Unit 5

Area & Volume

Area
Composite Area
Surface Area
Volume

Name: _____

Math Teacher: _____

Advanced Math 6 Unit 5 Calendar

1/7	1/8	1/9	1/10	1/11
Unit 5 Pre-Test MSG Set Up Unit Overview	Area of Parallelograms, Rectangles, Squares and Triangles Formula Organizer	Area of Composite Figures	Area of Composite Figures	Quiz
IXL Skills Week of 1/7: FF.5, FF.6, FF.7 & FF.8				
1/14	1/15	1/16	1/17	1/18
Nets (Create your own net)	Surface Area	Surface Area	Surface Area Practice	Quiz
IXL Skills Week of 1/14: FF.15 & FF.9				
1/21	1/22	1/23	1/24	1/25
MLK Holiday	Volume	Volume	Unit 5 Post Test Review	Test
IXL Skills Week of 1/21: FF.16 & FF.18				

Unit 5: Area & Volume
Standards, Checklist and Concept Map

Georgia Standards of Excellence (GSE):

GSE6.G.1: Find area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems

- Find the area of a polygon (regular or irregular) by dividing it into squares, rectangles, and/or triangles and find the sum of the areas of those shapes

GSE6.G.2: Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas ***V = lwh*** and ***V = Bh*** to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.

GSE6.G.4 : Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.

What Will I Need to Learn??

_____ I can find the area of a polygon by splitting it up into squares, rectangles, and/or triangles, and finding the sum of all of the areas

_____ I can find the volume of a right rectangular prism with fractional edges by packing it with unit cubes

_____ I can apply the formula ***V = lwh*** to find the volume of a right rectangular prism with fractional edge lengths

_____ I can represent 3-dimensional shapes with nets

_____ I can use nets to determine the surface area of 3-dimensional figures

_____ I can apply these concepts of area, volume, and surface area to solve real-world and mathematical problems

Unit 5 Circle Map: Make a Circle Map below of important vocab and topics from the standards listed to the left.

Unit 5 - Vocabulary

Term	Definition and/or Picture-Example
Area	
Base (of a triangle)	
Base (of a 3D figure)	
Congruent	
Cubic Units	
Edge	
Equilateral Triangle	

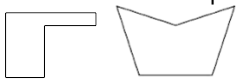
Term	Definition and/or Picture-Example
Face	
Isosceles Triangle	
Lateral Faces	
Net	
Parallel	
Parallelogram	
Perpendicular	

Term	Definition and/or Picture-Example
Polygon	
Regular Polygon	
Polyhedron	
Prism	
Pyramid	
Quadrilateral	
Rectangle	
Rectangular Prism	

Term	Definition and/or Picture-Example
Rhombus	
Right Triangle	
Scalene Triangle	
Square	
Surface Area	
Trapezoid	
Vertex (vertices)	
Volume	

Math 6 – Unit 5: Area & Volume Review

Knowledge & Understanding

1) How could you determine the area of a composite figure, such as the ones shown here? 

_____

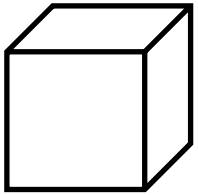
_____

2) What types of units are used to describe area? _____

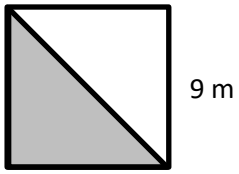
3) What types of units are used to describe volume? _____

Proficiency of Skills

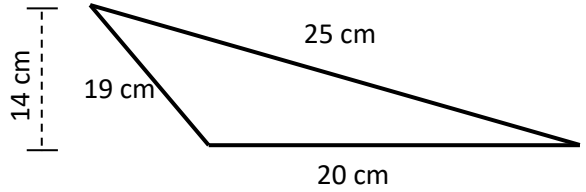
4) Determine the volume of the cube: _____



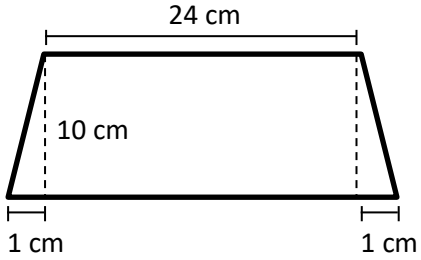
5) Find the area of the shaded section of the square: _____



6) Find the area of the triangle: _____

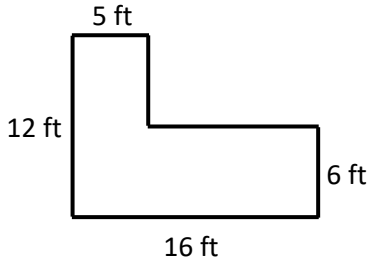


7) Determine the area of the trapezoid: _____



8) The surface area of a cube can be found by using the formula $SA = 6s^2$. Determine the surface area of a cube with a length of 8cm.

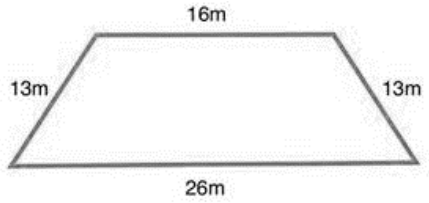
9) Find the area of the figure shown below: _____



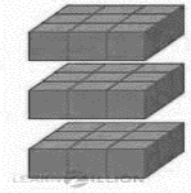
Application

10) If carpet costs $4 per square yard, how much would it cost to carpet a rectangular room that is 6 yards wide and 10 yards long? _____

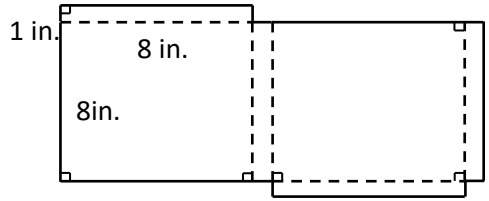
11) What is the area of the trapezoid? _____



12) A rectangular prism is filled with small cubes of the same size. The bottom layer consists of 9 cubes, each with a volume of 2 cubic inches. If there are 3 layers of cubes in the prism, what is the volume of the rectangular prism? _____



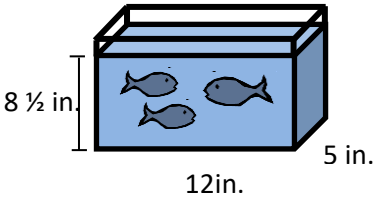
13) A box is made of cardboard with no overlap. The net of the box is shown below. How many square inches of cardboard is needed to make the box? _____



14) The triangular sides of the tent are equilateral, with a base of 20 inches and a height of 15 inches. The three rectangular sides of the tent are each 50 inches long and 20 inches wide. What is the surface area of the tent? _____

15) Mariah and Max are making a plaque to dedicate to the swaggerific saxophone players of the ECMS sixth-grade band. The center is a 10-inch square, and the edges of the frame measure 12 inches long and 12 inches wide. What is the area of the frame? _____

