Unit 6 GOMATH Book

Ch. 13-15

LESSON
13.1 Area of Quadrilaterals

COMMON CORE 6.G.1
Find the area of . . . special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; . . . .

ESSENTIAL QUESTION

How can you find the areas of parallelograms, rhombuses, and trapezoids?

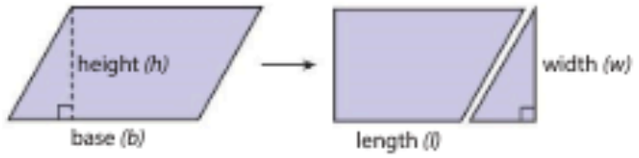
EXPLORE ACTIVITY COMMON CORE 6.G.1

Area of a Parallelogram

Recall that a rectangle is a special type of parallelogram.

A Draw a large parallelogram on grid paper. Cut out your parallelogram.

B Cut your parallelogram on the dashed line as shown. Then move the triangular piece to the other side of the parallelogram.



C What figure have you formed? _____

Does this figure have the same area as the parallelogram? _____

base of parallelogram = _____ of rectangle

height of parallelogram = _____ of rectangle

area of parallelogram = _____ of rectangle

What is the formula for the area of this figure? A = _____

or _____

D What is the formula for the area of a parallelogram? A = _____

Math Talk
Mathematical Practices
How is the relationship between the length and width of a rectangle similar to the relationship between the base and height of a parallelogram?

Area of a Parallelogram

The area A of a parallelogram is the product of its base b and its height h.

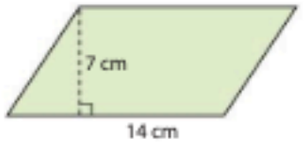
$A = bh$

EXPLORE ACTIVITY *(cont'd)*

Reflect

1. Find the area of the parallelogram.

$A =$ _____



Finding the Area of a Trapezoid

To find the formula for the area of a trapezoid, notice that two copies of the same trapezoid fit together to form a parallelogram. Therefore, the area of the trapezoid is $\frac{1}{2}$ the area of the parallelogram.

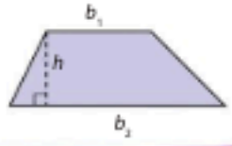
The height of the parallelogram is the same as the height of the trapezoid. The base of the parallelogram is the sum of the two bases of the trapezoid.

$$A = b \cdot h$$
$$A = (b_1 + b_2) \cdot h$$

Area of a Trapezoid

The area of a trapezoid is half its height multiplied by the sum of the lengths of its two bases.

$A = \frac{1}{2}h(b_1 + b_2)$

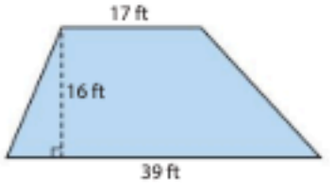


EXAMPLE 1

Real World

COMMON CORE 6.G.1

A section of a deck is in the shape of a trapezoid. What is the area of this section of the deck?



$b_1 = 17 \quad b_2 = 39 \quad h = 16$

Use the formula for area of a trapezoid.

$A = \frac{1}{2}h(b_1 + b_2)$

$= \frac{1}{2} \cdot 16(17 + 39)$ Substitute.

$= \frac{1}{2} \cdot 16(56)$ Add inside the parentheses.

$= 8 \cdot 56$ Multiply $\frac{1}{2}$ and 16.

$= 448$ square feet Multiply.

Math Talk

Mathematical Practices

Does it matter which of the trapezoid's bases is substituted for b_1 and which is substituted for b_2? Why or why not?

YOUR TURN

2. Another section of the deck is also shaped like a trapezoid. For this section, the length of one base is 27 feet, and the length of the other base is 34 feet. The height is 12 feet. What is the area of this section of the deck? $A =$ _____ ft^2

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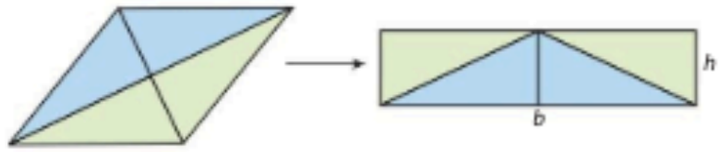
Online Assessment and Intervention.
Your Turn

Finding the Area of a Rhombus

A **rhombus** is a quadrilateral in which all sides are congruent and opposite sides are parallel. A rhombus can be divided into four triangles that can then be rearranged into a rectangle.



The base of the rectangle is the same length as one of the diagonals of the rhombus. The height of the rectangle is $\frac{1}{2}$ the length of the other diagonal.

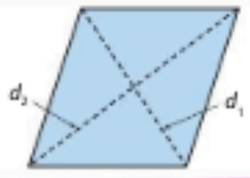
$$A = b \cdot h$$
$$A = d_1 \cdot \tfrac{1}{2}d_2$$

Math On the Spot
Math On the Spot

Area of a Rhombus

The area of a rhombus is half of the product of its two diagonals.

$$A = \tfrac{1}{2}d_1 d_2$$



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Online Assessment and Intervention.
Interactive Example

EXAMPLE 2

Real World

COMMON CORE 6.G.1

Cedric is constructing a kite in the shape of a rhombus. The spars of the kite measure 15 inches and 24 inches. How much fabric will Cedric need for the kite?

To determine the amount of fabric needed, find the area of the kite.

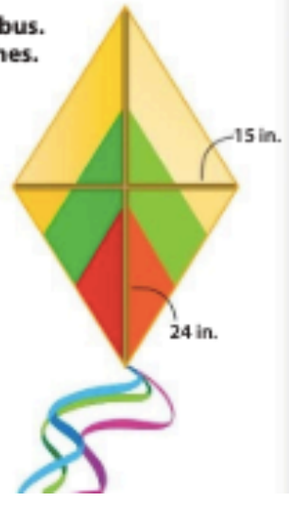
$d_1 = 15$ $d_2 = 24$

Use the formula for area of a rhombus.

$A = \frac{1}{2}d_1 d_2$

$= \frac{1}{2}(15)(24)$ Substitute.

$= 180$ square inches Multiply.



YOUR TURN

Find the area of each rhombus.

3. $d_1 = 35$ m; $d_2 = 12$ m

   $A =$ _____ m^2

4. $d_1 = 9.5$ in.; $d_2 = 14$ in.

   $A =$ _____ in^2

5. $d_1 = 10$ m; $d_2 = 18$ m

   $A =$ _____ m^2

6. $d_1 = 8\frac{1}{4}$ ft; $d_2 = 40$ ft

   $A =$ _____ ft^2

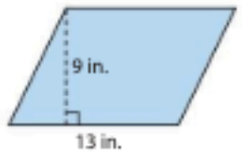
Guided Practice

1. Find the area of the parallelogram. (Explore Activity)

$A = bh$

$=$ (_____)(_____)

$=$ _____ in^2

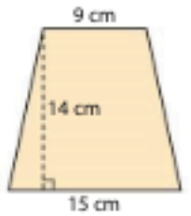


2. Find the area of the trapezoid. (Example 1)

$A = \frac{1}{2}h(b_1 + b_2)$

$= \frac{1}{2}(\square)(\square + \square)$

$=$ _____ cm^2

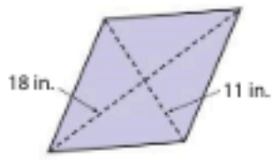


3. Find the area of the rhombus. (Example 2)

$A = \frac{1}{2}d_1d_2$

$= \frac{1}{2}(\square)(\square)$

$=$ _____ in^2



ESSENTIAL QUESTION CHECK-IN

4. How can you find the areas of parallelograms, rhombuses, and trapezoids?

_____

_____

_____

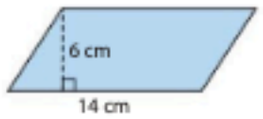
_____

Name _____ Class _____ Date _____

13.1 Independent Practice

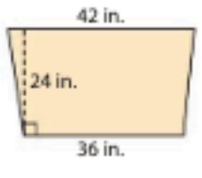
COMMON CORE 6.G.1

5. Find the area of the parallelogram.



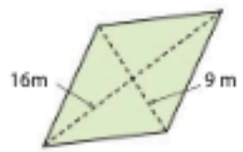
6. What is the area of a parallelogram that has a base of $12\frac{3}{4}$ in. and a height of $2\frac{1}{2}$ in.?

