}{3}x$	8. $6 \bullet x \bullet y = 12$

CIRCLES

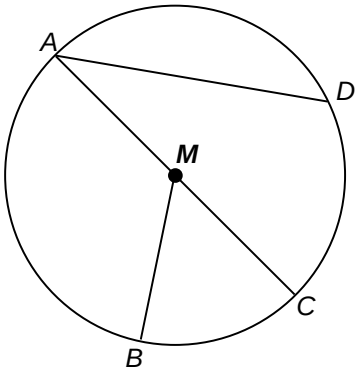
Follow your teacher's directions for (1) and (2).

(1)

(2)



Fill in the blanks below using the figure to the right. For each problem, complete the first statement with a word and the second statement with symbols.



3. Points on a circle are all equidistant from its _____.

   In the figure, this point is represented by _____.

4. A line segment from the center of a circle to any point on

   the circle is called a _____.

   In the figure, this segment is represented by _____.

5. A line segment with both endpoints on the circle is called a _____.

   In the figure, this segment is represented by _____.

6. A chord that goes through the center of the circle is called a _____.

   In the figure, this chord is represented by _____.

7. The distance around a circle is its _____.

8. Record the meanings of circle, center of a circle, radius, chord, diameter, and circumference in **My Word Bank**.

A LENGTH INVESTIGATION

We will measure and record the circumference and diameter of circular objects of various sizes and explore their relationship.

1. What tools do you need to do this?

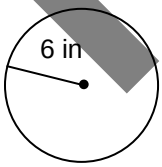
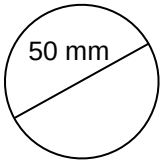
2. Measure the diameter and circumference of four different circular objects to the nearest millimeter and record your measurements in the table below. In the last column, compute the quotient and round to the nearest hundredth.

Object	Diameter (d)	Circumference (C)	$\frac{C}{d}$
A.			
B.			
C.			
D.			

3. The circumference of a circle is *about* equal to _____ times the length of the diameter.

4. Write an equation to describe the relationship between the circumference (C) and the diameter (d). Use the symbol "≈" to represent "is about equal to."

Find exact values or estimates as appropriate for the missing measures of the following circles. Use the symbol "=" for exact values and "≈" for estimates.

5. r _____ d _____ C _____ 	6. r _____ d _____ C _____ 	7. r _____ d _____ C = 24 ft	8. r _____ d _____ C = 45 m

PRACTICE 1

A LITTLE HISTORY: Many civilizations over the centuries have observed that the value of the ratio of the circumference to the diameter of a circle is a constant. As an example, a Roman writer observed that the number of paces around the outer portion of any circular temple was about three times the number of paces through the center. In mathematics, the Greek letter pi (written π) is used to represent this constant. The number π is not rational, that is, π cannot be expressed as a quotient of integers. Here are some approximations to π that appeared in different civilizations over the ages. Use a calculator, and round each to the nearest 5 decimal places.

Fraction used as approximation to π	**Decimal approximation for π** (to the nearest hundred-thousandth)
1. Egyptian: $\frac{256}{81}$	
2. Greek: between $\frac{22}{7}$ and $\frac{223}{71}$	
3. Hindu: $\frac{3{,}927}{1{,}250}$	
4. Roman: $\frac{377}{120}$	
5. Chinese: $\frac{355}{113}$	
6. Babylonian: $\frac{25}{8}$	

7. The decimal approximation to π, correct to seven decimal places, is 3.1415926.

   a. Which civilization named above had the best decimal approximation to π?

   b. Round this decimal approximation to the nearest hundredth. _____

> If you want to write the exact value of pi, you should use the symbol π.
> Common numerical approximations for π, such as 3.14 or $\frac{22}{7}$, are not exact.

8. Starting with your equation from the previous page, now write exact equations for the circumference of a circle:

a. In terms of d, C = _____	b. In terms of r, C = _____

9. Find the circumference of a circle with d = 14 cm using the approximation $\pi = \frac{22}{7}$.

10. Find the circumference of a circle with r = 6 ft using the approximation π = 3.14.

A CLOSER LOOK AT APPROXIMATE VALUES FOR π

There is no fraction that represents the exact value of π. If an exact solution to a problem is required, leave the symbol π in the solution. However, if the solution is needed for a task for which an approximation will serve, such as for making a measurement with a ruler, you may approximate π to the accuracy required for the application.

Compute the numerical approximations for each measurement that represents the circumference of a circle. Measurements are all in linear units.

Exact Circumference of a Circle	Approximate *C* using 3 for π	Approximate *C* using 3.14 for π	Approximate *C* using $\frac{22}{7}$ for π
1. $C = 7 \bullet \pi$ (d = _____)			
2. $C = 2 \bullet \pi \bullet 14$ (d = _____)			
3. $C = 1.4\pi$ (d = _____)			
4. $C = 100\pi$ (d = _____)			
5. $C = 2 \bullet \pi \bullet 5$ (d = _____)			

6. Using a value of 3 may be the simplest approximation for π. Why may it not be the "best?"

7. Describe when it's easier to calculate circumference approximations using 3.14 versus $\frac{22}{7}$ for π.

8. Record the meaning of pi (π) in **My Word Bank**.

PRACTICE 2

1. The symbol for pi is _____.
2. Some common approximations for pi are _____.
3. Explain what pi means in your own words.

4. For the circumference formula $C = \pi d$, solve for d.

5. For the circumference formula $C = 2\pi r$, solve for r.

Solve each problem using either 3.14 or $\frac{22}{7}$ for π. Round solutions appropriately.

6. Calculate the diameter of the top of a soup can with a circumference of 32 cm.

   Appropriate formula: _____

   Substitute and solve:

   Solution:

7. Calculate the radius of a plate with a circumference of 88 cm.

   Appropriate formula: _____

   Substitute and solve:

   Solution:

8. The earth is about 93,000,000 miles from the sun, and the earth revolves around the sun one time per year. If the earth's orbit is approximately a circle, how far does the earth travel in one year?

9. Explain why the solutions above are not exact measurements.

CIRCUMFERENCE REPRESENTATIONS

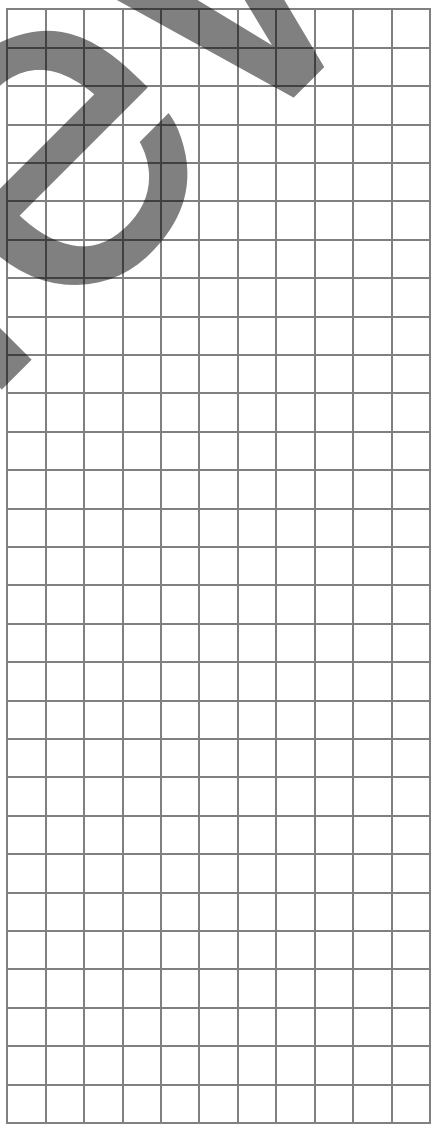
1. Your teacher will help you determine which data to transfer into the table to the right from **A Length Investigation**.

