

# Book 7: Area and Volume



Name: \_\_\_\_\_

Start Date: \_\_\_\_\_

Completion Date: \_\_\_\_\_



**Year Overview:**

Earning and Spending Money	Home	Travel and Transportation	Recreation and Wellness
1. Budget 2. Personal Banking 3. Interest 4. Consumer Credit 5. Major Purchases	6. Scale Drawings & Ratios <b>7. Area &amp; Volume</b> 8. Angles 9. Triangles 10. Slope & Elevation	11. Travel Project	12. Puzzles & Games 13. Understanding Statistics 14. Budgeting Recreation

**Topic Overview**

There is a lot of mathematics that can help you understand, design, and create things at home. Scale drawings help you to design decks and buildings, or read architectural drawings. Ratios not only help you to interpret scale drawings, you also see them in TVs and computer monitors. This section of the home unit is designed to help you understand and create scale drawing and understand the ratios around you.

**Outcomes**

Overlapping Outcomes in Scale Drawings and Ratios

**M21.1** Extend and apply understanding of the preservation of equality by solving problems that involve the manipulation and application of formulae within home, money, recreation, and travel themes.

Theme Specific Outcomes

**M21.7** Demonstrate and extend understanding of similarity and proportional reasoning related to scale factors, scale drawing, scale models, surface area, and volume.

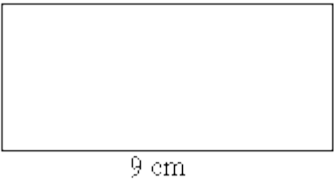
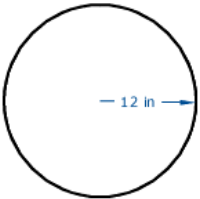
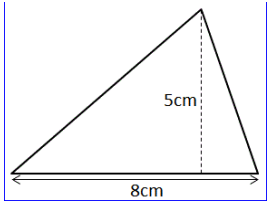
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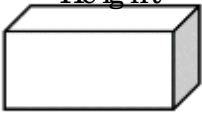
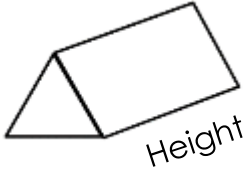
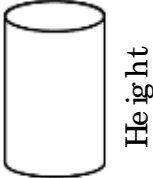


## Formulas

### Surface Area

Shape, Terms	Formula for <u>AREA</u>	Example
<p><b><u>Rectangle</u></b></p> <p>Length (L) = long side                      Width (W) = short side</p>	$A = L \times W$	 <p style="text-align: right;">4 cm</p> <p style="text-align: center;">9 cm</p> $A = (4 \text{ cm})(9 \text{ cm})$ $A = 36 \text{ cm}^2$
<p><b><u>Circle</u></b></p> <p>Radius (r) = distance from center to edge                      Pi (<math>\pi</math>) = ratio of circumference to diameter, 3.14</p>	$A = \pi r^2$	 <p style="text-align: center;">— 12 in —&gt;</p> $A = \pi(12 \text{ in})^2$ $A = 452 \text{ in}^2$
<p><b><u>Triangle</u></b></p> <p>Base (b) = bottom                      Height (h) = distance from point to opposite side (base), at <math>90^\circ</math></p>	$A = (b \times h) \div 2$	 <p style="text-align: center;">5 cm</p> <p style="text-align: center;">8 cm</p> $A = (8 \text{ cm} \times 5 \text{ cm}) \div 2$ $A = 20 \text{ cm}^2$

## Volume

Shape	Image	Area of the Base	Volume formula
Rectangular Prism		Area = Length x Width $A = LW$	$V = LWH$
Triangular Prism		Area = $\frac{1}{2}$ (base x height) $A = \frac{1}{2}bh$	$V = \frac{1}{2}bhH$
Cylinder		Area = $\pi \times (\text{radius})^2$ Area = $\pi r^2$	$V = \pi r^2H$

## Area, Surface Area, and Volume

You often need to calculate areas and volumes when you are building, painting, or designing rooms in your home. These calculations let you buy the right amount of materials. Area is the amount of space that a flat object takes up, while the surface area is the area of all of an object's sides. The volume of an object is how much space a 3 Dimensional object takes up.

### Check Your Skills

Show all your work or explain how you got your answers.