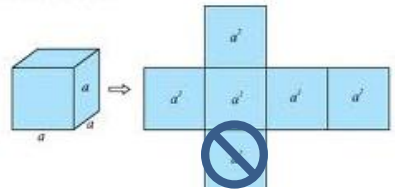
16) A fish tank is shown below. What is the volume of the water in the tank? _____



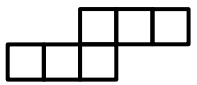
17) How many cubic feet are in a cubic yard? _____

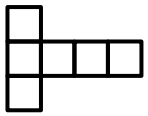
18) The volume of a rectangular prism can be found by using the formula V=Bh. If the base of a prism is square with a side length of 3 inches and the height of the prism is 2 ¼ inches, find the volume of the prism. _____

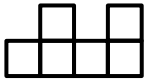
19) Andres is painting five faces of a storage cube (he isn't painting the bottom face). If each faces is 8 inches, how many square inches will he need to paint? _____

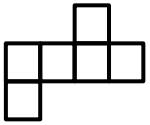


20) Which of the following nets could NOT be folded to form a cube?

a) 

b) 

c) 

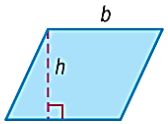
d) 

Area of Parallelograms

Area of a Parallelogram

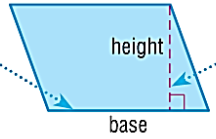
Words The area A of a parallelogram is the product of its base b and its height h.

Model



Symbols $A = bh$

The **base** of a parallelogram can be any one of its sides.

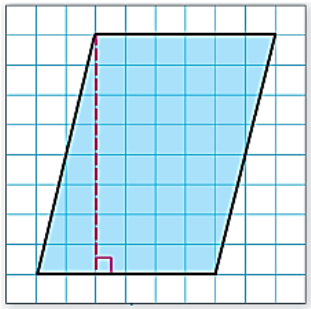


The **height** is the perpendicular distance from the base to the opposite side.

Parallelograms include special quadrilaterals, such as rectangles, squares, and rhombi.

Examples:

Find the area of the parallelogram.



The base is 6 units, and the height is 8 units.

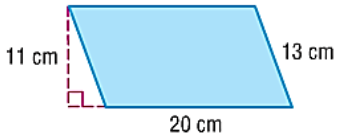
$A = bh$ Area of parallelogram

$A = 6 \cdot 8$ Replace b with 6 and h with 8.

$A = 48$ Multiply.

The area is 48 square units or 48 units^2.

Find the area of the parallelogram.



Estimate $A \approx 20 \cdot 10$ or 200 cm^2

$A = bh$ Area of parallelogram

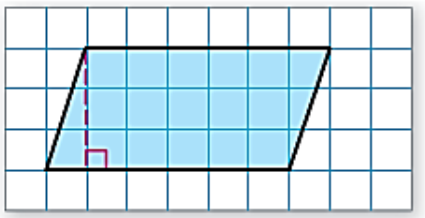
$A = 20 \cdot 11$ Replace b with 20 and h with 11.

$A = 220$ Check for Reasonableness $220 \approx 200$ ✓

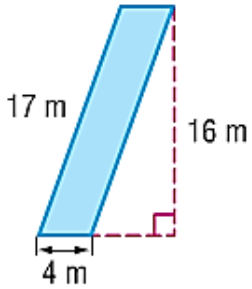
The area is 220 square centimeters or 220 cm^2.

You Try:

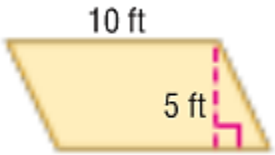
a)



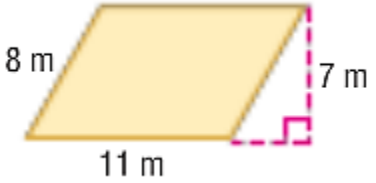
b)



c)



d)

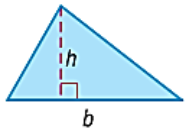


Area of Triangles

Area of a Triangle

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

Model

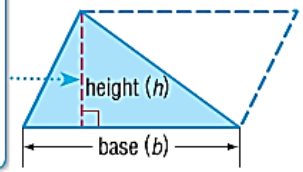


Symbols $A = \frac{1}{2}bh$ or $A = \frac{bh}{2}$

Congruent figures are figures that are the same shape and size.

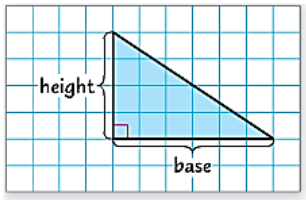
A parallelogram can be formed by two congruent triangles. Since congruent triangles have the same area, the area of a triangle is one half the area of the parallelogram.

The base of a triangle can be any one of its sides. The height is the perpendicular distance from that base to the opposite vertex.



Examples:

Find the area of the triangle.



By counting, you find that the measure of the base is 6 units and the height is 4 units.

$A = \frac{1}{2}bh$ Area of a triangle

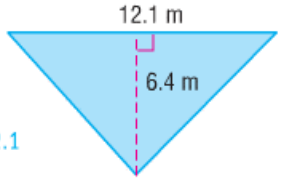
$A = \frac{1}{2}(6)(4)$ Replace b with 6 and h with 4.

$A = \frac{1}{2}(24)$ Multiply.

$A = 12$ Multiply.

The area of the triangle is 12 square units.

Find the area of the triangle.



$A = \frac{1}{2}bh$ Area of a triangle

$A = \frac{1}{2}(12.1)(6.4)$ Replace b with 12.1 and h with 6.4.

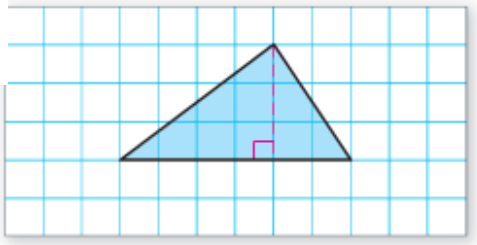
$A = \frac{1}{2}(77.44)$ Multiply.

$A = 38.72$ Divide. $\frac{1}{2}(77.44) = 77.44 \div 2$, or 38.72

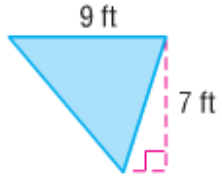
The area of the triangle is 38.72 square meters.