2. Draw horizontal and vertical axes on the graph below. Label and scale the axes.

3. Graph the data points and draw a line that best fits the data.

4. What does the point (0, 0) represent on this graph?

Diameter (*x*)	**Circumference (*y*)**



5. Estimate the *y*-value when $x = 1$ on your graph. In other words, what is $(1, y)$?

6. What does the point $(1, y)$ represent on this graph?

7. Write an equation that best approximates this graph.

8. Explain in words what this equation means.

9. Explain why each of the following represents a proportional relationship.

   a. The values in your data table.

   b. The graph.

   c. The equation.

CIRCLE AREA

We will use our knowledge of the area of parallelograms and circumference of circles to make the formula for the area of a circle plausible. We will use this formula to solve problems.

[7.RP.2a, 7.RP.3, 7.NS.3, 7.EE.3, 7.G.4, 7.SP.7a; SMP1, 2, 3, 4, 5, 6, 7, 8]

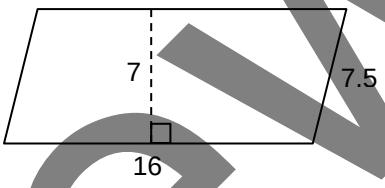
GETTING STARTED

Find the area of each figure below in square units.

1.

The formula for the area of a rectangle is:

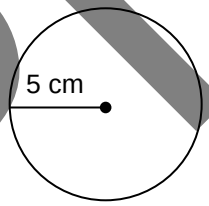
2.



The formula for the area of a parallelogram is:

Find each length.

3. Find the circumference of the circle below. Use a common approximation for π.



4. Find the radius of a circle with an exact circumference equal to 9π ft.

AN AREA INVESTIGATION

Follow your teacher's directions for (1) – (4).

(1)

(2)

(3)

Before folding and cutting, this figure was a _____.

Now the new figure looks much like a _____.

A formula for the area of this new figure is _____.

The approximate "base" of the new figure is _____ of the circle's circumference.

The approximate "height" of the new figure is the _____ of the circle.

(4)

5. Measure the radius of the circle used for this investigation. Substitute it into the formula from (4) to find the area of the circle. Use a common approximation for π. Round to the nearest mm.

PRACTICE 3

Find the area of each circle below. Use $\pi = 3.14$.

1. radius = 9 cm	2. diameter = 22 in	3. circumference = 31.4 ft

Find the exact area of each circle below. Leave your answer in terms of π.

4. radius = 9 cm	5. diameter = 22 in	6. circumference = 10π ft

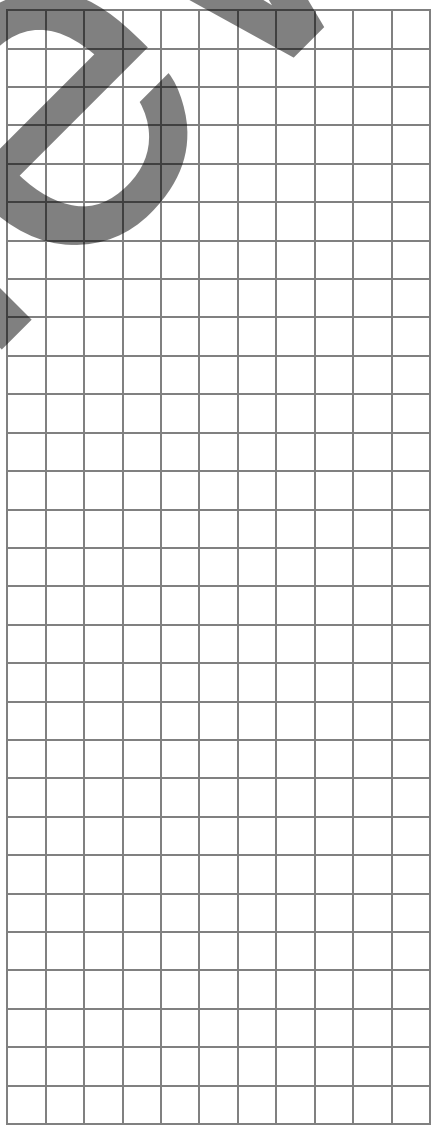
Pizza sizes are given in diameter length. Solve each problem about Frida's Pizza. Use $\pi = 3.14$.

7. Frida makes 12-inch medium pizzas and 14-inch large pizzas. By what percent is the large pizza bigger?	8. Frida uses 14.5" × 14.5" boxes for the large pizzas. What percent of the bottom of the box will a large pizza cover?

AREA REPRESENTATIONS

1. Use the formula for the area of a circle to complete the table to the right. Use $\pi = 3.14$.
2. Draw horizontal and vertical axes on the graph below. Label and scale the axes.
3. Graph the data points. How can you tell that a line does not fit the data very well?

Radius (*x*)	**Area (*y*)**
0 units	
1 unit	
2 units	
3 units	
4 units	



4. What does the point (0,0) represent on this graph?

5. What does the point (1, *y*) represent on this graph?

6. Write an equation that best represents this graph.

7. Explain why each of the following does NOT represent a proportional relationship.

   a. The values in your data table.

   b. The graph.

   c. The equation.

PRACTICE 4: EXTEND YOUR THINKING

Solve each problem below.

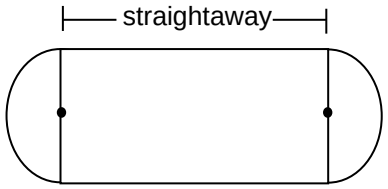
1. The exact circumference of a circle is 8π cm. Find the exact area.

2. The exact area of a circle is 25π cm^2. Find the exact circumference.

3. A revolving water sprinkler sprays water in a circular fashion to a distance of 20 feet in all directions. What area of grass does it cover?

4. Another sprinkler of the same kind covers an area of grass equal to 452.16 ft^2. How far does it spray water?

At John Wooden Middle School, a field is surrounded by a track. Each straightaway is 425 feet. The distance across the field (top to bottom in the diagram) is 150 feet. Use $\pi = 3.14$.