1. Simplify the following expressions;

a.  $\frac{1}{2} + \frac{3}{4}$

b.  $4 + 6 \div 3$

c.  $-2 - 2 \times 3$

d.  $((2 + 1)(3))^2$

2. Solve the following for x;

a.  $2x = 20$

b.  $2x + 4 = 20$

c.  $2(2x + 4) = 20$

d.  $\frac{3x-8}{4} = 1$

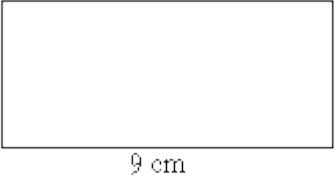
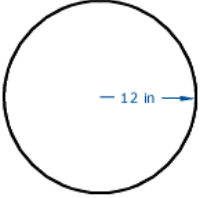
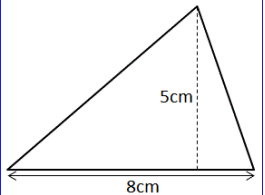
## 7.1 Area

Area is the amount of space a 2-dimensional (flat) object takes up. It is measured in units<sup>2</sup>, such as ft<sup>2</sup> or m<sup>2</sup>. Area is useful when figuring out how much

- flooring is needed in a house,
- wood is needed to cover a deck, or
- paint is needed for a wall.

*Below are formulae for the three basic shapes we will work with. These can also be used to figure out the area of other shapes.*

Shape, Terms	Formula for <u>AREA</u>	Example
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<p><b><u>Rectangle</u></b></p> <p>Length (L) = long side                      Width (W) = short side</p>	$A = L \times W$	 <p style="text-align: right;">4 cm</p> <p style="text-align: center;">9 cm</p> $A = (4 \text{ cm})(9 \text{ cm})$ $A = 36 \text{ cm}^2$
<p><b><u>Circle</u></b></p> <p>Radius (r) = distance from center to edge                      Pi (<math>\pi</math>) = ratio of circumference to diameter, 3.14</p>	$A = \pi r^2$	 <p style="text-align: center;">— 12 in —</p> $A = \pi(12 \text{ in})^2$ $A = 452 \text{ in}^2$
<p><b><u>Triangle</u></b></p> <p>Base (b) = bottom                      Height (h) = distance from point to opposite side (base), at <math>90^\circ</math></p>	$A = (b \times h) \div 2$	 <p style="text-align: center;">5 cm</p> <p style="text-align: center;">8 cm</p> $A = (8 \text{ cm} \times 5 \text{ cm}) \div 2$ $A = 20 \text{ cm}^2$

**7.1A Practice Your Skills: Area**

Find the area of the following shapes:



9 cm

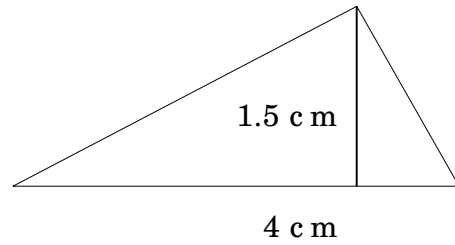
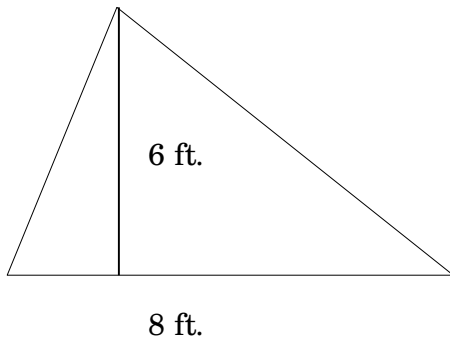
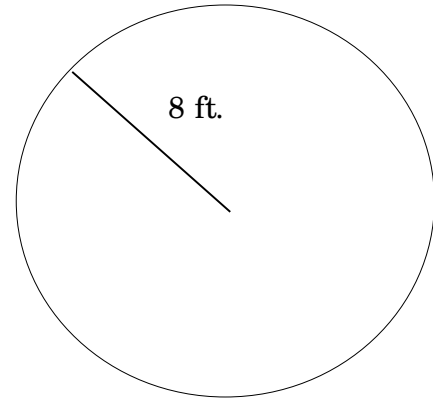
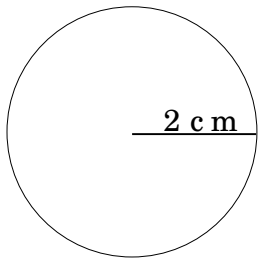
6 cm



4.5 in.