7. Find the area of the trapezoid.



8. The bases of a trapezoid are 11 meters and 14 meters. Its height is 10 meters. What is the area of the trapezoid?

9. Find the area of the rhombus.



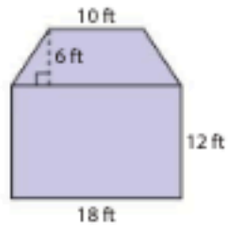
10. The diagonals of a rhombus are 21 m and 32 m. What is the area of the rhombus?

11. The seat of a bench is in the shape of a trapezoid with bases of 6 feet and 5 feet and a height of 1.5 feet. What is the area of the seat?

12. A kite in the shape of a rhombus has diagonals that are 25 inches long and 15 inches long. What is the area of the kite?

13. A window in the shape of a parallelogram has a base of 36 inches and a height of 45 inches. What is the area of the window?

14. **Communicate Mathematical Ideas** Find the area of the figure. Explain how you found your answer.



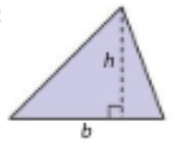
Finding the Area of a Triangle

Math On the Spot

Area of a Triangle

The area A of a triangle is half the product of its base b and its height h.

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



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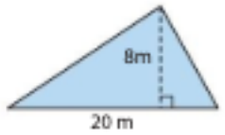
EXAMPLE 1

COMMON CORE 6.G.1

Find the area of each triangle.

A



$b = 20$ meters $\quad h = 8$ meters

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

$= \frac{1}{2}$ (20 meters) (8 meters) Substitute.

$= 80$ square meters Multiply.

Find the area of each triangle.

B

$b = 12$ inches $\quad h = 5$ inches

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

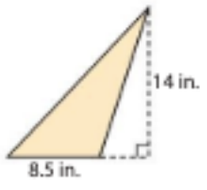
$= \frac{1}{2}$ (12 inches) (5 inches) Substitute.

$= 30$ square inches Multiply.

YOUR TURN

Find the area of the triangle.

3.



$A =$ _____

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Math Talk

Mathematical Practices

Why can you also write the formula for the area of a triangle as $A = \frac{bh}{2}$?

Guided Practice

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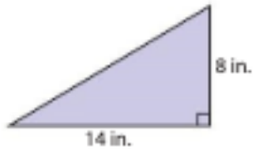
Selected Answers

Find the area of each triangle. (Explore Activities 1 and 2, Example 1)

1.



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

$= \frac{1}{2}$ (_____) (_____)

= _____ in^2

2. A pennant in the shape of a triangle has a base of 12 inches and a height of 30 inches. What is the area of the pennant? (Example 2)

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

$= \frac{1}{2}$ (_____) (_____)

= _____ in^2

ESSENTIAL QUESTION CHECK-IN

3. How do you find the area of a triangle?

_____

_____

_____

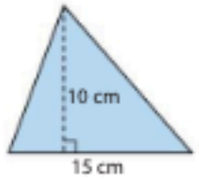
Name _____ Class _____ Date _____

13.2 Independent Practice

COMMON CORE 6.G.1

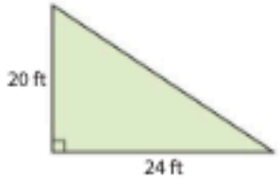
Find the area of each triangle.

4.



_____

5.

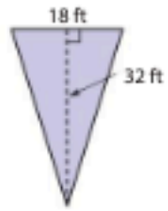


_____

6.

_____

7.



_____

8. What is the area of a triangle that has a base of $15\frac{1}{4}$ in. and a height of 18 in.?

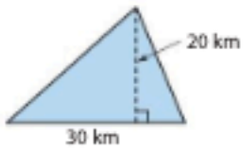
_____

9. A right triangle has legs that are 11 in. and 13 in. long. What is the area of the triangle?

_____

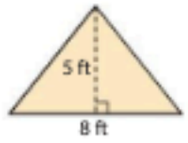
10. A triangular plot of land has the dimensions shown in the diagram. What is the area of the land?

_____



11. The front part of a tent has the dimensions shown in the diagram. What is the area of this part of the tent?

_____



12. **Multistep** The sixth-grade art students are making a mosaic using tiles in the shape of right triangles. Each tile has leg measures of 3 centimeters and 5 centimeters. If there are 200 tiles in the mosaic, what is the area of the mosaic?

_____

13. **Critique Reasoning** Monica has a triangular piece of fabric. The height of the triangle is 15 inches and the triangle's base is 6 inches. Monica says that the area of the fabric is 90 in^2. What error did Monica make? Explain your answer.

_____

_____

John and Mary are using rolls of fabric to make a rectangular stage curtain for their class play. The rectangular piece of fabric on each roll measures 2.5 feet by 15 feet. If the area of the curtain is 200 square feet, what is the least number of rolls they need?

Analyze Information

Rewrite the question as a statement.

- Find the least number of rolls of fabric needed to cover an area of 200 ft^2.

List the important information.

- Each roll of fabric is a 2.5 foot by 15 foot rectangle.
- The area of the curtain is 200 square feet.

Formulate a Plan

Write an equation to find the area of each roll of fabric.

Use the area of the curtain and the area of each roll to write an equation to find the least number of rolls.

Solve

STEP 1 Write an equation to find the area of each roll of fabric.

$A = lw$

$A = 15 \cdot 2.5$

$A = 37.5\ ft^2$

STEP 2 Write an equation to find the least number of rolls.

$n = 200 \div 37.5$

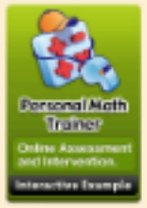
$n = 5\frac{1}{3}$

STEP 3 The problem asks for the least number of rolls needed. Since 5 rolls will not be enough, they will need 6 rolls to make the curtain.

John and Mary will need 6 rolls of fabric to make the curtain.

Justify and Evaluate

The area of each roll is about 38 ft^2. Since 38 $ft^2 \cdot 6 = 228\ ft^2$, the answer is reasonable.



YOUR TURN

4. A parallelogram-shaped field in a park needs sod. The parallelogram has a base of 21.5 meters and a height of 18 meters. The sod is sold in pallets of 50 square meters. How many pallets of sod are needed to fill the field?

_____

Guided Practice

1. A triangular bandana has an area of 70 square inches. The height of the triangle is $8\frac{1}{4}$ inches. Write and solve an equation to find the length of the base of the triangle. (Explore Activity Example 1)

_____

2. The top of a desk is shaped like a trapezoid. The bases of the trapezoid are 26.5 and 30 centimeters long. The area of the desk is 791 square centimeters. The height of the trapezoid is the width of the desk. Write and solve an equation to find the width of the desk. (Example 2)

_____

3. Taylor wants to paint his rectangular deck that is 42 feet long and 28 feet wide. A gallon of paint covers about 350 square feet. How many gallons of paint will Taylor need to cover the entire deck? (Example 3)

Write an equation to find the _____ of the deck.

Write and solve the equation.

Write an equation to find the _____.

Write and solve the equation.

Taylor will need _____ gallons of paint.

ESSENTIAL QUESTION CHECK-IN

4. How do you use equations to solve problems about area of rectangles, parallelograms, trapezoids, and triangles?

_____

_____

Name _____ Class _____ Date _____

13.3 Independent Practice

COMMON CORE 6.G.1, 6.EE.7

5. A window shaped like a parallelogram has an area of $18\frac{1}{3}$ square feet. The height of the window is $3\frac{1}{3}$ feet. How long is the base of the window?

_____

6. A triangular sail has a base length of 2.5 meters. The area of the sail is 3.75 square meters. How tall is the sail?

_____

7. A section in a stained glass window is shaped like a trapezoid. The top base is 4 centimeters and the bottom base is 2.5 centimeters long. If the area of the section of glass is 3.9 square centimeters, how tall is the section?

_____

8. **Multistep** Amelia wants to paint three walls in her family room. Two walls are 26 feet long by 9 feet wide. The other wall is 18 feet long by 9 feet wide.

a. What is the total area of the walls that Amelia wants to paint?

_____

b. Each gallon of paint covers about 250 square feet. How many gallons of paint should Amelia buy to paint the walls?