You Try:

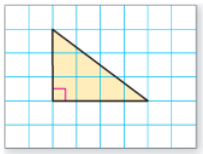
a)



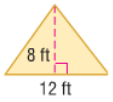
b)



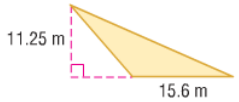
c)



d)



e)

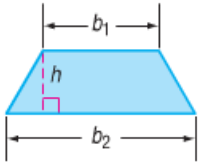


Area of Trapezoids

Area of a Trapezoid

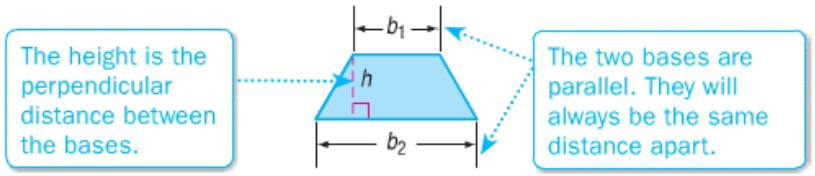
Words The area A of a trapezoid is one half the product of the height h and the sum of the bases b_1 and b_2.

Model



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

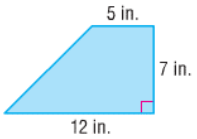
A trapezoid has two bases, b_1 and b_2. The height of a trapezoid is the distance between the bases.



When finding the area of a trapezoid, it is important to follow the order of operations. In the formula, the bases are to be added before multiplying by $\frac{1}{2}$ of the height h.

You Try:

Find the area of the trapezoid.



The bases are 5 inches and 12 inches.
The height is 7 inches.

$A = \frac{1}{2}h(b_1 + b_2)$ Area of a trapezoid

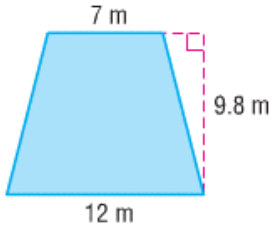
$A = \frac{1}{2}(7)(5 + 12)$ Replace h with 7, b_1 with 5, and b_2 with 12.

$A = \frac{1}{2}(7)(17)$ Add 5 and 12.

$A = 59.5$ Multiply.

The area of the trapezoid is 59.5 square inches.

Find the area of the trapezoid.



$A = \frac{1}{2}h(b_1 + b_2)$ Area of a trapezoid

$A = \frac{1}{2}(9.8)(7 + 12)$ Replace h with 9.8, b_1 with 7, and b_2 with 12.

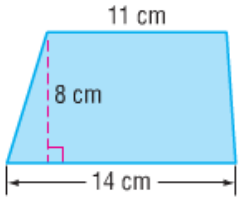
$A = \frac{1}{2}(9.8)(19)$ Add 7 and 12.

$A = 93.1$ Multiply.

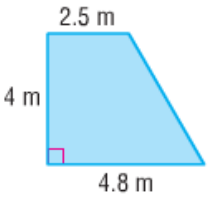
So, the area of the trapezoid is 93.1 square meters.

You Try:

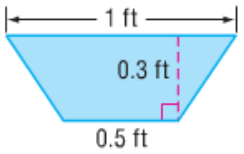
a.



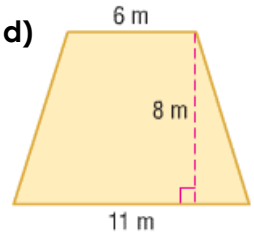
b.



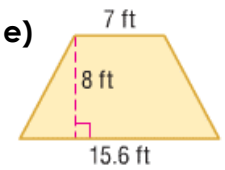
c.



d)

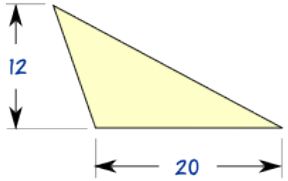
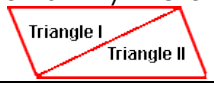


e)

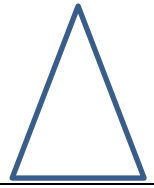


Area of Triangles and Quadrilaterals

Area is the amount of space INSIDE a figure. It is always measured in square units.

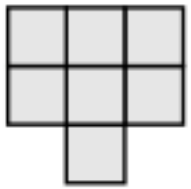
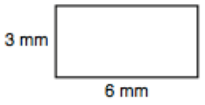
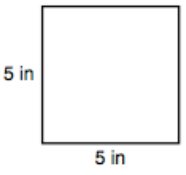
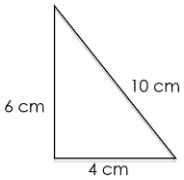
Triangle	Quadrilateral
$A = \frac{1}{2} b \bullet h$ **B = Base** **H = Height**	$A = l \bullet w$ **or** $A = b \bullet h$ **L = Length** **W = Width**
Example: What is the area of the triangle?  h = height = 12 m b = base = 20 m A = ½bh = ½ • 20 •12 = 120 m^2	**Example:** What is the area of the rectangle?  l = length = 8cm w = width = 3 cm A = lw = 8 • 3 = 24 cm^2
Note: A triangle is half of a rectangle. That is why the area of a triangle is half the area of a rectangle.  	

You Try:

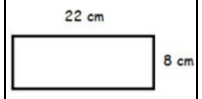
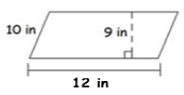
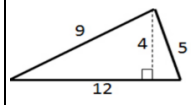
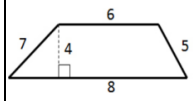
Triangle	Square	Rectangle
		
h = 6ft **b = 5ft**	**side = 8in**	**l = 9cm** **w = 3cm**
Formula: _____ Area: _____	Formula: _____ Area: _____	Formula: _____ Area: _____

How do you calculate area?	Formulas for Area
Area is the _____ of _____ units needed to fill a _____. Or, the amount of _____ in a polygon. To calculate area, you must _____ all the _____. Area is always measured in _____.	Square: Rectangle: Triangle:

You Try:

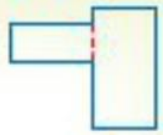
1) When calculating area, you can count the square units in a polygon.  How many square units are there?	2) What is the area of this shape? 	3) What is the area of this shape? 
4) You can also use the formulas above to calculate the area of shapes.  	5) What is the area of this shape?  	6) What is the area of this shape? 

Additional Practice with Area

Name of Polygon				
Picture				
Write the formula				
Substitute for the variables (Show work)				
Solve. Include square units in your answer.				

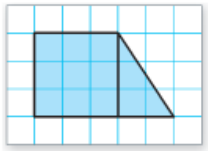
Area of Composite Figures

A **composite figure** is a figure made of two or more two-dimensional figures. The composite figure shown to the right is made of two rectangles.



Find the Area of a Composite Figure

You can decompose some trapezoids into a square and a triangle to find the area.



Area of Square

$A = \ell \cdot w$

$A = 3 \cdot 3$, or 9

Area of Triangle

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

$A = \frac{1}{2}(2)(3)$, or 3

Then add the area of the square and the area of the triangle to find the area of the trapezoid. The area of the trapezoid is 9 + 3 or 12 square units.