3 in.





7.1B Practice Your Skills: Area

1. Draw and label a rectangle that has an area of  $30 \text{ cm}^2$ .

2. What is the length of a rectangle whose area is  $24 \text{ m}^2$  and whose width is 4 m?

3. Draw and label a triangle that has an area of  $20 \text{ cm}^2$ .

4. What is the height of a triangle whose area is  $44 \text{ in}^2$  and whose height is 11 in?

5. What is the radius of a circle whose area is  $28.26 \text{ m}^2$ ?

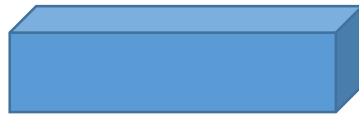
## 7.2 Surface Area

Surface area is the total area of all the faces of a 3-dimensional object. It is measured in units<sup>2</sup>. Sometimes, we only need to calculate some of the faces in order to build or create something. For instance, if you are going to put stucco onto your shed, you do not need to calculate the ceiling or floor in order to know how much stucco to buy.

We use nets to help us visualize all faces of an object. A net is a 2-dimensional pattern that can be used to create a 3-dimensional object. Nets can help us learn how to calculate surface areas of objects.



### A. Rectangular Prism



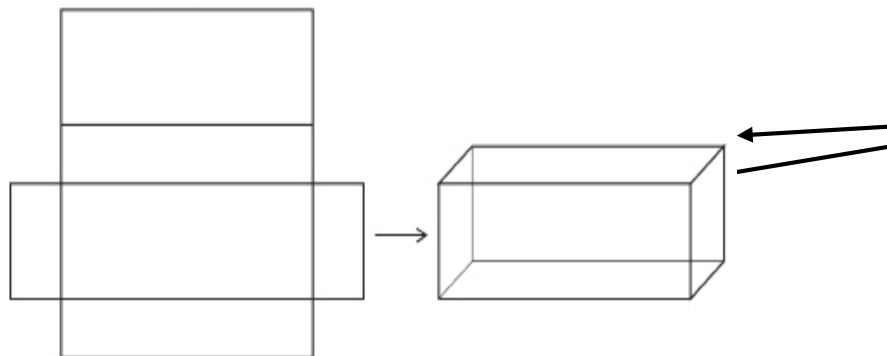
Where have you seen shapes that look like a rectangular prism? Look around - can you identify some?

The boxes around us are rectangular prisms. Because they stack nicely together, rectangular prisms are often used in food packaging. Look at your cupboards - each cupboard is its own rectangular prism!



The shape gets its name because the sides are parallel, and its ends are shaped like a rectangle.

Have you ever opened up a box and made it flat? This is what a net is. Looking at the net of a rectangular prism, we can see the parts that give this shape its name.