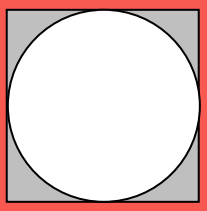
5. Find the area of the entire field.

6. Find the distance around the outer edge of the track.

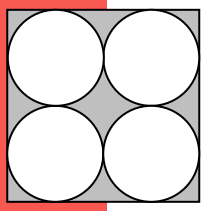
7. Revisit and complete the opening problem, **Felix the Sheep**.

PENNY DROP PROBABILITES

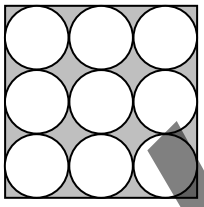
A



B



C



In the Penny Drop Game, a player drops a penny on a board on the floor. If the penny does not land on the board, the player drops it again. If the penny lands on the board and is at least half way in a white space, the player wins. If not, the player loses.

- Figures A, B, and C above represent boards for the Penny Drop Game.
- All three are squares that have side lengths equal to 1 foot.
- All the circles within board B have the same diameter length.
- All the circles within board C have the same diameter length.

1. Predict which board you think provides the greatest chance of winning. _____

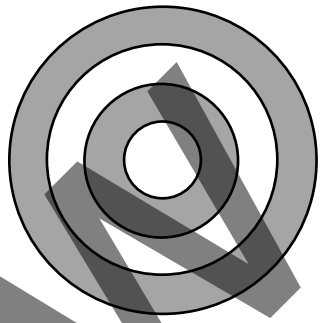
2. Test your prediction by calculating the probabilities of winning and losing for each **board**. What is your conclusion?

A	B	C

DART BOARD PROBABILITES

The dart board below is made up of concentric circles, which are circles that have the same center.

- The smallest circle has a 4-inch diameter.
- Each successive circle has a radius 2 inches greater than the previous one.
- For a target board game, you earn 2 points if you land on white and 1 point if you land on gray.
- You win if you earn more gray points than white points.



Is this a fair game? Explain.

AREA AND VOLUME APPLICATIONS

We will apply our knowledge of the area of polygons and volume of prisms to more complicated figures.

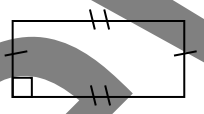
[7.RP.2a, 7.NS.3, 7.EE.3, 7.G.3, 7.G.4, 7.G.6; SMP2, 3, 4, 6, 7, 8]

GETTING STARTED

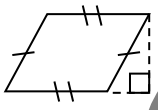
Find the area of each figure. They all have height equal to $\frac{1}{2}$ in. Diagrams are not to scale.

1.

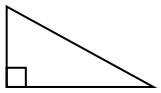
2. The base is twice the height.



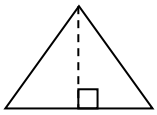
3. The base is $\frac{1}{4}$ inch longer than the height.



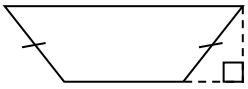
4. The base is $\frac{1}{3}$ inch longer than the height.



5. The base of this triangle is the same as the base of the triangle in problem 4.



6. The shorter base is $\frac{1}{4}$ inch longer than the height. The longer base is $2\frac{1}{2}$ times the length of the height.

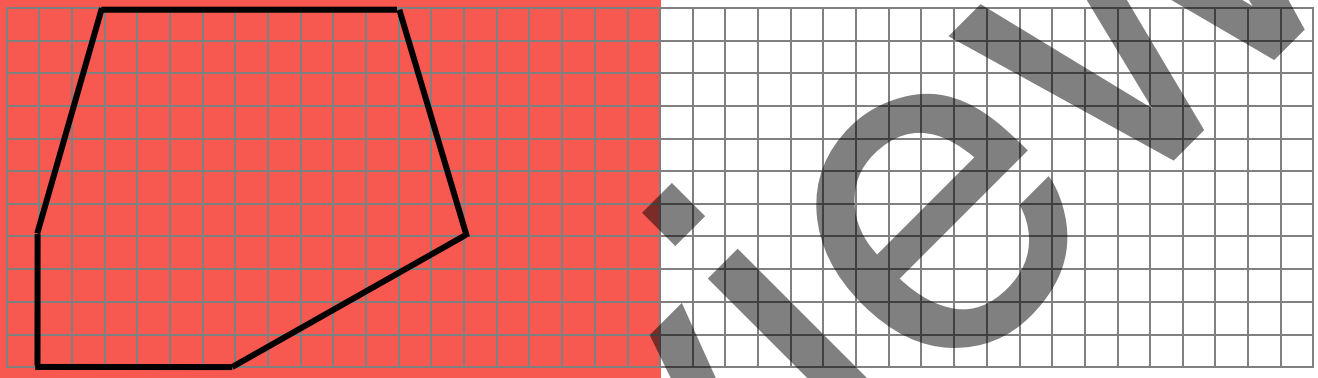


AREA OF COMPOSITE FIGURES

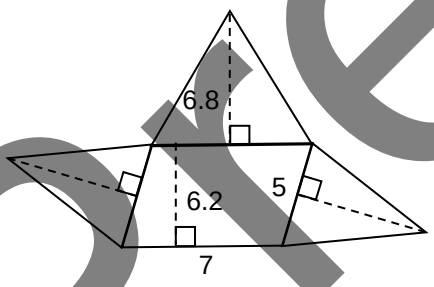
Each small square on the grid below is equal to 1 square unit of area.

1. Find the total area of the composite figure below.

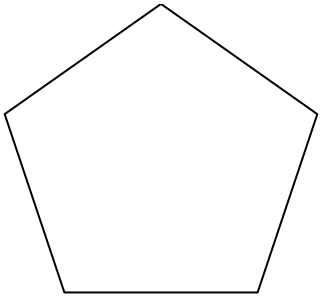
2. Create a composite figure using more than one polygon whose total area is $\frac{4}{5}$ of the area of the figure in problem 1.



3. One part of the composite figure below is a parallelogram. The triangles all have the same height. Find the area in square units.

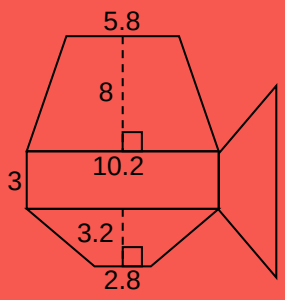


4. Measure relevant segments to find the area of the pentagon below. Round to the nearest tenth of a cm.

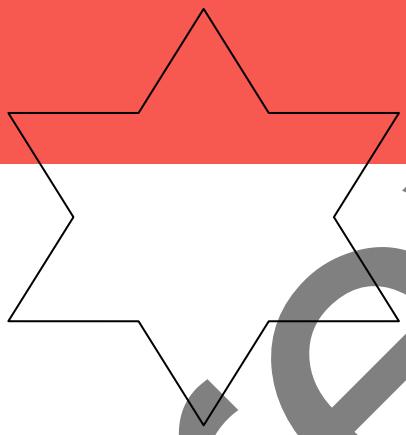


PRACTICE 5

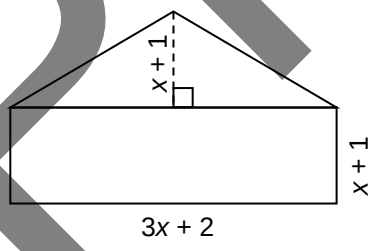
1. One part of the composite figure below is a rectangle. The smaller trapezoids are identical. Find the total area.