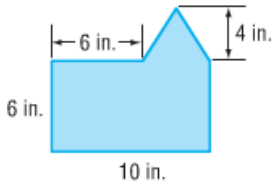
You can find the area of a composite figure using the same strategy. To find the area of a composite figure, separate it into figures with areas you know how to find. Then add those areas.

Example

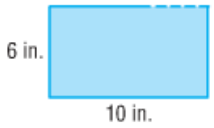
Tutor

1. **Find the area of the figure at the right.**

The figure can be separated into a rectangle and a triangle. Find the area of each.



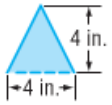
Area of Rectangle



$A = \ell w$

$A = 10 \cdot 6$ or 60

Area of Triangle



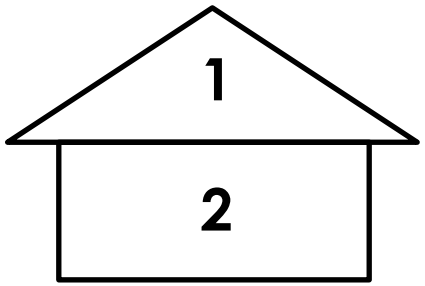
$A = \frac{1}{2}bh$

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

The base of the triangle is 10 − 6 or 4 inches.

The area is 60 + 8 or 68 square inches.

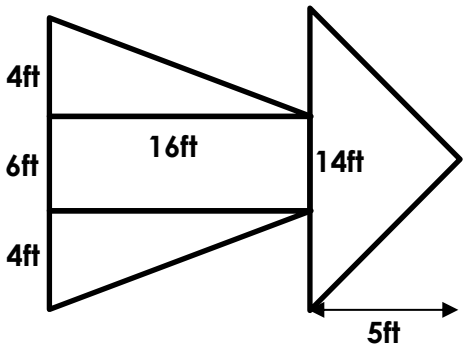
The figure below is a composite figure. How would you find its area?



The house is made up of two shapes that you are familiar with – a triangle and a rectangle. You can "decompose" or "take apart" the figure to find the area of each piece and then find the sum of those areas to get the total area.

Try This:

Find the area of the rocket figure below.



1) How many shapes can this figure be broken into?

2) What two different types of shapes can you see?

3) Determine the area of each shape.

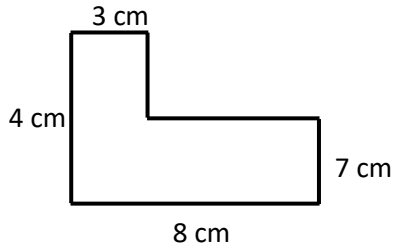
Shape	Shape #1	Shape #2	Shape #3	Shape #4
Formula	$Area_{\triangle} = \frac{1}{2}bh$			
Work	$\frac{1}{2} \cdot 16 \cdot 4$ $8 \cdot 4$			
Solution	$32\ ft^2$			

Lastly, add the area of each piece. Total Area = _____

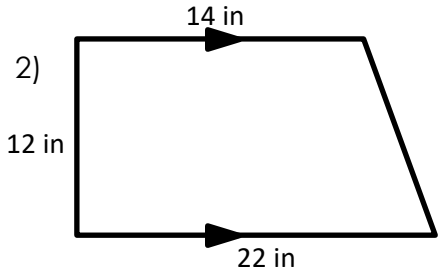
You Try:

Find the area of each composite figure. Remember to show all work! *(Hint: Often, you will have to draw in lines to decompose the figure. Pay careful attention to the side lengths that are given so you can figure out the side lengths that are missing!)*

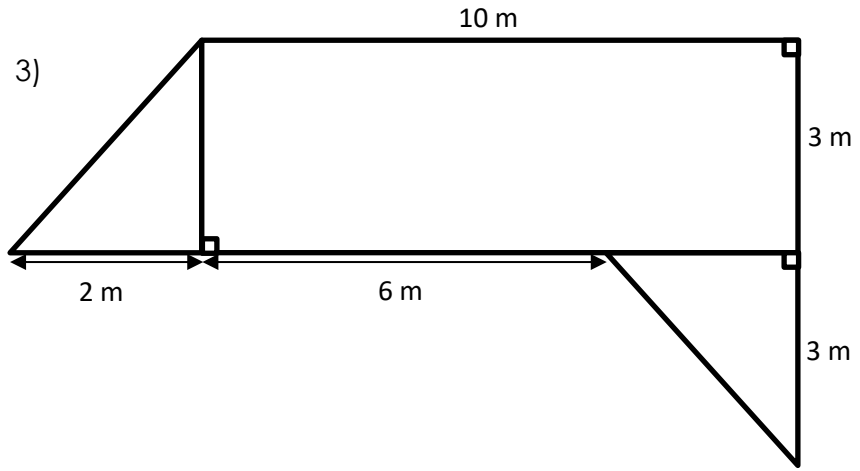
1)



2)



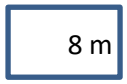
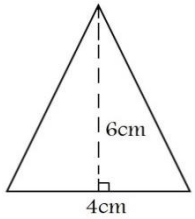
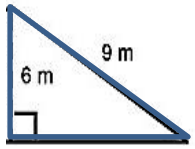
3)



Area Error Analysis

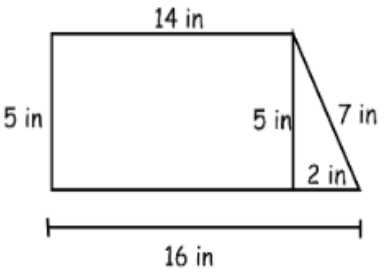
Fill in the Flow Map with the 3 steps to solving problems on area:

Silly Sally has struck again! Analyze her work in Column #1, and *circle her mistake*. In Column #2, explain what she did wrong. In Column #3, work out the problems correctly, showing ALL work!

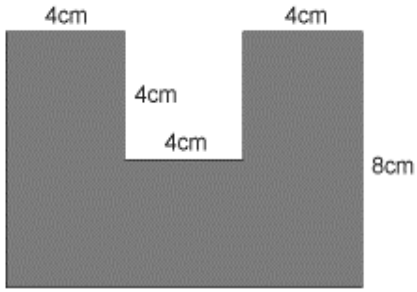
Silly Sally's Work (Circle her mistake):	What did Silly Sally do wrong?	Show Silly Sally how it's done! (Show ALL steps!)
 8 m, 12 m A = lw 12 • 8 20 m²		
 6cm, 4cm A = ½ b h ½ • 4 • 6 24 cm²		
 9 m, 6 m, 8 m A = ½ b h ½ • 8 • 9 ½ • 72 36 m²		

Find the area of each composite figure:

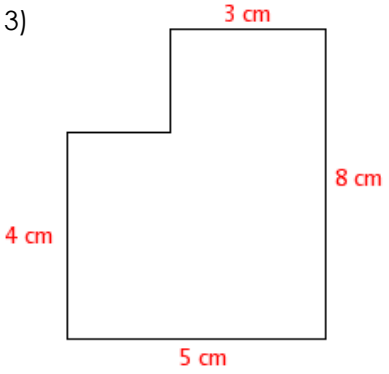
1)



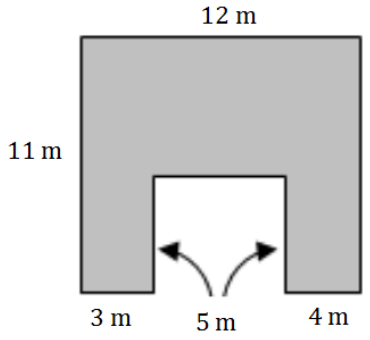
2)



3)

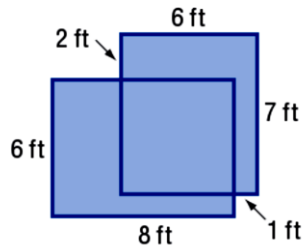


4)

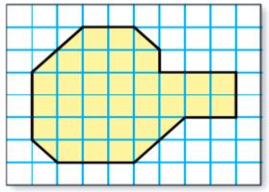


More Area Practice with Composite Figures

1) Find the area of the figure below.



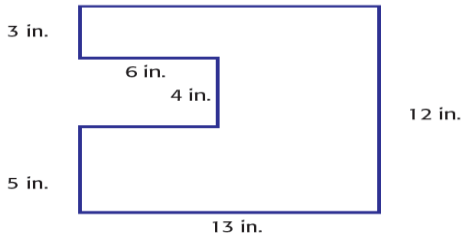
2) The shaded part of the grid represents the plans for a fish pond.

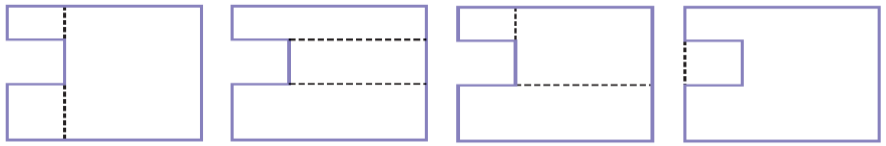


If each square on the grid represents 5 square feet, what is the approximate area of the fish pond?

F. 175 square feet
G. 165 square feet
H. 150 square feet
I. 33 square feet

3) **Match each math sentence with the correct division of the complex figure below.**





4. (6 × 3) + (7 × 7) + (13 × 5)

_____

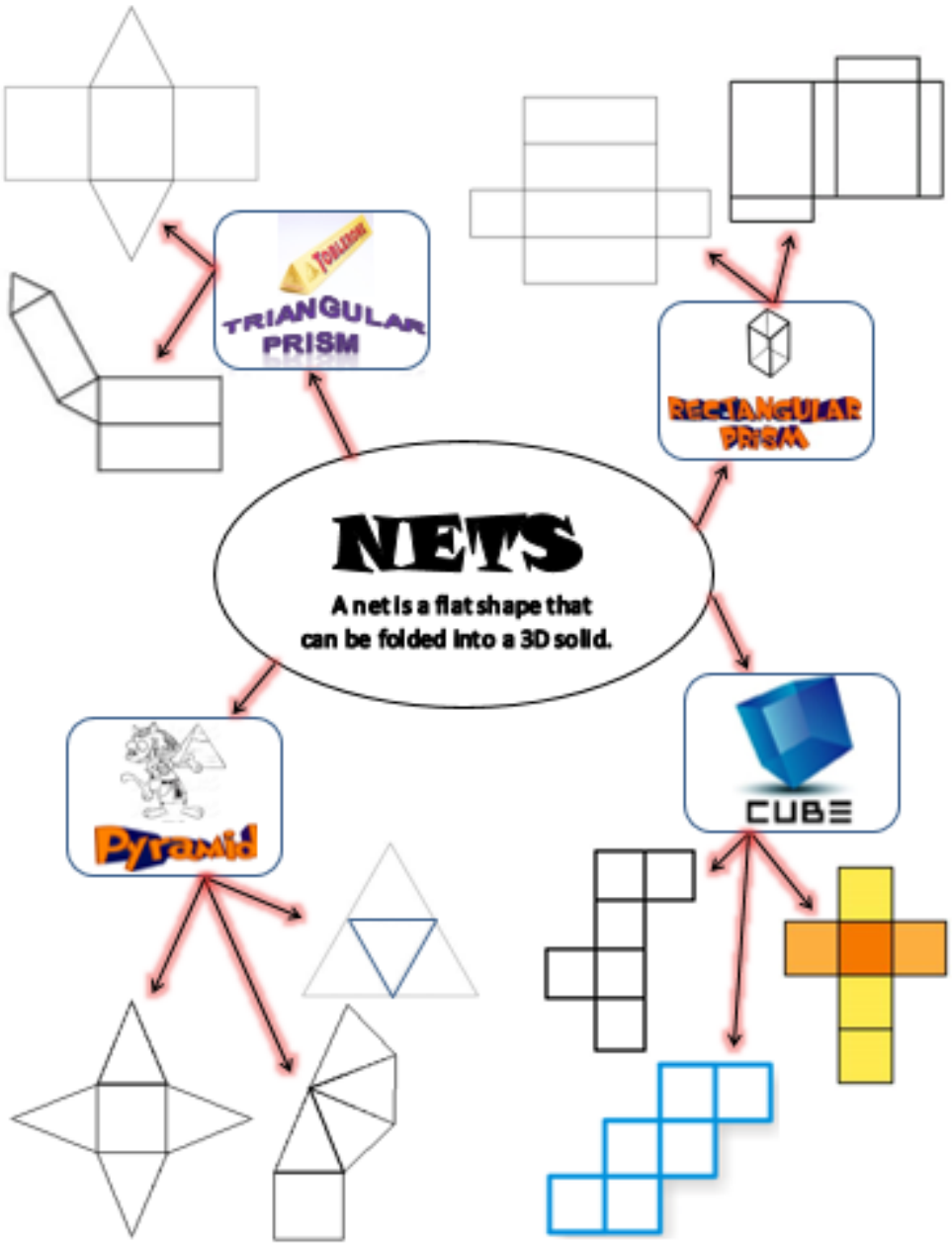
5. (6 × 3) + (6 × 5) + (7 × 12)

_____

6. (13 × 12) – (6 × 4)

7. (13 × 3) + (7 × 4) + (13 × 5)

Nets

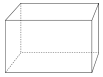
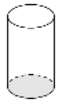


Nets of 3-Dimensional Figures

Face is a flat _____ of a solid figure.

Edge is a _____ segment where two faces of a _____ meet.