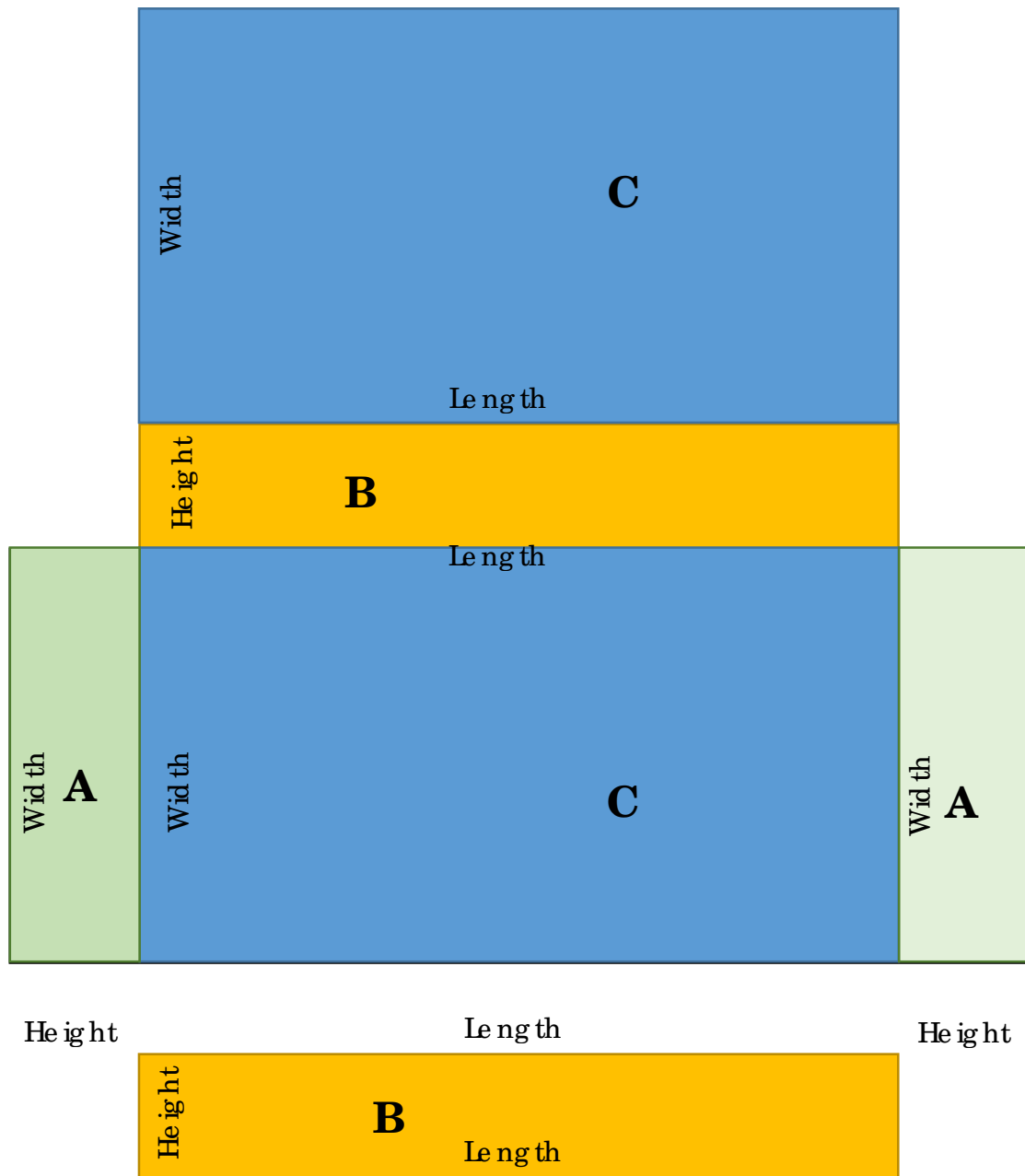


Parallel edges give this shape the name 'prism'.

The two end faces are rectangles, giving this shape the name 'rectangular'.

Build it: Rectangular Prism

1. Look at the following net. Which faces are identical? You will notice that there are 3 pairs of identical faces. These have been coloured so that you can see them.



2. Cut out the net given. You will refer to it in the next section as well.

7.2A Practice Your Skills: Calculating Surface Area of a Rectangular Prism

- Calculate the area of each face of the rectangular prism you cut out. Luckily, because each pair of sides is identical, you only need to calculate the area of one A, one B, and one C. Then you can double each one to find the total area.
  - Measure each side to the closest 0.1 cm.
  - Round the calculated area of each face to the closest 0.1 cm<sup>2</sup>.

Side Measurements	Calculation	Answer for Area
<b><u>Face A:</u></b> (H)Height: (W)Width:		
<b><u>Face B:</u></b> (L)Length: (H)Height:		
<b><u>Face C:</u></b> (L)Length: (W)Width:		

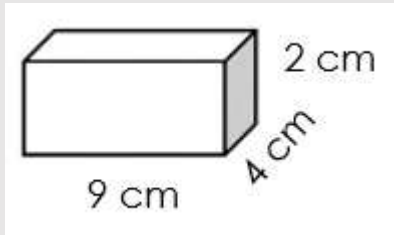
- Calculate the total surface area of the object. The units of surface area are cm<sup>2</sup>.

$$\text{Surface Area} = 2 \times \text{Face A} + 2 \times \text{Face B} + 2 \times \text{Face C}$$

$$\text{Surface Area} = 2 \times (H \times W) + 2 \times (L \times H) + 2 \times (L \times W)$$

- Fold your net and tape it together to create a 3 Dimensional rectangular prism. Save this object for a later activity.