_____

9. **Critical Thinking** The area of a triangular block is 64 square inches. If the base of the triangle is twice the height, how long are the base and the height of the triangle?

_____

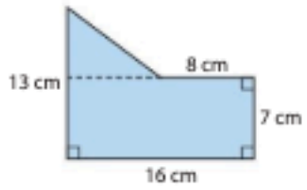
Math On the Spot

EXAMPLE 1

COMMON CORE 6.G.1

Find the area of each polygon.

A **STEP 1** Draw a horizontal line segment on the diagram that divides the polygon into a rectangle and a triangle.



STEP 2 Find the area of the rectangle.

$A = bh = 16 \cdot 7 = \mathbf{112}$ square centimeters

STEP 3 Find the area of the triangle.

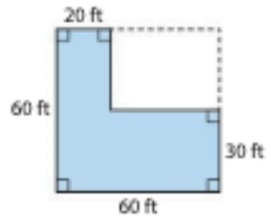
$b = 16 - 8 = 8$ $\quad h = 13 - 7 = 6$

$A = \frac{1}{2}bh = \frac{1}{2} \cdot 8 \cdot 6 = \mathbf{24}$ square centimeters

STEP 4 Add the areas from Steps 2 and 3 to find the total area.

$A = \mathbf{112} + \mathbf{24} = 136$ square centimeters

B **STEP 1** Extend the top edge and the right edge of the polygon to form a square with side length 60 feet. Find the area of this square.



$60 \cdot 60 = \mathbf{3600}$ square feet

STEP 2 Notice that the square you drew has a rectangular "missing piece." Find the area of this missing piece.

$b = 60 - 20 = 40$ $\quad h = 60 - 30 = 30$

$A = bh = 40 \cdot 30 = \mathbf{1200}$ square feet

STEP 3 Subtract the area in Step 2 from the area in Step 1.

$A = \mathbf{3600} - \mathbf{1200} = 2400$ square feet

Math Talk
Mathematical Practices

What other shapes could you divide the polygon in A into? What formulas would you use?

Personal Math Trainer
Online Assessment and Intervention
Interactive Example

Reflect

Q **2.** Describe another way to find the area of the polygon in B.

Guided Practice

Personal Math Trainer
Online Assessment and Intervention

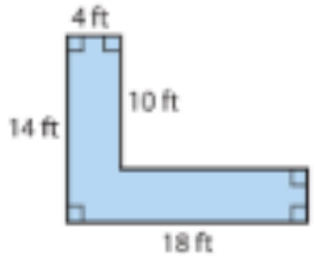
Selected Answers
See all the selected answers.

1. In the diagram, the area of the large square is 1 square unit. Two diagonal segments divide the square into four equal-sized triangles. Two of these triangles are divided into smaller red and blue triangles that all have the same height and base length. Find the area of a red triangle. (Explore Activity)

_____

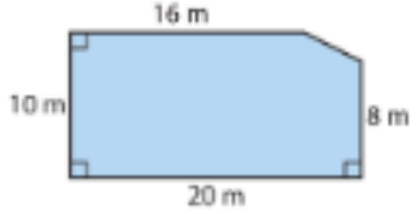
Find the area of each polygon. (Example 1)

2.



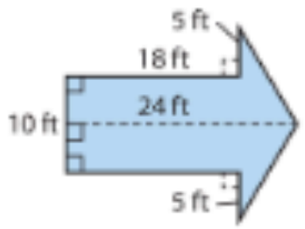
$A =$ _____ square feet

3.



$A =$ _____ square meters

4. Jess is painting a giant arrow on a playground. Find the area of the giant arrow. If one can of paint covers 100 square feet, how many cans should Jess buy? (Example 2)



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ESSENTIAL QUESTION CHECK-IN

5. How can you find the area of a polygon that is not one for which you know an area formula?

_____

_____

_____

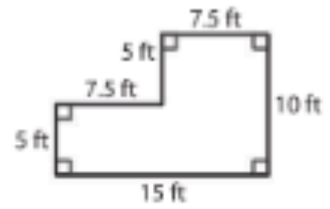
13.4 Independent Practice

6.G.1

Personal Math Trainer
Online Assessment and Intervention

Selected Answers
See all the selected answers.

6. Alice wants to put wall-to-wall carpeting in a small room with the floor plan shown.

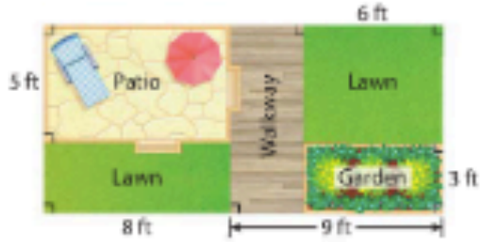


a. Alice says she can find the area of the room by dividing the floor plan into two trapezoids. Show how she can divide the floor plan. Then find the area using her method.

b. Describe another way to find the area.

c. How much will Alice pay for carpet that costs $4.50 per square foot?

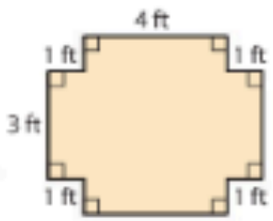
7. Hal's backyard has a patio, a walkway, and a garden.



a. About what percent of the total area of Hal's backyard is the area taken up by the patio, walkway, and garden? Round to the nearest whole percent.

b. One longer side of Hal's backyard lies next to the back of his house. Hal wants to build a fence that costs $9.75 per foot around the other three sides. How much will Hal spend on his new fence?

8. The students in a furniture-making class make a tabletop shaped like the figure shown.

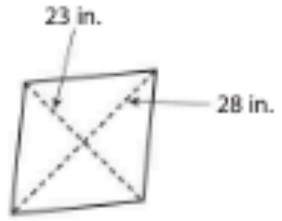


a. What is the area of the tabletop?

b. One of the students wants to make a tabletop shaped like a right triangle. This tabletop will have the same area as the tabletop shown. What are a set of possible lengths for the sides of the tabletop that meet in a right angle? Explain.

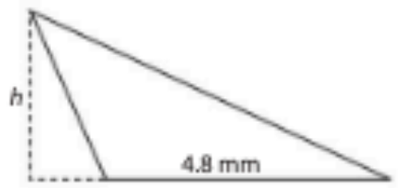
Selected Response

1. The lengths of the diagonals of the rhombus are given. What is the area of the rhombus?



Ⓐ 161 in² Ⓒ 644 in²
Ⓑ 322 in² Ⓓ 966 in²

2. In the triangle below, the value of h is $\frac{3}{4}$ the side length that is labeled on the figure. What is the area of the triangle?

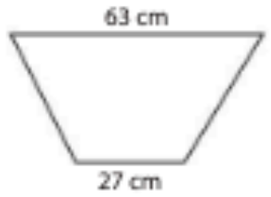


Ⓐ 3.6 mm² Ⓒ 8.64 mm²
Ⓑ 6.4 mm² Ⓓ 1 7.28 mm²

3. Tim is designing a logo. The logo is a polygon whose shape is a square attached to an equilateral triangle. The square and the equilateral triangle have side lengths of 2 centimeters, and the equilateral triangle has a height of about 1.7 cm. Find the area of the logo.

Ⓐ 1.7 cm² Ⓒ 5.7cm²
Ⓑ 4 cm² Ⓓ 7.4 cm²

4. The trapezoid below has an area of 1,575 cm².

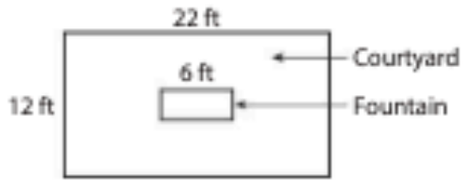


Which equation could you solve to find the height of the trapezoid?

Ⓐ $45h = 1{,}575$ Ⓒ $850.5h = 1{,}575$
Ⓑ $90h = 1{,}575$ Ⓓ $1{,}701h = 1{,}575$

Mini-Task

5. Cindy is designing a rectangular fountain in the middle of a courtyard. The rest of the courtyard will be covered in stone.



The part of the courtyard that will be covered in stone has an area of 246 square feet.

a. What is the width of the fountain?