2. Measure the relevant segments to find the area of the regular dodecagon below. Round to the nearest tenth of a cm.



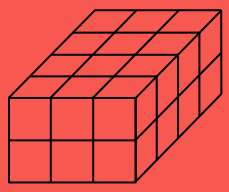
3. Find the area of the pentagon below. The rectangle has perimeter equal to 94 units of length. (Hint: find the value of x first.)



VOLUME AND SURFACE AREA

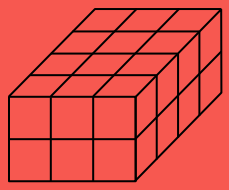
Follow your teacher's directions for (1) – (5).

(1)

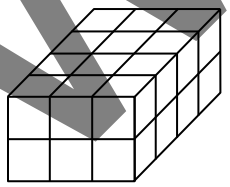


(2)

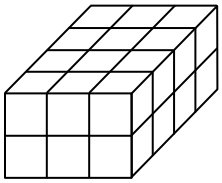
(3)



(4)



(5)



6. Record the meanings of volume and surface area in **My Word Bank**.

MATCH 'EM UP

Your teacher will give you some cards.

1. Match the figures to their names and measurements.

   The "wedge" matches to: _____ _____ _____ _____ _____ _____

   The "tube" matches to: _____ _____ _____ _____ _____ _____

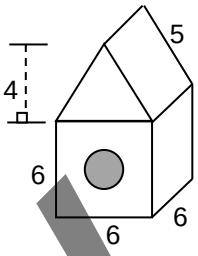
   The "tent" matches to: _____ _____ _____ _____ _____ _____

   The "barn" matches to: _____ _____ _____ _____ _____ _____

2. Draw the wedge. Describe how to find its surface area in words and write an expression for its surface area.	3. Draw the tube. Write an expression for the area of its opening (a base).
4. Draw the tent. Write an expression for the area of its floor (one of the faces).	5. Draw the barn. Write an expression for its front (a base).

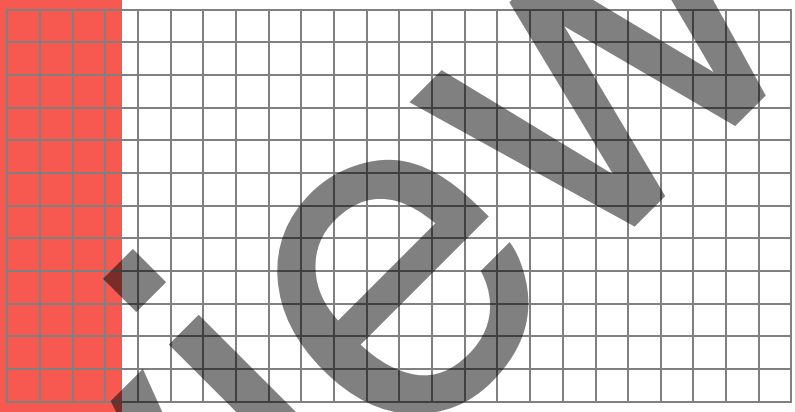
PRACTICE 6

The Birdhouse Revisited: In **Unit 2** you made a scale drawing of the birdhouse to the right. Lengths are given in inches. The circular opening has a diameter of 2 inches.



1. Name the two prisms that make up this birdhouse.

2. You are given a piece of wood that is 12 inches by 24 inches. Can you make all the pieces fit? Show with a diagram to the right. Each square in the grid paper represents a 1-inch square.



3. Find the total volume inside the bird house.

4. Find the area of the wood used, excluding the opening.

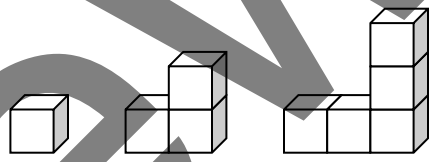
5. You buy a 10-pound bag of birdseed at For the Birds. If you give the birds about one-half cup of birdseed per week, will this bag last for a whole year?

PRACTICE 7: EXTEND YOUR THINKING

1. Find the missing measure for each cube in the table below.

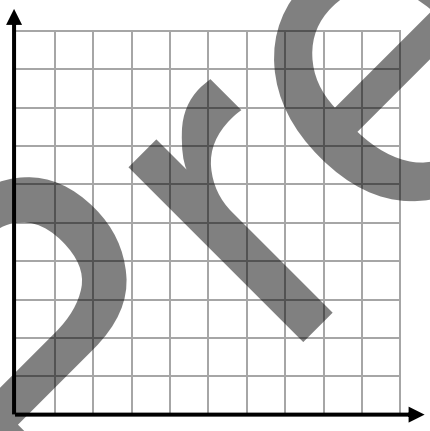
	Edge Length	Volume	Surface Area
Cube A	3 cm		
Cube B		125 cm^3	
Cube C			294 cm^2

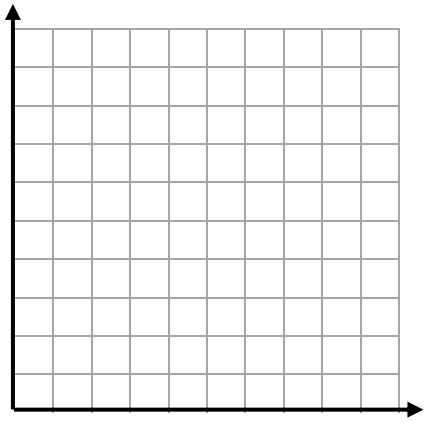
2. Cubes of edge length $\frac{1}{2}$-inch are assembled into a pattern. The first three steps are shown to the right. Find the volume and surface area of the solids in the first five steps. Surface area includes all exposed faces, including the "bottom" of the figure.