Sometimes, the measurements for a rectangular prism are given to you and you need to visualize the net for this object and calculate its Surface Area.

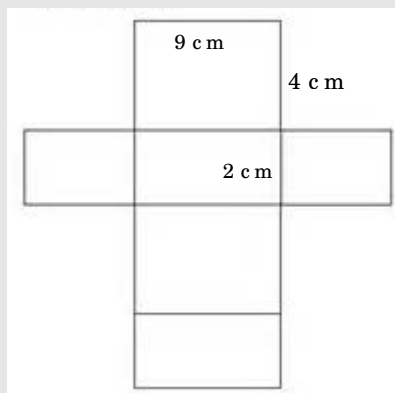


A rectangular prism is shown above. What is its surface area?

First record the length, width, and height.

- Length (L) = 9 cm
- Width (W) = 4 cm
- Height (H) = 2 cm

Then visualize the net for this rectangular prism.



Notice that there are 3 pairs of identical faces in your net, giving you the formula:

$$\text{Surface Area} = 2 \times (\text{H} \times \text{W}) + 2 \times (\text{L} \times \text{H}) + 2 \times (\text{L} \times \text{W})$$

$$\text{Surface Area} = 2(2 \text{ cm} \times 4 \text{ cm}) + 2(9 \text{ cm} \times 2 \text{ cm}) + 2(9 \text{ cm} \times 4 \text{ cm})$$

$$\text{Surface Area} = 2(8 \text{ cm}^2) + 2(18 \text{ cm}^2) + 2(36 \text{ cm}^2)$$

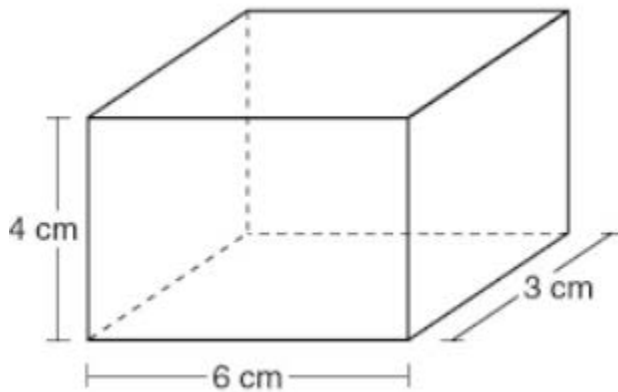
$$\text{Surface Area} = 16 \text{ cm}^2 + 36 \text{ cm}^2 + 72 \text{ cm}^2$$

$$\text{Surface Area} = 124 \text{ cm}^2$$



7.2A Practice Your Skills: Surface Area of Rectangular Prisms

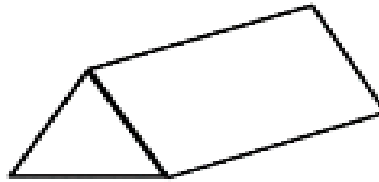
1. Calculate the area for the following rectangular prism.



2. Calculate the surface area for a rectangular prism with the following dimensions:

- Length – 4.5 cm
- Width – 2.3 cm
- Height – 6.1 cm

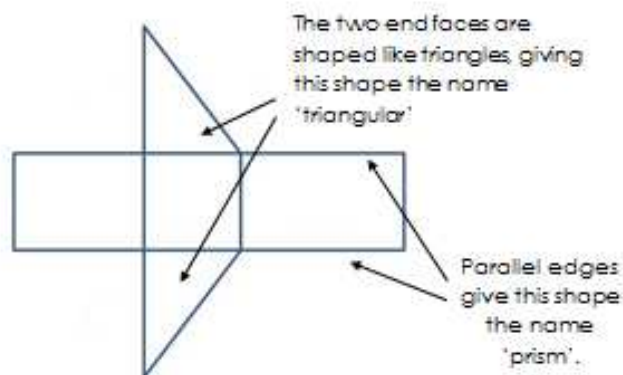
**B. Triangular Prism**



Triangular prisms are not as common in packaging as rectangular prisms, but they are found around our homes and businesses.