_____

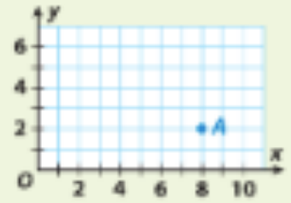
b. What fraction of the area of the courtyard will be occupied by the fountain?

_____

Complete these exercises to review skills you will need for this module.

Graph Ordered Pairs

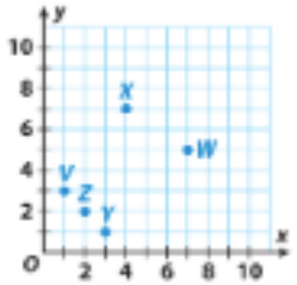
EXAMPLE Find the coordinates for Point *A*.



Start at *O*.
Count 8 units to the right and 2 units up from *O*.

The coordinates for Point *A* are (8, 2).

Write the ordered pair for each point shown on the graph.



1. Point *V* _____
2. Point *W* _____
3. Point *X* _____
4. Point *Y* _____
5. Point *Z* _____

Identify Polygons

EXAMPLE Name the type of polygon.

Count the number of sides.
Compare the sides.
Compare the angles.

There are 4 congruent sides and angles. The shape is a rhombus.

Name each figure. Choose from hexagon, isosceles triangle, right triangle, and trapezoid.

6.  _____

7.  _____

Math On the Spot

Personal Math Trainer
Online Assessment and Intervention
Your Turn

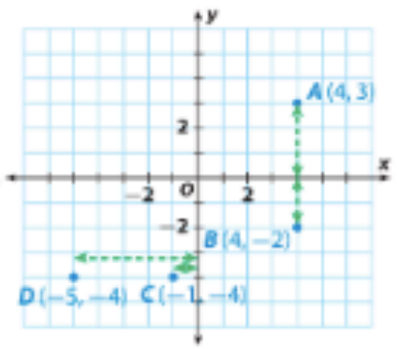
Finding Distances in the Coordinate Plane

You can also use absolute values to find distances between two points that have the same *x*-coordinates or the same *y*-coordinates on a coordinate plane.

EXAMPLE 1

COMMON CORE 6.NS.6b

Find each distance.



A What is the distance between point *A* and point *B*?

STEP 1 Find the distance between point *A* and the *x*-axis.

The *y*-coordinate is 3, so point *A* is |3| units from the *x*-axis.

STEP 2 Find the distance between point *B* and the *x*-axis.

The *y*-coordinate of *B* is −2, so point *B* is |−2| = 2 units from the *x*-axis.

STEP 3 Find the sum of the distances.

Distance from *A* to *B* = |3| + |−2| = 3 + 2 = 5 units.

B What is the distance between point *D* and point *C*?

STEP 1 Find the distance between point *D* and the *y*-axis.
Point *D* is |−5| = 5 units from the *y*-axis.

STEP 2 Find the distance between point *C* and the *y*-axis.
Point *C* is |−1| = 1 unit from the *y*-axis.

STEP 3 Find the distance between *C* and *D* by finding this

Distance of *D* from the *y*-axis − distance of *C* from the *y*-axis

|−5| − |−1| = 4 units

Math Talk
Mathematical Practices
How is the distance between a point and its reflection across an axis related to the distance between the point and the axis? Explain.

YOUR TURN

Q **Find the distance between each pair of points.**

3. *E*(−4, 7) and *F*(5, 7) _____

4. *G*(0, −5) and *H*(0, −10) _____

Personal Math Trainer
Online Assessment and Intervention
Your Turn

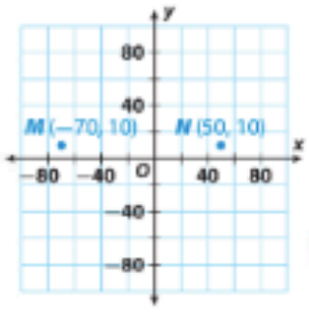
Solving Distance Problems

You can solve problems using the distance between points on a grid.

EXAMPLE 2 Problem Solving

6.NS.8

The coordinate plane represents a map. Each grid unit represents 20 miles. A retail company has warehouses at *M*(−70, 10) and *N*(50, 10). How long does it take a truck that drives 40 miles per hour to travel from warehouse *M* to warehouse *N*?



Analyze Information

Identify the important information.

- One warehouse is located at *M*(−70, 10). The other is at *N*(50, 10).
- A truck drives from *M* to *N* at a speed of 40 miles per hour.

Formulate a Plan

- Find the distance between *M* and *N* by adding the absolute values of the *x*-coordinates of the points.
- Find the time it takes the truck to drive this distance by using the relationship, distance = rate · time.

Solve

Add the absolute values of the *x*-coordinates to find the distance between point *M* and point *N* on the grid.

$$|-70| + |50| = 70 + 50 = 120$$

The warehouses are 120 miles apart.

The truck drives 120 miles at 40 mi/h. Because 120 = 40(3), it takes the truck 3 hours to travel from *M* to *N*.

Justify and Evaluate

You found the sum of the absolute values of the *x*-coordinates to find the horizontal distance on the grid. Then you used distance = rate · time to find the time it takes to drive that distance.

YOUR TURN

5. A store is located at *P*(50, −30). How long will it take a truck driving at 50 miles per hour to drive from warehouse *N* to this store?

Guided Practice

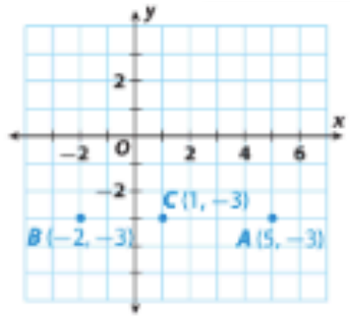
1. The point (5, −2) is reflected across the *x*-axis. What are the coordinates of the reflection? (Explore Activity)

_____

2. The point (−6, 8) is reflected across the *y*-axis. What are the coordinates of the reflection? (Explore Activity)

_____

Use the coordinate plane. (Example 1)



3. The distance between point *A* and point *B* is

	+		=		+		=	units.

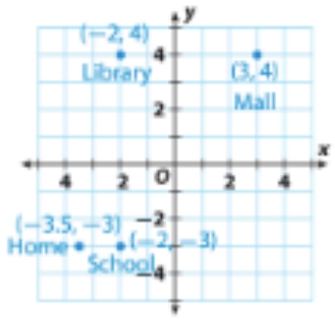
4. The distance bet The distance between point A and point C is

	−		=		−		=	units.

5. Plot the reflection of point *C* across the *y*-axis.
What is the distance between point *C* and its reflection? _____

6. Plot the reflection of point *A* across the *x*-axis.
What is the distance of the reflection from the *x*-axis? _____

Use the map shown. Each grid on the map represents 1 city block. (Example 2)



7. Yoko walks from the library to the mall.
How many city blocks does she walk? _____

8. If Yoko walks 1 block in 3 minutes, how long does it take her to walk from the school to the library? How long does it take her to walk from home to school?

_____

ESSENTIAL QUESTION CHECK-IN

9. How do you use absolute value to find the distance between two points that have the same *x*-coordinates but different *y*-coordinates?

_____

_____

_____

_____

EXPLORE ACTIVITY Real World 6.G.3

Polygons in the Coordinate Plane

A **polygon** is a closed plane figure formed by three or more line segments that meet only at their endpoints. A **vertex** is the point where two sides of a polygon meet. The *vertices* of a polygon can be represented as ordered pairs, and the polygon can then be drawn in the coordinate plane.

Sheila wants to make a pattern of two different tile shapes on a floor. She first graphs the shapes on a coordinate plane.

A Plot these points to form one of the tile shapes:

$A(3, 5)$, $B(4, 6)$, $C(5, 5)$, $D(4, 4)$

Connect the points in order.

The polygon formed is a(n) ________________.

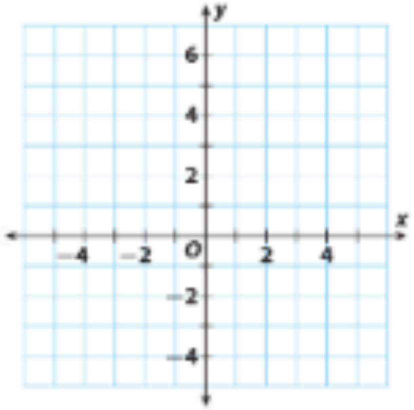
B Plot these points to form the other tile shape:

$P(-5, 2)$, $Q(-4, 3)$, $R(0, 3)$, $S(1, 2)$,

$T(1, -2)$, $U(0, -3)$, $V(-4, -3)$, $W(-5, -2)$

Connect the points in order.