Step #	1	2	3	4	5
V					
SA					

3. Graph (step #, *V*) and (step #, *SA*) on separate graphs. Title and label them clearly.





4. Angelo thinks these graphs represent proportional relationships. Is Angelo correct? Explain.

REVIEW

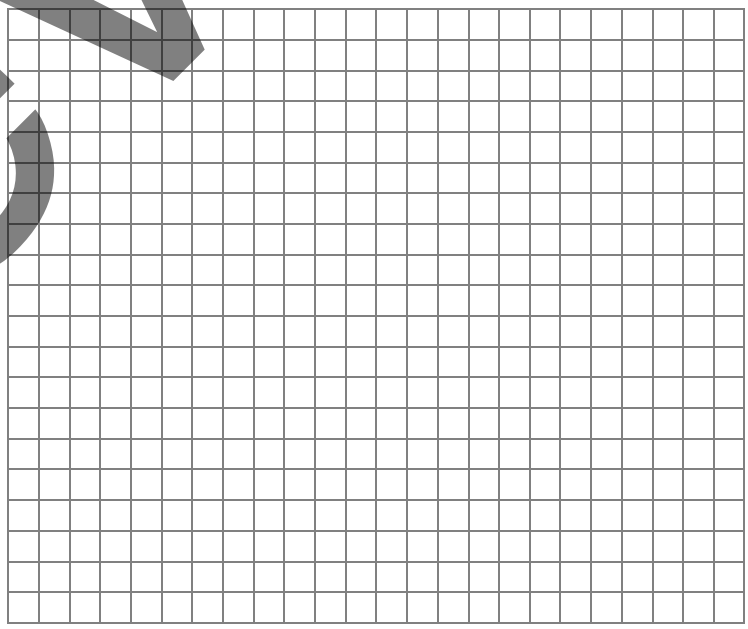
AREA CHALLENGE

Your teacher will give you some figures. Each small square is one square unit of area.

1. Find the area of each figure and justify your answers with words and calculations.

A.	B.	C.
D.	E.	F.

2. Find the sum of all the areas.



3. Create a large square with the pieces.

4. Find the area of the square.

5. Sketch a reduction of the square on the grid paper to scale and with all pieces clearly labeled.
(Let each small square here represent a large square on the original puzzle.)

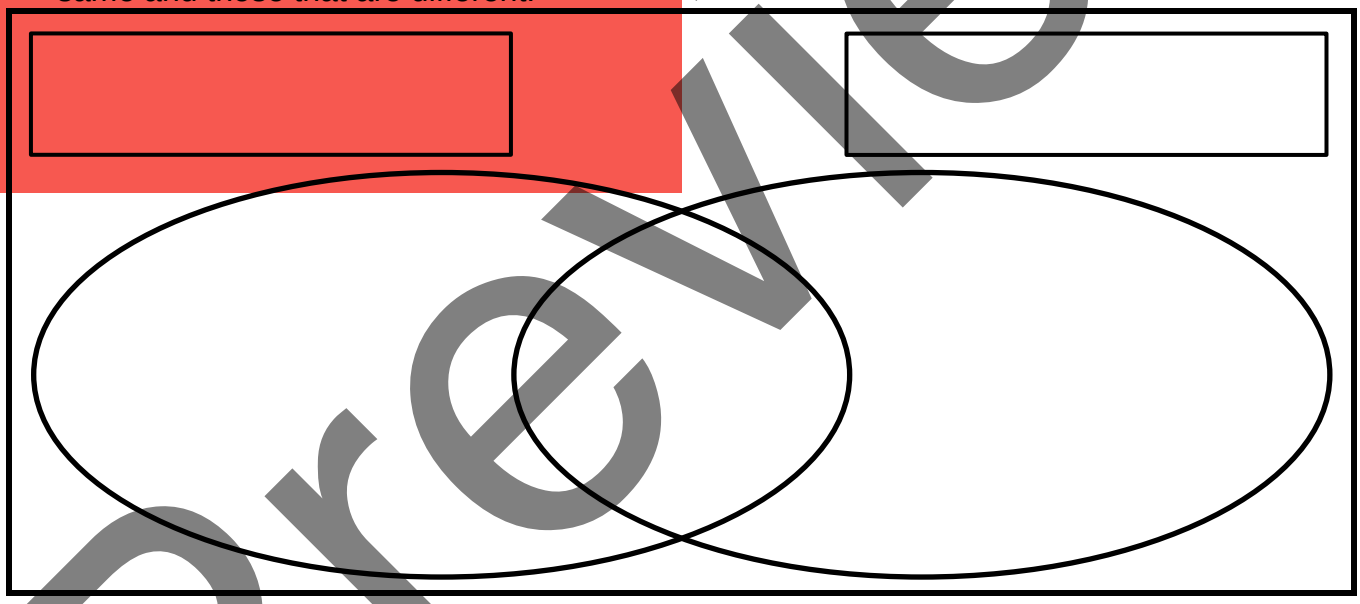
6. What is the scale factor?

MATCH AND COMPARE SORT: LENGTH, AREA, AND VOLUME

1. Individually, match words with descriptions. Record results.

Card set △			Card set ◯		
Card number	**word**	**Card letter**	**Card number**	**word**	**Card letter**
I			**I**		
II			**II**		
III			**III**		
IV			**IV**		

2. Partners, choose a pair of numbered matched cards and record the attributes that are the same and those that are different.



3. Find the missing values. Round as needed. Lengths given in units, areas in square units.

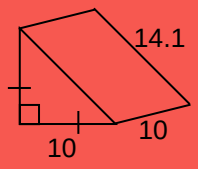
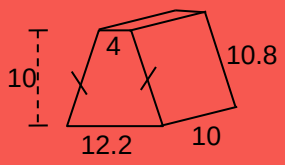
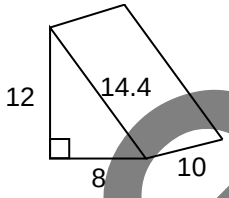
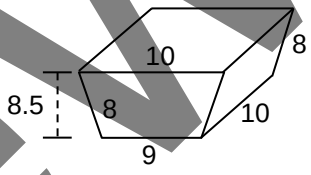
Radius	**Diameter**	**Circumference** (leave in terms of π)	**Circumference** (use $\pi = 3.14$)	**Area** (leave in terms of π)	**Area** (use $\pi = 3.14$)
		7π			
					78.5

POSTER PROBLEMS: LENGTH, AREA, AND VOLUME

Part 1: Your teacher will divide you into groups.

- Identify members of your group as A, B, C, or D.
- Each group will start at a numbered poster. Our group start poster is _____.
- Each group will have a different colored marker. Our group marker is _____.

Part 2: Do the problems on the posters by following your teacher's directions. All measures are given in linear units.

Poster 1 (or 5)	Poster 2 (or 6)	Poster 3 (or 7)	Poster 4 (or 8)
			

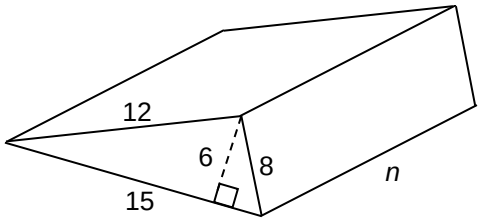
A. Name the Base and find its area.