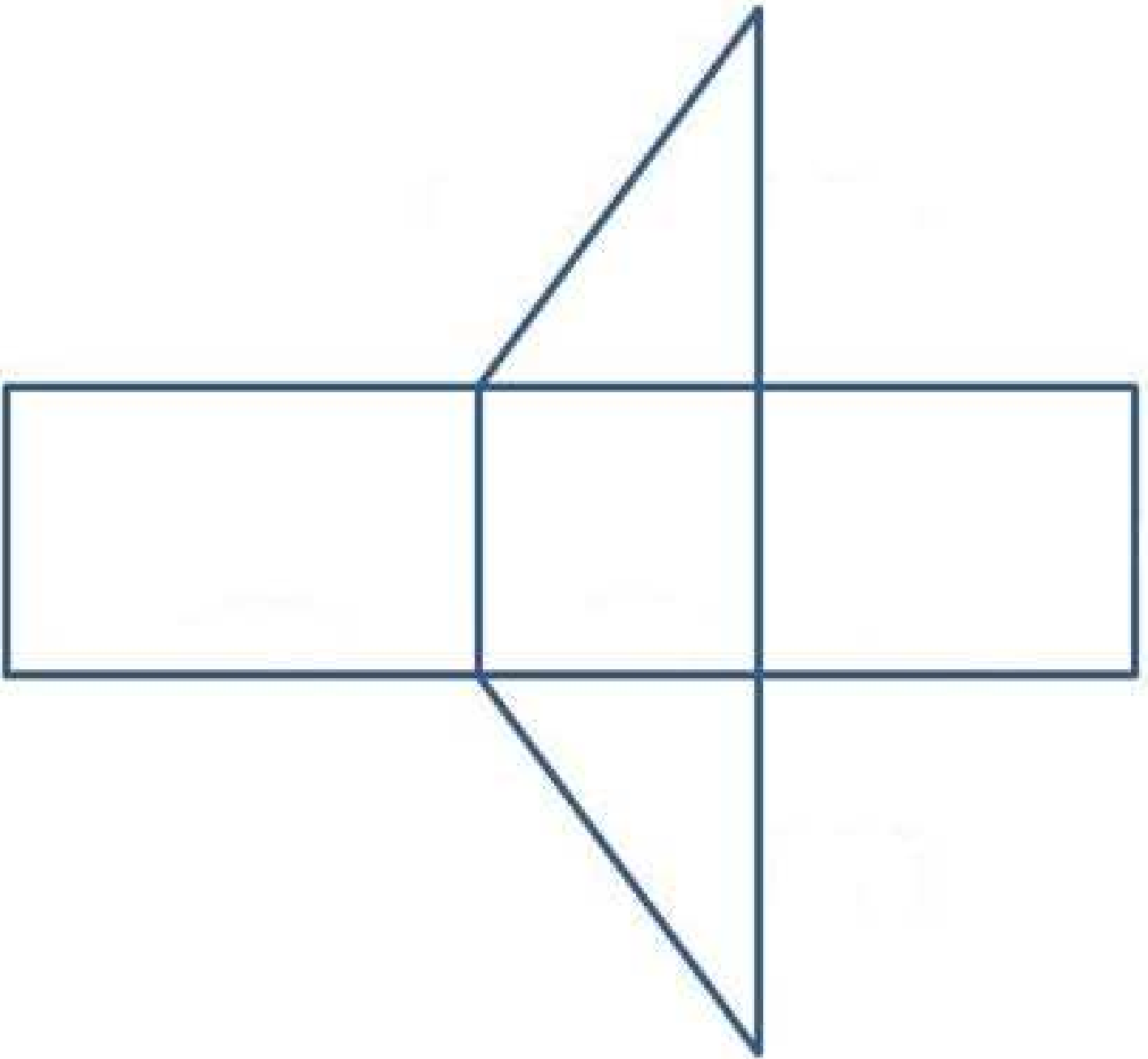


This shape gets its name because the sides are parallel, and its ends are shaped like triangles. Looking at the net of a triangular prism, we can see the parts that give this shape its name.