The polygon formed is a(n) ________________.



Reflect

1. How is the number of vertices related to the number of sides of the polygon and to the type of polygon? Give two examples.

____

____

____

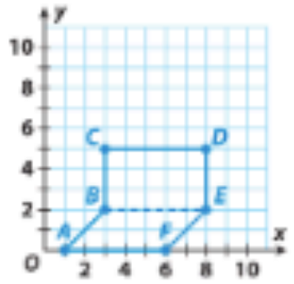
____

EXAMPLE 2

Real World

COMMON CORE 6.G.3

Caleb is planning a new deck for his house. He graphs the deck as polygon *ABCDEF* on a coordinate plane in which each grid unit represents one foot. The vertices of the polygon are *A*(1, 0), *B*(3, 2), *C*(3, 5), *D*(8, 5), *E*(8, 2), and *F*(6, 0). What is the area of Caleb's deck?



STEP 1 Graph the vertices, and connect them in order.

Draw a horizontal dashed line segment to divide the polygon into two quadrilaterals—a rectangle and a parallelogram.

STEP 2 Find the area of the rectangle using the length of segment *BE* as the base *b* and the length of segment *BC* as the height *h*.

$b = |8| - |3| = 5$ feet $\qquad h = |5| - |2| = 3$ feet

$A = bh = 5 \cdot 3 = 15$ square feet

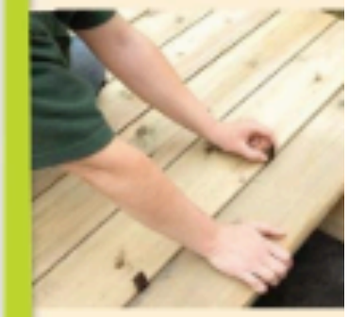
STEP 3 Find the area of the parallelogram using the length of segment *AF* as the base. Use the length of a segment from *F*(6, 0) to the point (6, 2) as the height *h*.

$b = |6| - |1| = 5$ feet $\qquad h = |2| - 0 = 2$ feet

$A = bh = 5 \cdot 2 = 10$ square feet

STEP 4 Add the areas to find the total area of the deck.

$A = 15 + 10 = 25$ square feet



Math On the Spot

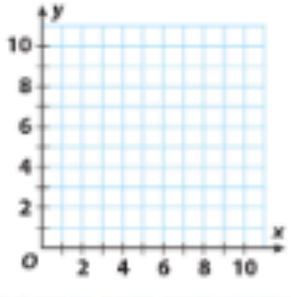
Personal Math Trainer
Online Assessment and Intervention.
Interactive Example

Personal Math Trainer
Online Assessment and Intervention.
Your Turn

YOUR TURN

3. The vertices of a polygon are *L*(1, 2), *M*(1, 6), *N*(7, 6), *O*(7, 2), *P*(5, 0), and *Q*(3, 0). Graph the polygon. Then find its area.

$A =$ _____ square units



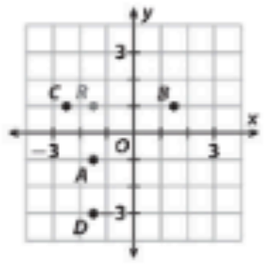
COMMON CORE

MODULE 14 MIXED REVIEW

Assessment Readiness

Selected Response

1. Which point is a reflection of point *R* across the *x*-axis?

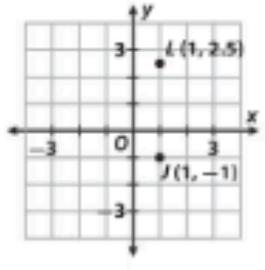


Ⓐ Point *A*
Ⓑ Point *B*
Ⓒ Point *C*
Ⓓ Point *D*

2. Which point is a reflection of (12, −8) across the *y*-axis on a coordinate plane?

Ⓐ (−12, −8)
Ⓑ (−8, 12)
Ⓒ (8, 12)
Ⓓ (12, 8)

3. What is the distance between points *J* and *L* on the grid?



Ⓐ 1.5 units
Ⓑ 2 units
Ⓒ 3 units
Ⓓ 3.5 units

4. What is the greatest common factor of 12 and 30?

Ⓐ 2
Ⓑ 3
Ⓒ 6
Ⓓ 12

5. What is the distance between two points located at (−6, 2) and (−6, 8) on a coordinate plane?

Ⓐ 4 units
Ⓑ 6 units
Ⓒ 10 units
Ⓓ 12 units

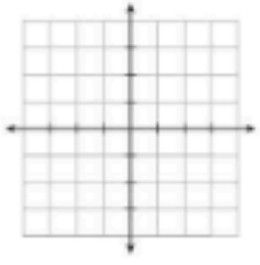
6. Which is the sum of $\frac{1}{12} + \frac{3}{8}$?

Ⓐ $\frac{1}{6}$
Ⓑ $\frac{1}{5}$
Ⓒ $\frac{11}{48}$
Ⓓ $\frac{11}{24}$

Mini-Task

7. An artist is laying out the design for a wall hanging on a coordinate plane. She uses polygon *EFGH* with vertices *E*(4, 4), *F*(−4, 4), *G*(−4, −4), and *H*(4, −4) to represent the finished piece. Each unit on the grid represents two feet.

a. Plot the polygon on the grid, and classify its shape.



Name of Polygon: _____

b. How much area will the art cover on a wall? _____

Are YOU Ready?

Complete these exercises to review skills you will need for this module.

Use of Parentheses

EXAMPLE $\frac{1}{2}(14)(12+18) = \frac{1}{2}(14)(30)$ Perform operations inside parentheses first.

$= 7(30)$ Multiply left to right.

$= 210$ Multiply again.

Evaluate.

1. $\frac{1}{2}(3)(5+7)$ _____

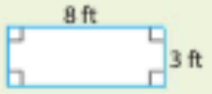
2. $\frac{1}{2}(15)(13+17)$ _____

3. $\frac{1}{2}(10)(9.4+3.6)$ _____

4. $\frac{1}{2}(2.1)(3.5+5.7)$ _____

Area of Squares, Rectangles, Triangles

EXAMPLE Find the area of the rectangle.



$A = bh$ Use the formula for area of a rectangle.

$= 8 \cdot 3$ Substitute for base and height.

$= 24$ Multiply.

Area equals 24 square feet.

Find the area of each figure.

5. a triangle with base 6 in. and height 3 in. _____

6. a square with sides of 7.6 m _____

7. a rectangle with length $3\frac{1}{4}$ ft and width $2\frac{1}{2}$ ft _____

8. a triangle with base 8.2 cm and height 5.1 cm _____

Surface Area of a Pyramid

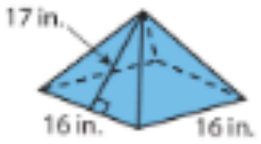
The **surface area** of a three-dimensional figure is the sum of the areas of its faces. A net can be helpful when finding surface area.

A **pyramid** is a three-dimensional figure whose base is a polygon and whose other faces are triangles that meet at a point. A pyramid is identified by the shape of its base.

EXAMPLE 1

COMMON CORE 6.G.4

Make a net of this square pyramid, and use the net to find the surface area.

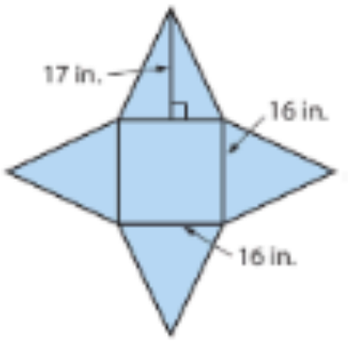


STEP 1 Make a net of the pyramid.

Draw the square base.

Draw a triangle on each side.

Label the dimensions.



STEP 2 Use the net to find the surface area.

There are four triangles with base 16 in. and height 17 in.

The area of the 4 triangles is $4 \times \frac{1}{2}(16)(17) = 544$ in^2.

The area of the base is $16 \times 16 = 256$ in^2.

The surface area is $544 + 256 = 800$ in^2.