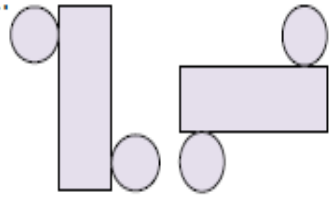
Vertex is a _____ where _____ or more edges of a solid figure meet or the pointed end of a cone opposite of its base.

FIGURE	FACES Look Like	BASE	How many faces?	NET
Cube 				
Rectangular Prism 				
Triangular Prism 				
Square Pyramid 				
Triangular Pyramid 				
Cylinder 				
Cone 				

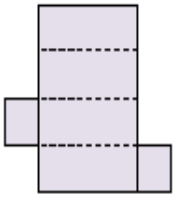
Matching Nets and 3-D Figures

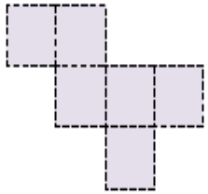
Using Nets to Understand 3-D Figures - Matching Worksheet

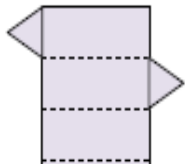
Write the letter of the shape that each net would create.

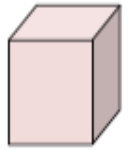
_____ 1. 

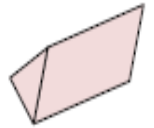
_____ 2. 

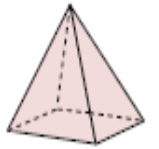
_____ 3. 

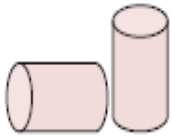
_____ 4. 

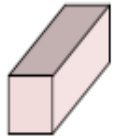
_____ 5. 

a. 

b. 

c. 

d. 

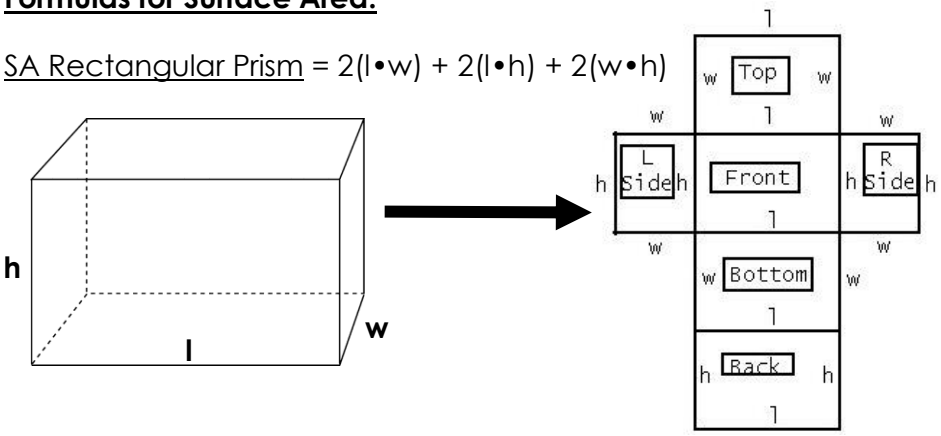
e. 

Using Formulas to Find Surface Area

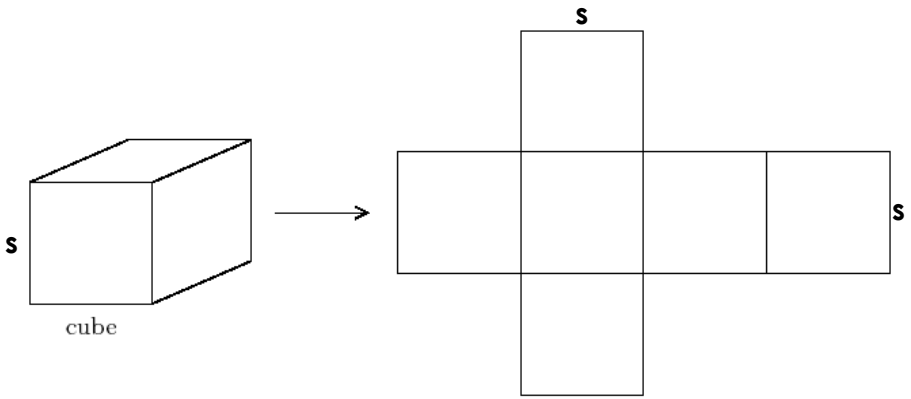
A **formula** is a mathematical rule using variables. It allows us to easily find a value such as area, volume, circumference, perimeter, etc. Formulas are used often in math and science!

Formulas for Surface Area:

SA Rectangular Prism = 2(l•w) + 2(l•h) + 2(w•h)



SA Cube = $6s^2$



Using Formulas to Find Surface Area

So… what exactly IS surface area, anyway?

_____

_____

RECTANGULAR PRISM

Draw a rectangular prism:	Draw the net of a rectangular prism:
How do you think you could calculate the **SURFACE AREA** of a **RECTANGULAR PRISM**?	

PYRAMID

Draw a **SQARE PYRAMID**:	Draw the net of a **SQARE PYRAMID**:
How do you think you could calculate the **SURFACE AREA** of a **SQARE PYRAMID**?	

CUBE

Draw a **CUBE**:	Draw the net of a **CUBE**:
How do you think you could calculate the **SURFACE AREA** of a **CUBE**?	

Complete the following statement:

When I need to find the surface area of a 3-dimensional (3-D) figure, I can do that by…

_____

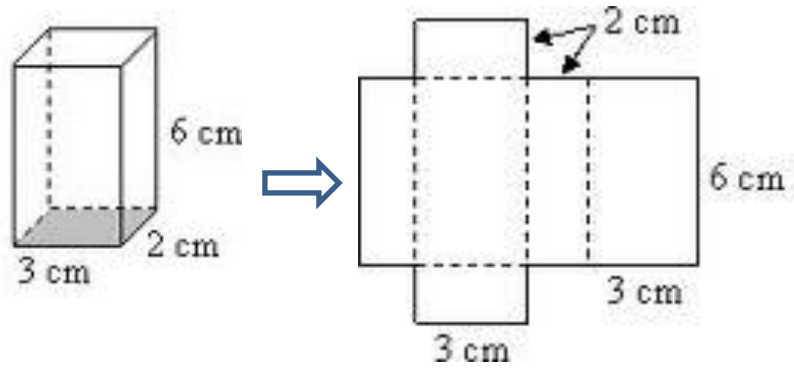
_____

_____

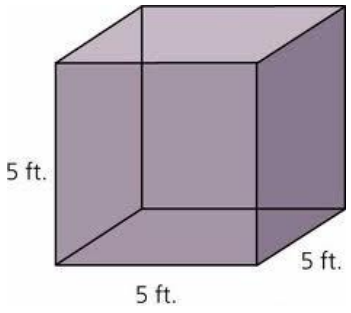
You Try:

Using either method (nets or formulas), find the surface area.