B. Find the lateral surface area.

C. Find the total surface area.

D. Find the volume.

Part 3: Work with your group. For the triangular prism below, four different students wrote the following expressions to represent its surface area. Circle the correct ones.



a. $n \bullet (15 + 12 + 8) + (15 \bullet 6)$

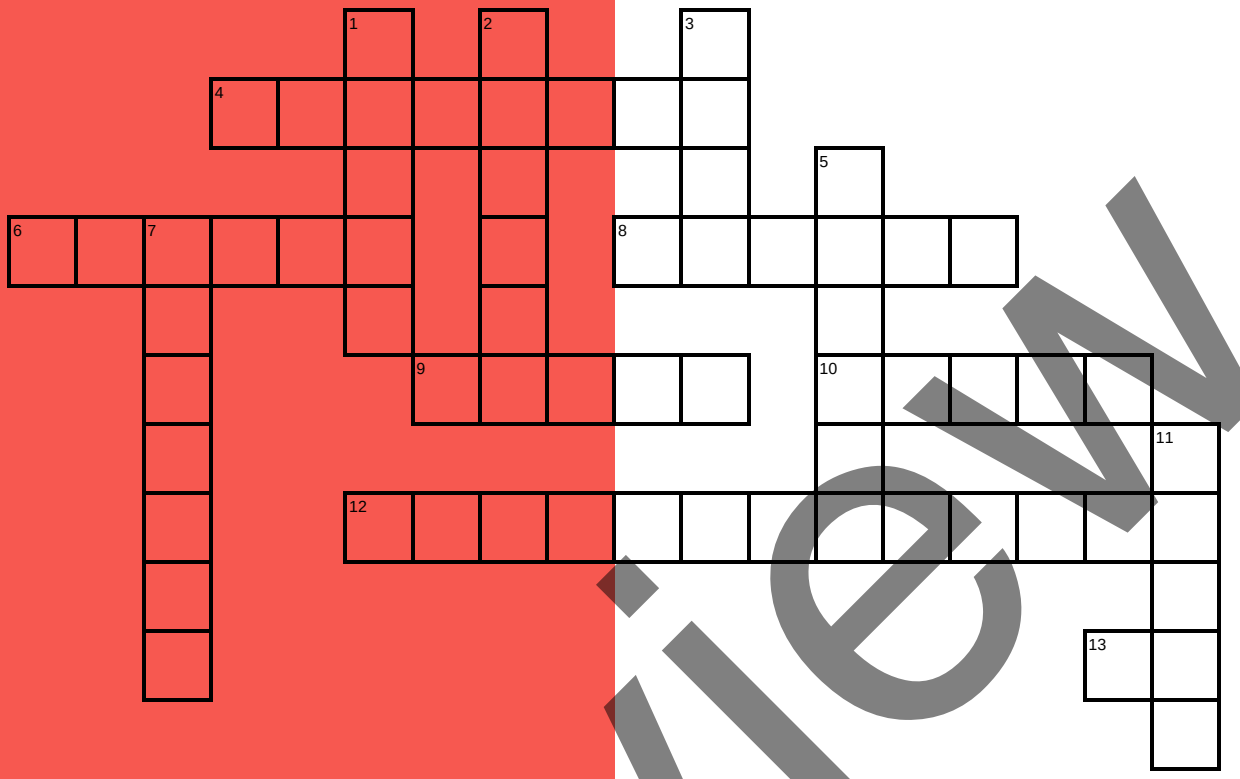
b. $(2)\left(\frac{1}{2}\right)(15 \bullet 6) + (8 \bullet 12) + 15n$

c. $\left(\frac{1}{2}\right)(15 \bullet 6) + \left(\frac{1}{2}\right)(15 \bullet 6) + 8n + 12n + 15n$

d. $(2)\left(\frac{15 \bullet 6}{2}\right) + (8 + 12 + 15)n$

e. Choose one expression from parts a – d that is not correct and explain the mistake.

VOCABULARY REVIEW



Across

4 Chord through the center of a circle

6 A measurement in cubic units

8 Half the diameter

9 Solid figure with parallel polygonal bases and parallelograms for faces

10 Line segment with endpoints on a circle

12 Length around a circle

13 Quotient of circumference of a circle and its diameter

Down

1 Sides of a prism

2 A point in the middle of a circle

3 A measurement in square units

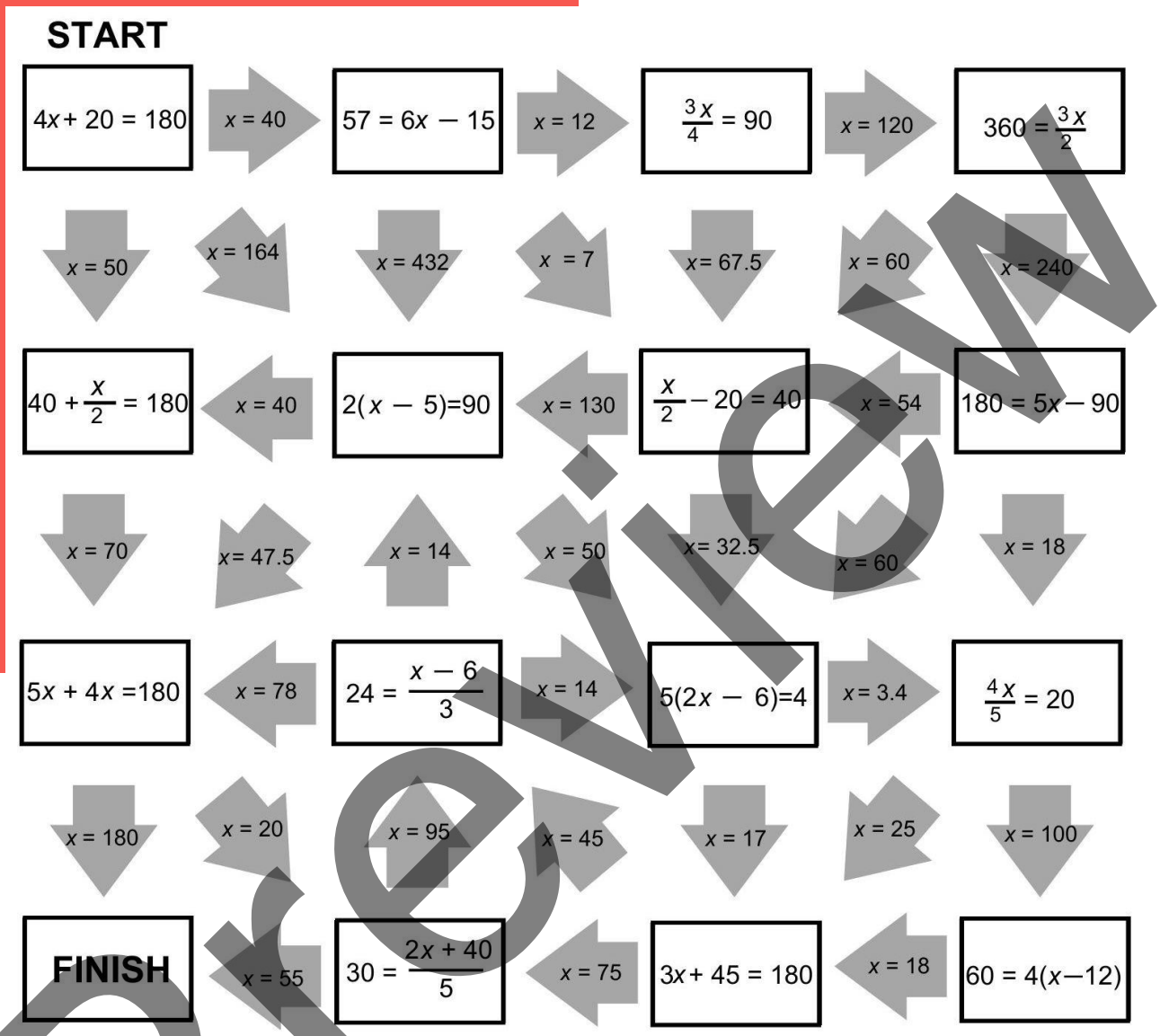
5 The set of all points that are the same distance from a given point in a plane