Math Talk
Mathematical Practices
How many surfaces does a triangular pyramid have? What shape are they?

Math On the Spot

Animated Math

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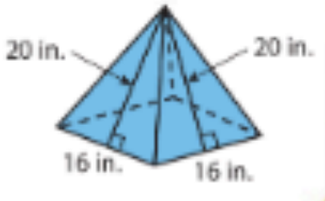
Online Assessment and Intervention.
Interactive Example

Personal Math Trainer
Online Assessment and Intervention.
Your Turn

YOUR TURN

Q **4.** Use a net to find the surface area of the pyramid.



Surface Area of a Prism

A **prism** is a three-dimensional figure with two identical and parallel bases that are polygons. The other faces are rectangles. A prism is identified by the shape of its base.

EXAMPLE 2

COMMON CORE 6.G.4

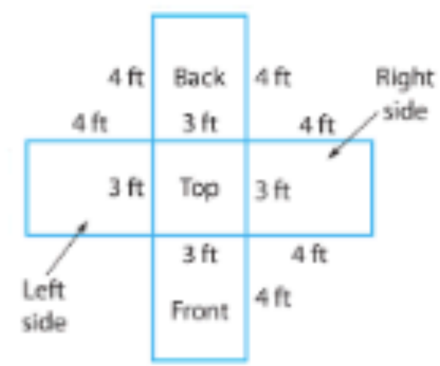
A sculpture sits on pedestal in the shape of a square prism. The side lengths of a base of the prism are 3 feet. The height of the prism is 4 feet. The museum director wants to cover all but the underside of the pedestal with foil that costs $0.22 per square foot. How much will the foil cost?

STEP 1 Use a net to show the faces that will be covered with foil.

Draw the top.

Draw the faces of the prism that are connected to the top.

You don't need to include the bottom of the pedestal.



STEP 2 Use the net to find the area that will be covered with foil.

Area of top $= 3 \cdot 3 = 9\ \text{ft}^2$

The other four faces are identical.

Area of four faces $= 4 \cdot 3 \cdot 4 = 48\ \text{ft}^2$

Area to be covered $= 9 + 48 = 57\ \text{ft}^2$

STEP 3 Find the cost of the foil.

$57 \cdot \$0.22 = \$12.54$

The foil will cost $12.54.

Reflect

5. **Critical Thinking** What shapes would you see in the net of a triangular prism?

____

Math On the Spot

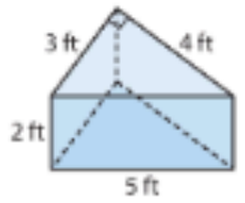
My Notes

Personal Math Trainer
Online Assessment and Intervention
Interactive Example

Personal Math Trainer
Online Assessment and Intervention
Your Turn

YOUR TURN

6. The figure shown is a triangular prism. How much would it cost to cover the bases and the other three faces with foil that costs $0.22 per square foot?



_____

Personal Math Trainer
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Selected Answers

Guided Practice

A square pyramid is shown.

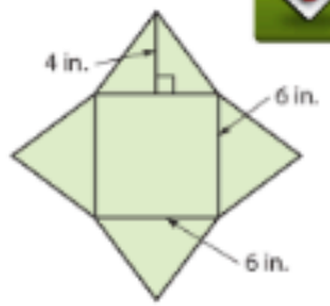
1. The figure has _____ square base and _____ triangular faces. (Explore Activity)

2. Find the surface area. (Example 1)

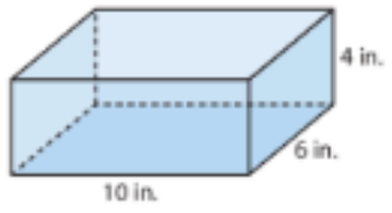
The area of the base is _____ square inches.

The area of the four faces is _____ square inches.

The surface area is _____ square inches.



3. Yolanda makes wooden boxes for a crafts fair. She makes 100 boxes like the one shown, and she wants to paint all the outside faces. (Example 2)



a. Find the surface area of one box.

_____

b. Find the total surface area of 100 boxes.

_____

c. One can of paint will cover 14,000 square inches. How many cans of paint will Yolanda need to buy?

_____

ESSENTIAL QUESTION CHECK-IN

4. How is a net useful when finding the surface area of prisms and pyramids?

_____

_____

_____

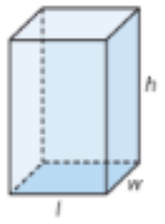
Finding Volume

A rectangular prism has six faces. Any pair of opposite faces can be called the **bases** of the prism.

Volume of a Rectangular Prism

$V = \ell wh$, or $V = Bh$

(where B represents the area of the prism's base; $B = \ell w$)

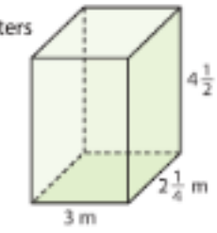


EXAMPLE 1

CCSS 6.G.2

Find the volume of the rectangular prism.

$\ell = 3$ meters $\quad w = 2\frac{1}{4}$ meters $\quad h = 4\frac{1}{2}$ meters



$V = \ell wh$

$= 3 \cdot 2\frac{1}{4} \cdot 4\frac{1}{2}$

$= 3 \cdot \frac{9}{4} \cdot \frac{9}{2}$ — Write each mixed number as an improper fraction.

$= \frac{243}{8}$ — Multiply.

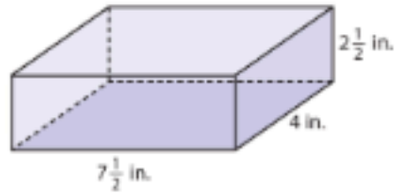
$= 30\frac{3}{8}$ cubic meters — Write as a mixed number in simplest form.

Math Talk
Mathematical Practices
Can you also use the formula $V = Bh$ to find the volume? Does it matter which face you choose as the base?

YOUR TURN

Find the volume of each rectangular prism.

2.



3. length $= 5\frac{1}{4}$ inches

width $= 3\frac{1}{2}$ inches

height $= 3$ inches

Solving Volume Problems

When you solve a real-world problem involving the volume of a prism, you can choose to use either of the volume formulas you know.

EXAMPLE 2

Real World

CCSS 6.G.2

A terrarium is shaped like a rectangular prism. The prism is $25\frac{1}{2}$ inches long, $13\frac{1}{2}$ inches wide, and 16 inches deep. What is the volume of the terrarium?

STEP 1 Choose one side to be the base, and find its area.

$B = 25\frac{1}{2} \times 13\frac{1}{2}$ — Use the $25\frac{1}{2}$-inch by $13\frac{1}{2}$-inch face as the base.

$= \frac{51}{2} \times \frac{27}{2}$

$= \frac{1,377}{4}$ — The area of the base is $\frac{1,377}{4}$ square inches. You need to perform another operation, so you don't need to write this value as a mixed number.

STEP 2 Find the volume.

$V = Bh$

$= \frac{1,377}{4} \times 16$ — Substitute $\frac{1,377}{4}$ for B and 16 for h.

$= \frac{1,377}{\cancel{4}_{1}} \times \frac{\cancel{16}^{4}}{1}$ — Simplify before multiplying.

$= 5,508$

The volume of the terrarium is 5,508 cubic inches.

YOUR TURN

4. A rectangular swimming pool is 15 meters long, $10\frac{1}{2}$ meters wide, and $2\frac{1}{2}$ meters deep. What is its volume?

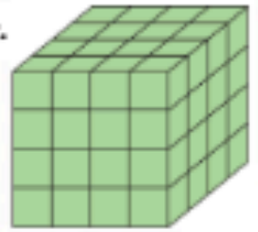
Personal Math Trainer — Online Assessment and Intervention — Your Turn

Math On the Spot

Personal Math Trainer — Online Assessment and Intervention — Interactive Example

Guided Practice

A large cube is made up of smaller unit cubes as shown on the right. Each small cube has an edge length of $\frac{1}{2}$ unit. (Explore Activity)

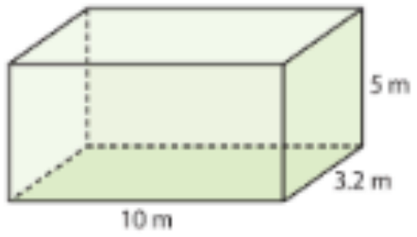


1. Each edge of the large cube is _____ units.

2. The volume of the large cube is _____ cubic units.

Find the volume of each prism. (Example 1)

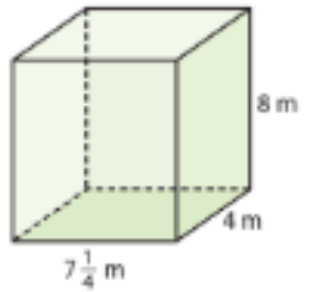
3.