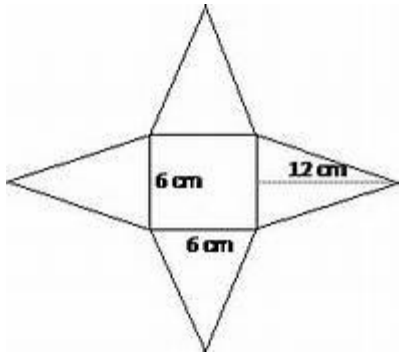
1)



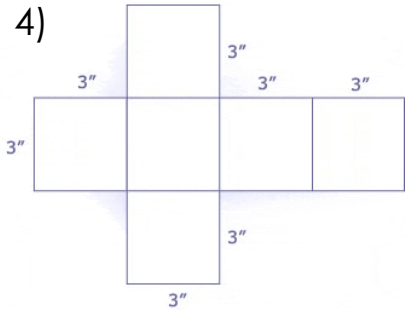
2)



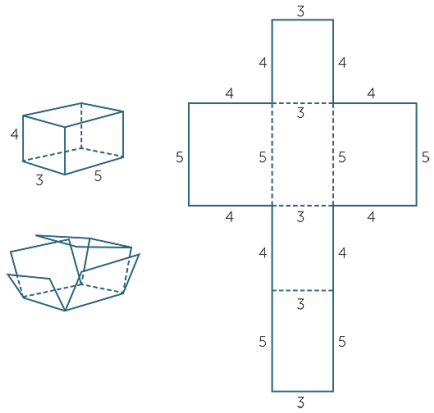
3)



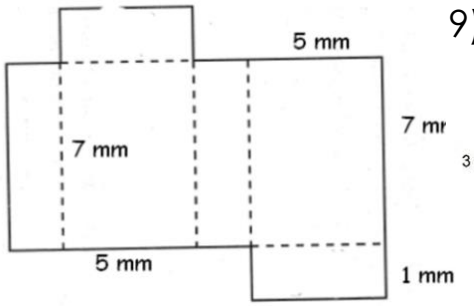
4)



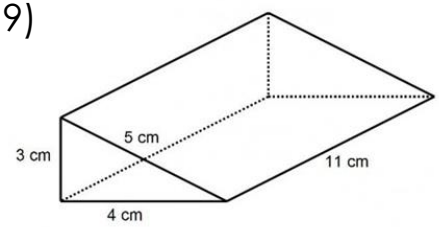
5)



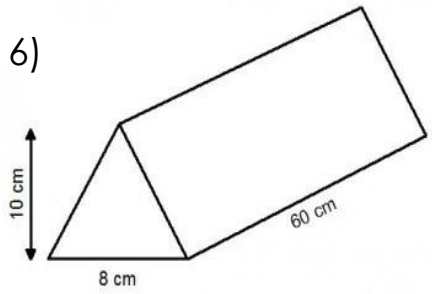
8)



9)

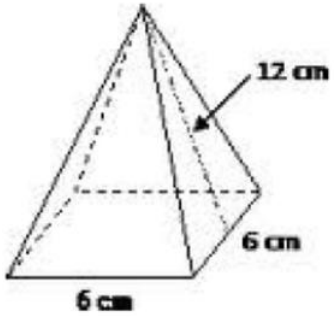


6)

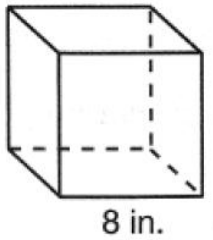


7) Find the Surface Area of a cube with side length 4cm.

10)



11)



Surface Area in the Real World

Solve each of the problems by drawing a net and finding the surface area.

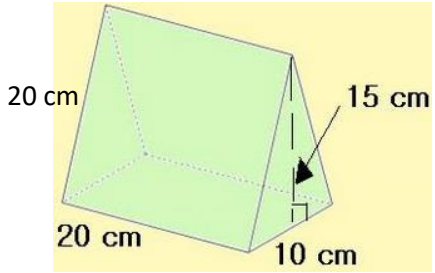
1) A pizza box is 15 inches wide, 14 inches long, and 2 inches tall. How many square inches of cardboard were used to create the box?

2) What is the surface area of a Rubik's Cube that is 6 cm tall?

3) Angelo is making a replica of an Egyptian pyramid. He is making a square pyramid with a base that is 3 feet long and 3 feet wide. The triangular sides of the pyramid each have a height of 14 feet. How much material will Angelo need to cover the pyramid?

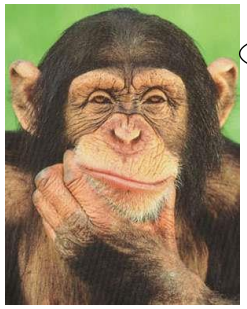
4) Sydney is painting a rectangular toy box for her little brother. She will paint all 4 sides and the top (she will NOT paint the bottom). If the toy box is 20 inches tall, 12 inches wide, and 25 inches long, how many square inches will she need to paint?

5) DeAndre is making a tent for his hamster. It is 20 cm long, and the triangular bases are 15 cm high and 10 cm wide (see picture below). How much material will he need to make the tent?



Volume of Rectangular Prisms

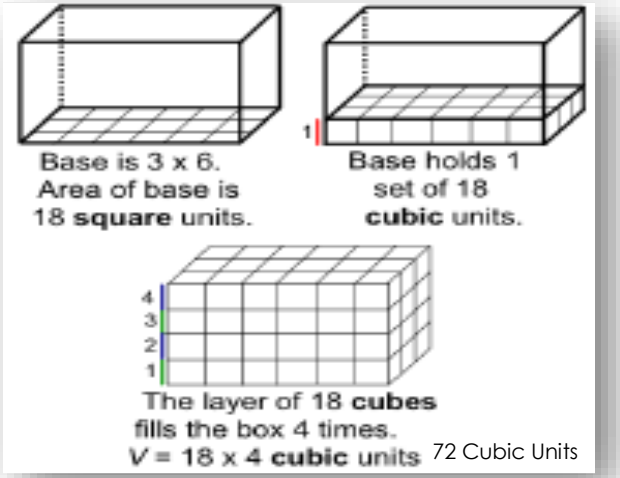
Volume is the amount of space *inside* a 3D object, measured in *cubic units*.



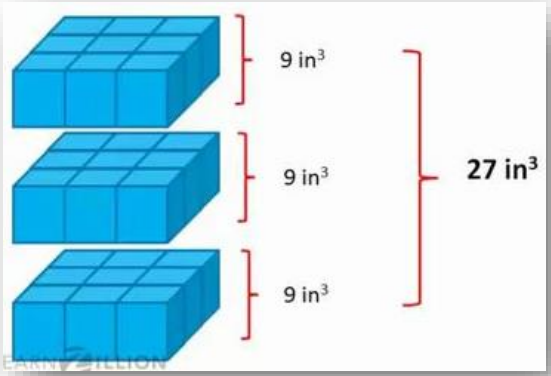
Ever wonder WHY volume is measured in *cubic units*??