7 Faces of prism that are perpendicular to the bases

11 Sheep who grazes

SPIRAL REVIEW

1. Follow the math path to computational fluency.

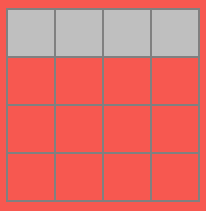


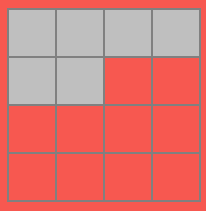
2. Complete the table.

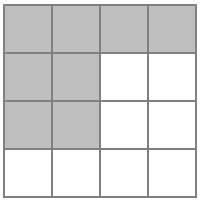
Fraction			$\frac{42}{25}$			$\frac{1}{150}$
Decimal				0.425	1.84	
Percent	28%	7%				

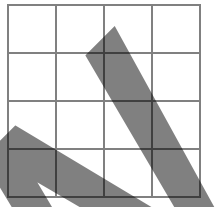
SPIRAL REVIEW
Continued

3. Buddy created the following pattern with squares.

Step 1: 

Step 2: 

Step 3: 

Step 4: 

a. Draw step 4.

b. Make a table with at least 5 steps. Be sure to include titles.

c. Make a graph. Be sure to include titles and labels.

d. What is the rule for this pattern?

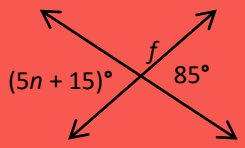
e. How many squares are in step 100?

f. What step has 66 squares?

g. Does this pattern represent a proportional relationship? Explain.

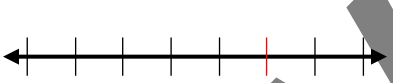
SPIRAL REVIEW
Continued

4. Find the measure of angle *f* and the value of *n* for the figure below.



5. Solve and graph:

$5 - 2x < 3$



(For 6-7) Mx. Rondo's class wants to purchase gardening supplies so they can clean up the school garden. They plan to collect bottles and cans, and then recycle them to earn the money. Through internet research, they learned:

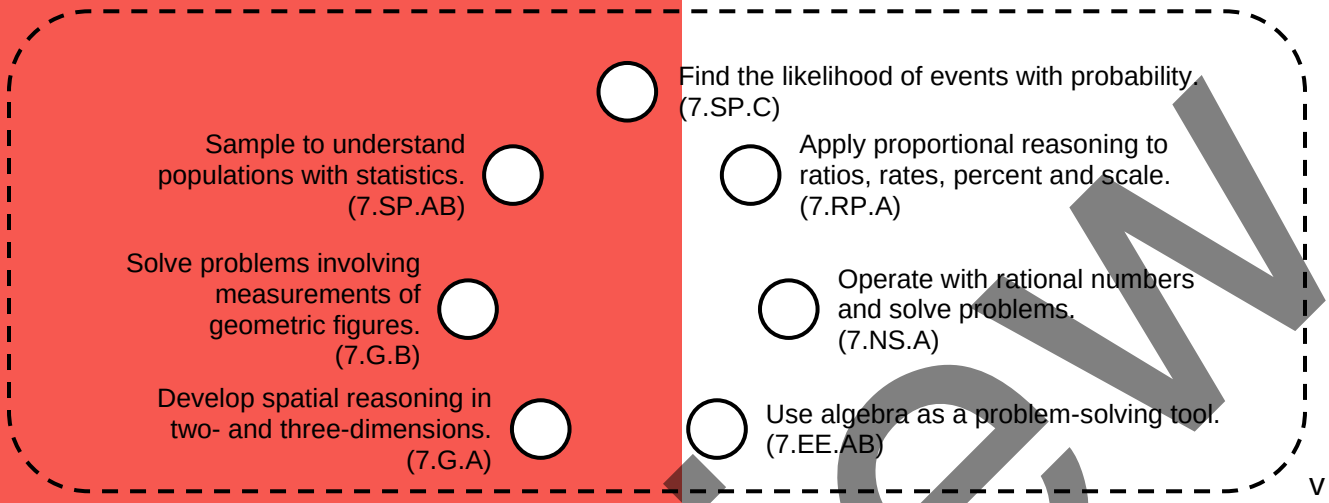
- The recycling center will pay $0.05 for a small can or glass bottle.
- The recycling center will pay $0.10 for a large can or glass bottle.
- 6 pairs of gardening gloves cost $15.99.
- One set of gardening tools cost $19.49.

6 The class wants to purchase at least 24 pairs of gloves and 2 sets of gardening tools. They estimate tax and shipping to be at least 10% of the total. Write an expression and compute the least amount of money they must earn.

7. A cafeteria worker gave the class 220 large bottles and a parent donated $50 towards the project. Write an inequality to determine the number of small bottles and cans they must collect to earn the money. Then solve the inequality.

REFLECTION

1. **Big Ideas**. Shade all circles that describe big ideas in this unit. Draw lines to show connections that you noticed.



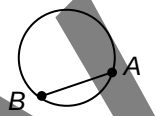
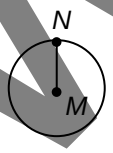
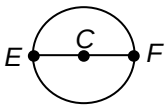
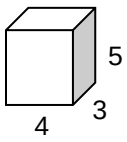
Give an example from this unit of one of the connections above.

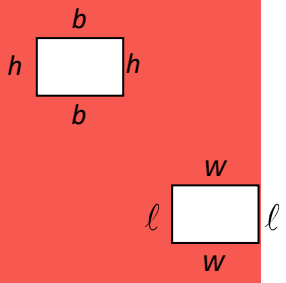
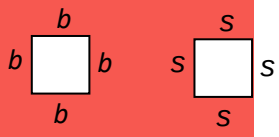
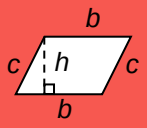
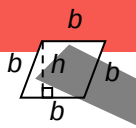
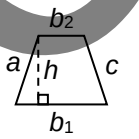
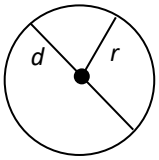
2. **Unit Progress.** Go back to **Monitor Your Progress** on the cover and complete or update your responses. Explain something you understand better now than before.