$V =$ _____ × _____ × _____

$=$ _____ cubic meters

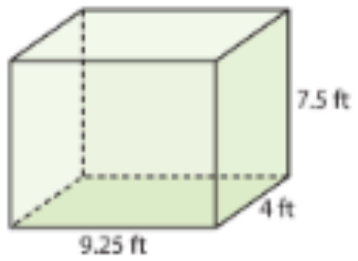
4.



$B =$ _____ × _____ $=$ _____ m^2

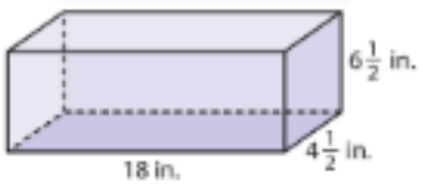
$V =$ _____ cubic meters

5.



$V =$ _____ cubic feet

6.



$V =$ _____ cubic inches

7. A cereal box is $8\frac{1}{2}$ inches long, $3\frac{1}{2}$ inches wide, and 12 inches high.

What is the volume of the box? (Example 2) _____

ESSENTIAL QUESTION CHECK-IN

8. Which two formulas can you use to find the volume of a rectangular prism? Why are these two formulas equivalent?

_____

_____

_____

Name _____ Class _____ Date _____

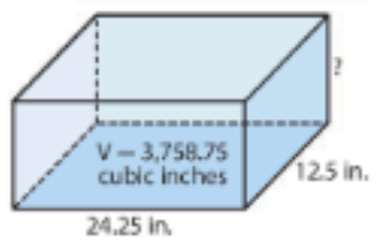
15.3 Independent Practice

COMMON CORE 6.EE.7, 6.G.2

Personal Math Trainer

Selected Answers

3. Jala has an aquarium in the shape of a rectangular prism with the dimensions shown. What is the height of the aquarium?



Height = _____

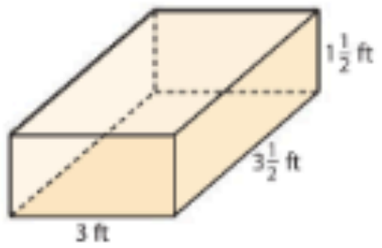
4. The area of the base of a rectangular juice box is $4\frac{1}{2}$ square inches. If the volume of the box is 18 cubic inches, how tall is the box?

Height = _____

5. A box of cereal is shaped like a rectangular prism. The box is 20 centimeters long and 30 centimeters high. Its volume is 3,600 cubic centimeters. Find the width of the box.

Width = _____

6. About 7.5 gallons of water fill up 1 cubic foot of space. How many gallons of water will fill a goldfish pool shaped like the prism shown?



_____

7. **Physical Science** A small bar of gold measures 40 mm by 25 mm by 2 mm. One cubic millimeter of gold weighs about 0.0005 ounce. Find the volume in cubic millimeters and the weight in ounces of this small bar of gold.

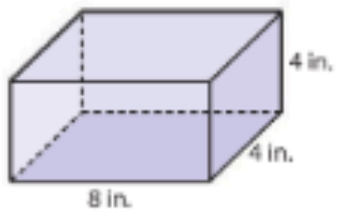
_____

_____

8. **History** A typical stone on the lowest level of the Great Pyramid in Egypt was a rectangular prism 5 feet long by 5 feet high by 6 feet deep and weighed 15 tons. What was the volume of the average stone? How much did one cubic foot of this stone weigh?

_____

9. Hank has cards that are 8 inches by 4 inches. A stack of these cards fits inside the box shown and uses up 32 cubic inches of volume. How tall is the stack of cards? What percent of the box's volume is taken up by the cards?



_____

MODULE QUIZ

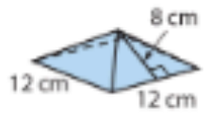
Ready to Go On?

Personal Math Trainer
Online Assessment and Intervention
Ready to Go On?

15.1 Nets and Surface Area

A square pyramid is shown sitting on its base.

1. Draw the net of the pyramid.

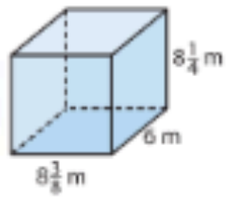


2. The surface area of the pyramid is _____ square centimeters.

15.2 Volume of Rectangular Prisms

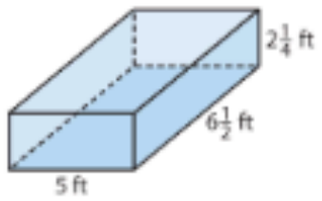
Find the volume of each rectangular prism.

3.



$V =$ _____ cubic meters

4.



$V =$ _____ cubic feet

15.3 Solving Volume Equations

Find the volume of each rectangular prism.

5. The volume inside a rectangular storage room is 2,025 cubic feet. The room is 9 feet high. Find the area of the floor. _____

6. An aquarium holds 11.25 cubic feet of water, and is 2.5 feet long and 1.5 feet wide. What is its depth? _____

ESSENTIAL QUESTION

7. How can a model help you to solve surface area and volume problems?

_____

_____

_____

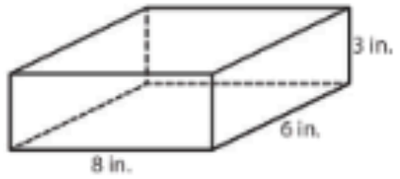
COMMON CORE

MODULE 15 MIXED REVIEW

Assessment Readiness

Selected Response

1. Indira is wrapping the box below. How much wrapping paper does she need?



Ⓐ 34 in.^{2} Ⓒ 144 in.^{2}

Ⓑ 90 in.^{2} Ⓓ 180 in.^{2}

2. Colin has an ice cube tray with 12 identical compartments. Each compartment is a prism that is 4 centimeters long, 3 centimeters wide, and 3 centimeters high. Given that 1 cubic centimeter holds 1 milliliter of water, how many milliliters of water can the tray hold?

Ⓐ 36 mL Ⓒ 432 mL

Ⓑ 66 mL Ⓓ 792 mL

3. A store manager set up a cardboard display to advertise a new brand of perfume. The display is a square pyramid whose base is 18 inches on each side. The height of each triangular face of the pyramid is 12 inches. How much cardboard was used to make the display?

Ⓐ 516 in^2 Ⓒ 756 in^2

Ⓑ 612 in^2 Ⓓ 1,080 in^2

4. Which expression is equivalent to $24 + 32$?

Ⓐ $8 \times (3 + 4)$

Ⓑ $8 \times (3 + 32)$

Ⓒ $6 \times (4 + 32)$

Ⓓ $6 \times (4 + 6)$

5. A bathtub in the shape of a rectangular prism is 5 feet long, $3\frac{1}{2}$ feet wide, and $4\frac{1}{4}$ feet high. How much water could the tub hold?

Ⓐ $14\frac{7}{8}$ ft^3 Ⓒ $74\frac{3}{8}$ ft^3

Ⓑ $25\frac{1}{2}$ ft^3 Ⓓ $87\frac{1}{2}$ ft^3

6. The point $(-1.5, 2)$ is reflected across the y-axis, What are the coordinates of the point after the reflection?

Ⓐ $(-1.5, -2)$ Ⓒ $(2, -1.5)$

Ⓑ $(1.5, 2)$ Ⓓ $(2, 1.5)$

Mini-Task

7. An cardboard box is open at one end and is shaped like a square prism missing one of its square bases. The volume of the prism is 810 cubic inches, and its height is 10 inches.

a. What is the length of each side of the base? _____

b. Draw a net of the box.

c. How much cardboard is used for the box?

_____

UNIT 6

Study Guide Review

MODULE 13 Area and Polygons

Key Vocabulary
parallelogram *(paralelogramo)*
rhombus *(romba)*
trapezoid *(trapecio)*

ESSENTIAL QUESTION

How can you use area and volume equations to solve real-world problems?