Since volume measures the amount of space INSIDE a figure, it's like you're *packing the figure with little tiny cubes*!!

Here's a visual of a ***rectangular prism*** being packed with unit cubes…



Here's a visual of a **cube** being packed with unit cubes…



Volume is the _____ of _____ units needed to fill the space in a three dimensional (3D) figure.
Volume is always measured in cubic units.

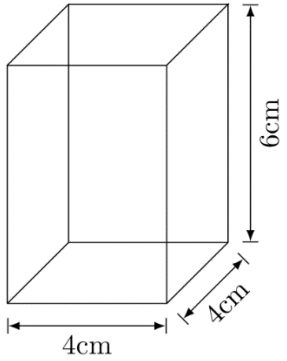
We calculate volume you must find the area of the _____ then multiply it by the _____.

This can be written as _____ • _____.

OR _____ • _____ • _____ for a rectangular prism.

Example:

Find the volume of the rectangular prism below.



$V = B \bullet h$

$V = l \bullet w \bullet h$

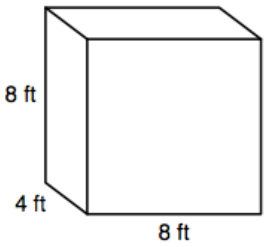
$V = 4 \bullet 4 \bullet 6$

$V = 96\ cm^3$

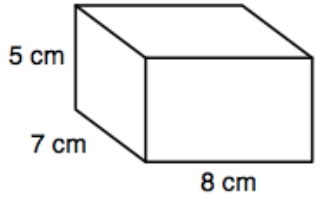
You Try:

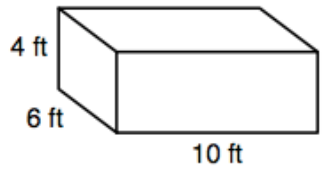
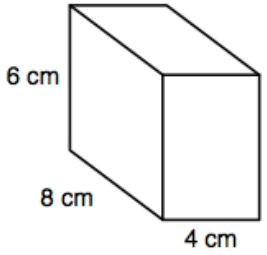
Find the volume.

1)



2)

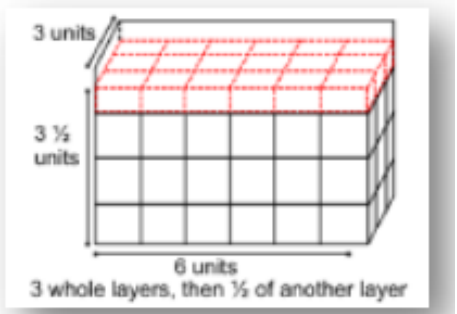


3) 	4) 
5) Find the volume of a rectangular prism with B = 78ft² and h = 23 ft.	6) Find the volume of a rectangular prism with l = 4.2cm, w = 3.8cm, and h = 6cm.
7) Find the volume of a rectangular prism with l = 8 ¼ in., w = 9in and h = 15in.	8) Find the missing dimension of the rectangular prism. L = 14 cm W = ? H = 3 cm V = 294 cm

Volume of Rectangular Prisms with Fractional Edges

Let's calculate the volume of a rectangular prism with a length of 6 units, a width of 3 units, and a height of 3 ½ units.

Look at the picture! →



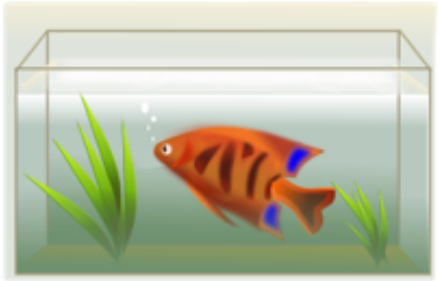
The bottom layer contains 6 units across and 3 units back, for a total of 18 units.

Then, there are 3 ½ layers of 18 units. (You have 3 layers, and then half of another layer.)

So, the total volume of this figure is 18 + 18 + 18 + 9 = **63 cubic units**.

Let's calculate the amount of water that Nora can pour into her fish tank that is 10 inches long, 6 inches wide, and 5 ¼ inches deep.

The bottom of the tank is 10 inches long and 6 inches wide, so the bottom layer is 60 cubic inches.



Then, there are 5 ¼ layers of 60 units. The volume of the tank is...

5 layers of 60 + ¼ layer

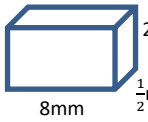
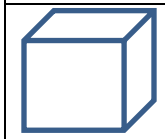
60 + 60 + 60 + 60 + 60 + 15 = 315 cubic inches

You Try:

Find the volume of a rectangular prism with a length of 3cm, a width of 2 ½ cm, and a height of 4 cm.

Volume Error Analysis

Sally is a silly little girl that makes silly mistakes! Analyze her work in Column #1, and *circle her mistake*. In Column #2, explain what she did wrong. In Column #3, show how Silly Sally should work out the problem. Show ALL work!

Silly Sally's Work (Circle her mistake):	What did Silly Sally do wrong?	Show Silly Sally how it's done! (Show ALL steps!)
 4m V = l w h V = 4 • 4 • 4 V= 12 m^3		
 2mm, 8mm, $\frac{1}{2}$mm V = l w h V = 8 • ½ • 2 V = 4 • 2 V = 8mm^2		
 Cube = 2/3 in. tall V = l w h V = $\frac{2}{3} \cdot \frac{2}{3} \cdot \frac{2}{3}$ V = $\frac{6}{9} = \frac{2}{3}$ in^3		
 8 ¼ yd, 2 ½ yd, 3 yd V = l w h V = 8 ¼ • 2 ½ • 3 V = 16 $\frac{1}{8}$ • 3 V = 48 $\frac{1}{8}$ yd^3		
 $8\frac{1}{4}$ yd, $1\frac{1}{2}$ yd, 2 yd V = l w h V = 4 ½ • 1 ½ • 2 V = $\frac{8}{2}$ • $\frac{3}{2}$ • 2 V = $\frac{24}{4}$ • 2 V = 12 yd^3		

More Volume Practice

Determine the Volume of each rectangular prism or cube below. Include units and show your work!

1. A cube that is 12 yards wide

2. The box with dimensions of 6 ft • 4 ft • 1 ½ ft

3. Determine the Volume of a rectangular truck bed that is 12 feet long, 5 ¼ feet wide, and 3 feet deep.

4. How much water can be poured into a cubic tank that is 2 ½ feet long?

5. What is the volume of a gift box that is 3 ½ inches wide, 2 inches tall, and 6 inches long?