3. **Mathematical Practice.** Explain how the structure of a simpler problem helped you solve a more complex one [SMP 1, 2, 7]. Then circle one more SMP on the back of this packet that you think was addressed in this unit and be prepared to share an example.

4. **Making Connections.** Explain how you used the idea of taking wholes apart and putting parts together to find areas or volumes of shapes.

STUDENT RESOURCES

Word or Phrase	Definition
center of a circle	See circle.
chord	A chord of a circle is a line segment whose endpoints lie on the circle. If the chord passes through the center of the circle, it is a diameter of the circle. The segment from A to B is a chord. 
circle	A circle is a closed curve in a plane consisting of all points at a fixed distance (the radius) from a specified point (the center). The center is at M and the radius is the length of the line segment from M to N. 
circumference	The circumference of a circle is the length of the circle, that is, the distance around it. The circumference of a circle of radius r is $C = 2\pi r$. See circle.
diameter	A diameter of a circle is a line segment joining two points of the circle that passes through the center of the circle. The line segment from E to F is a diameter. 
pi	Pi (written π) is the Greek letter used to denote the value of the ratio of the circumference of a circle to its diameter. Pi is an irrational number, with decimal representation $\pi = 3.14159\ldots$. The rational numbers 3.14 and $\frac{22}{7}$ are often used to approximate π.
radius	A radius of a circle is a line segment from the center of the circle to a point on the circle. The radius of a circle also refers to the length of that line segment. See circle.
surface area	The surface area of a three-dimensional figure is a measure of the size of the surface of the figure, expressed in square units. If the surface of the three-dimensional figure consists of two-dimensional polygons, the surface area is the sum of the areas of the polygons. A rectangular box has a length of 3", width of 4", and height of 5". Surface Area = 2(3 • 4) + 2(3 • 5) + 2(4 • 5) = 94 square inches 
volume	The volume of a three-dimensional figure is a measure of the size of the figure, expressed in cubic units. A rectangular box has a length of 3", width of 4", and height of 5". Volume = (3)(4)(5) = 60 cubic inches

Summary of Perimeter and Area Formulas			
Shape/Definition	**Diagram**	**Perimeter or Circumference**	**Area**
Rectangle a quadrilateral with 4 right angles		$P = 2b + 2h$ or $P = 2\ell + 2w$	$A = bh$ or $A = \ell w$
Square a rectangle with 4 equal side lengths		$P = 4b$ or $P = 4s$	$A = b^2$ or $A = s^2$
Parallelogram a quadrilateral with opposite sides parallel		$P = 2(b + c)$ or $P = 2b + 2c$	$A = bh$
Rhombus a quadrilateral with 4 equal side lengths		$P = 4b$	$A = bh$
Triangle a polygon with three sides		$P = a + b + c$	$A = \frac{1}{2} bh$
Trapezoid a quadrilateral with at least one pair of parallel sides		$P = a + b_1 + b_2 + c$	$A = \frac{1}{2} (b_1 + b_2)h$
Circle a closed figure in a plane where all points are a fixed distance (radius) from a given point (center)		$C = 2\pi r$ or $C = \pi d$	$A = \pi r^2$
For consistency, we illustrate all formulas using b to refer to the length of a base. The consistent use of b makes the relationships among formulas more apparent.			

About Pi

Pi (also written as the Greek letter π) is the value of the ratio of the circumference of a circle to its diameter. The constant π is slightly greater than 3, so that the circumference of a circle is a little more than 3 times its diameter.

Though we often use 3.14 or $\frac{22}{7}$ for the value of π, these are only approximations. It can be shown that π is not a rational number. That is, pi cannot be represented as a quotient of two integers. The decimal expansion of pi is nonrepeating (no repeating pattern exists).

π = 3.14159265358979323846264338327950288419 71…

Right Prisms

Every right prism has two faces (the Bases) that are congruent parallel polygons, and lateral faces that are rectangles.

Pictured below is a right triangular prism. It has two congruent parallel triangular bases and three faces that are rectangles. It is sitting on one of its lateral faces.

The height of the prism is the distance from one base to the other.

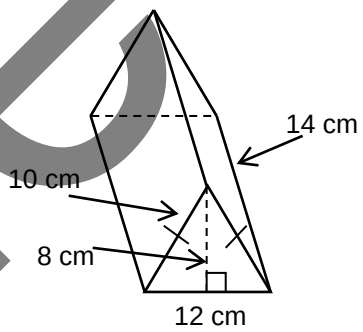
Problem: Find its surface area and volume.

Solution Step 1: Define variables.

Let b = length of triangular base = 12 cm

Let h = height of triangular base = 8 cm

Let H = height of right prism = 14 cm



Step 2: Find the volume.

To find the volume (V) of any right prism, multiply the area of the base (B) by the height (H) of the prism.

$V = BH$

$V = \left(\frac{1}{2}bh\right)H$

$V = \left(\frac{1}{2} \bullet 12 \bullet 8\right) \bullet 14$

$V = (48)(14) = 672 \text{ cm}^3$

Step 3: Find the surface area.

To find the surface area (SA) of any right prism, add the areas of the faces.

Find the area of the triangular base (two of these):

$A = \frac{1}{2}bh$

$A = \frac{1}{2} \bullet 12 \bullet 8 = 48 \text{ cm}^2$

Find the area of the 10 cm × 14 cm rectangular face (two of these):

$A = \ell\ w = 10 \bullet 14 = 140 \text{ cm}^2$

Find the area of the 12 cm × 14 cm rectangular face (one of these):

$A = \ell w = 12 \bullet 14 = 168 \text{ cm}^2$

Finally add areas of the faces.

$SA = 48 + 48 + 140 + 140 + 168$

$SA = 544 \text{ cm}^2$

COMMON CORE STATE STANDARDS

STANDARDS FOR MATHEMATICAL CONTENT	
7.RP.A	**Analyze proportional relationships and use them to solve real-world and mathematical problems.**
7.RP.2	Recognize and represent proportional relationships between quantities:
a	Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.
7.RP.3	Use proportional relationships to solve multistep ratio and percent problems.
7.NS.A	**Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.**
7.NS.3	Solve real-world and mathematical problems involving the four operations with rational numbers.
7.EE.B	**Solve real-life and mathematical problems using numerical and algebraic expressions and equations.**
7.EE.3	Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies.
7.G.A	**Draw, construct and describe geometrical figures and describe the relationships between them.**
7.G.3	Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.
7.G.B	**Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.**
7.G.4	Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.
7.G.6	Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.
7.SP.C	**Investigate chance processes and develop, use, and evaluate probability models.**
7.SP.7	Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy:
a	Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. For example, if a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.

STANDARDS FOR MATHEMATICAL PRACTICE	
SMP1	Make sense of problems and persevere in solving them.
SMP2	Reason abstractly and quantitatively.
SMP3	Construct viable arguments and critique the reasoning of others.
SMP4	Model with mathematics.
SMP5	Use appropriate tools strategically.
SMP6	Attend to precision.
SMP7	Look for and make use of structure.
SMP8	Look for and express regularity in repeated reasoning.

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