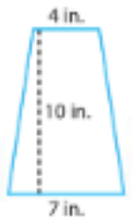
EXAMPLE 1

Find the area of the trapezoid.

$A = \frac{1}{2}(h)(b_1 + b_2)$

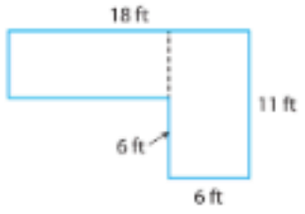
$A = \frac{1}{2}(10)(7 + 4)$

$A = 55 \text{ in}^2$



EXAMPLE 2

Find the area of Jorge's backyard.



Find the area of the first rectangle.

$A = bh$

$A = 12(5)$

$A = 60$ square feet

Find the area of the second rectangle.

$A = bh$

$A = 6(11)$

$A = 66$ square feet

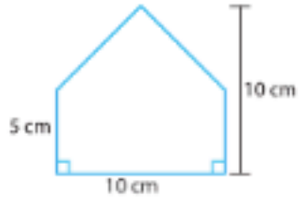
Total area of yard $= 60 + 66 = 126$ square feet

EXERCISES

Find the area of each figure. (Lessons 13.1, 13.2)

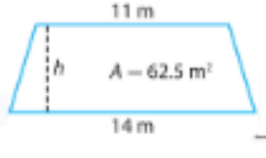
1. 

_____

2. 

_____

Find the missing measurement. (Lesson 13.3)

3. 

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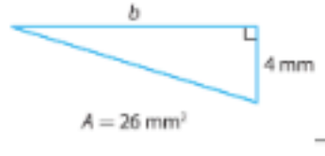
4. 

_____

MODULE 14 Distance and Area in the Coordinate Plane

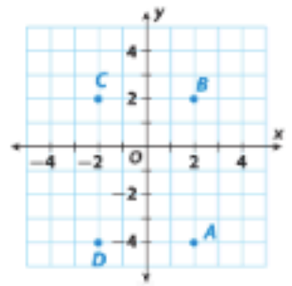
Key Vocabulary
polygon *(polígono)*
reflection *(reflexión)*
vertex, vertices *(vértice, vértices)*

ESSENTIAL QUESTION

What steps might you take to solve a polygon problem given the coordinates of its vertices?

EXAMPLE 1

Find the distance between points *A* and *B* on the coordinate plane.



Find the distance between point *A* and the *x*-axis.

The *y*-coordinate is −4. The absolute value represents the distance.

$|-4| = 4$ The distance is 4 units.

Find the distance between point *B* and the *x*-axis.

The *y*-coordinate is 2. The distance is 2 units.

Add the two distances to find the distance between the two points.

$4 + 2 = 6$ The distance between points *A* and *B* is 6 units.

EXAMPLE 2

Find the area of the rectangle whose vertices are the points on the coordinate plane in Example 1.

Use the distance between points *A* and *B* in Example 1 as the height.

height = 6 units

Find the distance between points *A* and *D* and use it as the base.

Distance from *A* to $D = |-2| + 2 = 2 + 2 = 4$

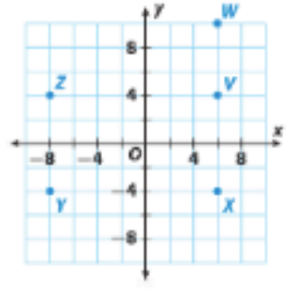
base = 4 units

Find the area.

$A = bh = 4 \cdot 6 = 24$ square units

EXERCISES

Find the distance between the two points.



1. *Z* and *Y* _____

2. *X* and *Y* _____

3. *W* and *X* _____

4. Find the area of rectangle *XYZV* _____.

MODULE 15

Surface Area and Volume of Solids

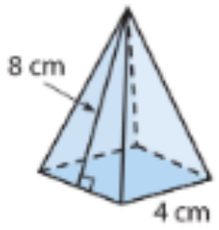
Key Vocabulary
net *(plantilla)*
pyramid *(pirámide)*
surface area *(área total)*

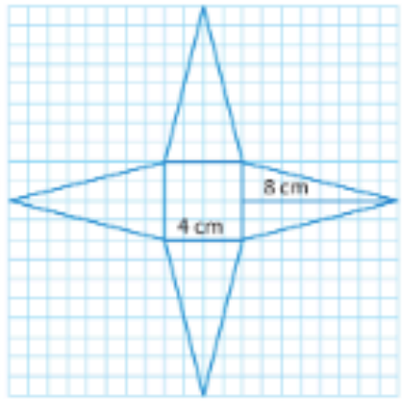
ESSENTIAL QUESTION

How can a model help you solve surface area and volume problems?

EXAMPLE 1

Draw a net and find the surface area of the pyramid.





Find the area of the square base.

$A = bh$

$A = 4 \cdot 4$

$A = 16 \text{ cm}^2$

Find the area of one triangle and multiply by four.

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

$A = \frac{1}{2}(4 \cdot 8)$

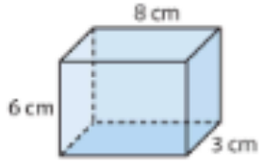
$A = 16 \text{ cm}^2$

The area of the 4 triangles is $4 \cdot 16 = 64 \text{ cm}^2$.

The total surface area of the pyramid is $16 \text{ cm}^2 + 64 \text{ cm}^2 = 80 \text{ cm}^2$.

EXAMPLE 2

A cubic centimeter of gold weighs approximately 19.32 grams. Find the weight of a brick of gold that has a height of 6 centimeters, width of 3 centimeters, and length of 8 centimeters.



$V = lwh$

$V = 8 \ (3) \ (6)$

$V = 144 \text{ cm}^3$

The weight of the gold is 144×19.32 grams, which is 2,782.08 grams.

UNIT 6 MIXED REVIEW

Assessment Readiness

Personal Math Trainer
Online Assessment and Intervention
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Selected Response

1. Jessie has a piece of cardboard that is 8.5 inches by 11 inches. She makes a picture frame with the cardboard by cutting out a 4 inch by 4 inch square from the center of the cardboard. What is the area of the frame?

   Ⓐ 16 in^2 Ⓒ 93.5 in^2
   Ⓑ 77.5 in^2 Ⓓ 118.5 in^2

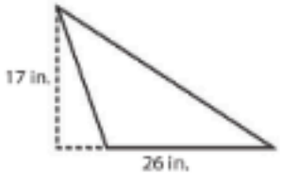
2. Jermaine is ordering a piece of glass in the shape of a trapezoid to create a patio table top. Each square foot of glass costs $25. The trapezoid has base lengths of 5 feet and 3 feet and a height of 4 feet. What is the cost of the glass?

   Ⓐ $400 Ⓒ $800
   Ⓑ $437.50 Ⓓ $1,500

3. What is the area of a trapezoid that has bases measuring 19 centimeters and 23 centimeters, and a height of 14 centimeters?

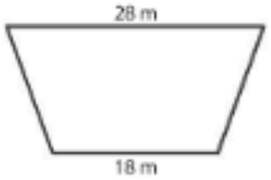
   Ⓐ 105 square centimeters
   Ⓑ 266 square centimeters
   Ⓒ 294 square centimeters
   Ⓓ 322 square centimeters

4. What is the area of the triangle shown below?



   Ⓐ 110.5 square inches
   Ⓑ 221 square inches
   Ⓒ 442 square inches
   Ⓓ 884 square inches

5. The trapezoid below has an area of 475 square meters.



   Which equation could you solve to find the height of the trapezoid?

   Ⓐ $23h = 475$
   Ⓑ $252h = 475$
   Ⓒ $46h = 475$
   Ⓓ $504h = 475$

6. A rectangular prism has a volume of 1,500 cubic centimeters. It has a length of 34 centimeters and a width of 22 centimeters. Which equation could be solved to find the height of the rectangular prism?

   Ⓐ $374h = 1{,}500$
   Ⓑ $28h = 1{,}500$
   Ⓒ $748h = 1{,}500$
   Ⓓ $56h = 1{,}500$

7. Which expression represents the sum of 59 and x?

   Ⓐ $59 + x$
   Ⓑ $59 \div x$
   Ⓒ $59x$
   Ⓓ $59 - x$