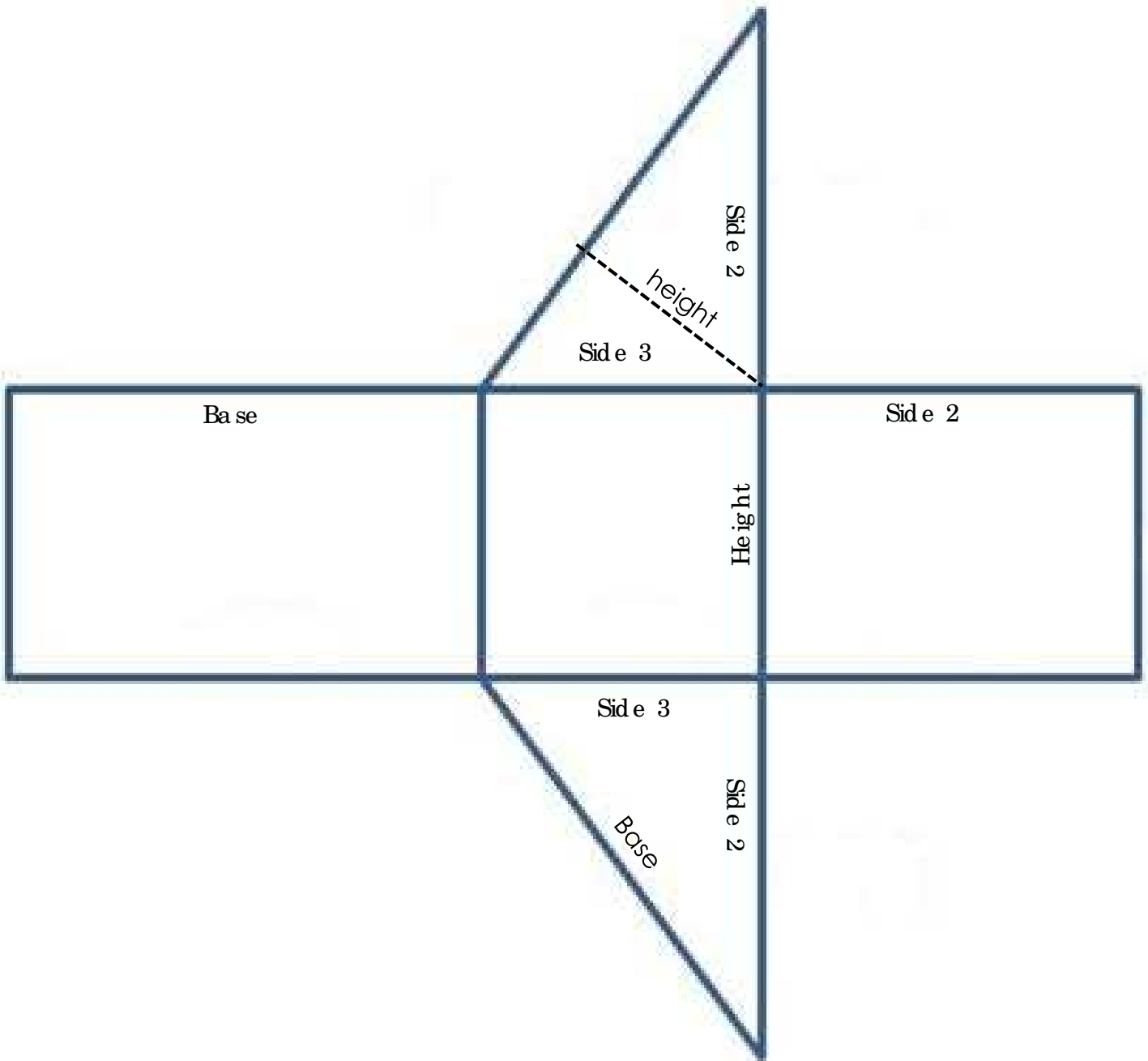


Build it: Triangular Prism

1. Look at the following net. Which faces are identical? Identify the sides that are identical and fill them in with the same colour. If there are sides that are not like any other, colour them different colours.
2. Cut out the net given. You will refer to it in the next section as well.



careful to use (h) to show the height of the triangle and (H) to show the height of the prism.



7.2B Practice Your Skills: Calculating Surface Area of Triangular Prisms

1. Calculate the area of each face of the triangular prism you cut out.

- Measure each side to the closest 0.1 cm.
- Round the calculated area of each face to the closest 0.1 cm<sup>2</sup>.

Base :

Side 2:

Side 3:

Height:

Height:

Side Measurements	Calculation	Answer for Area
<b><u>Face</u></b>		
<b><u>Face</u></b>		
<b><u>Face</u></b>		
<b><u>Face</u></b>		

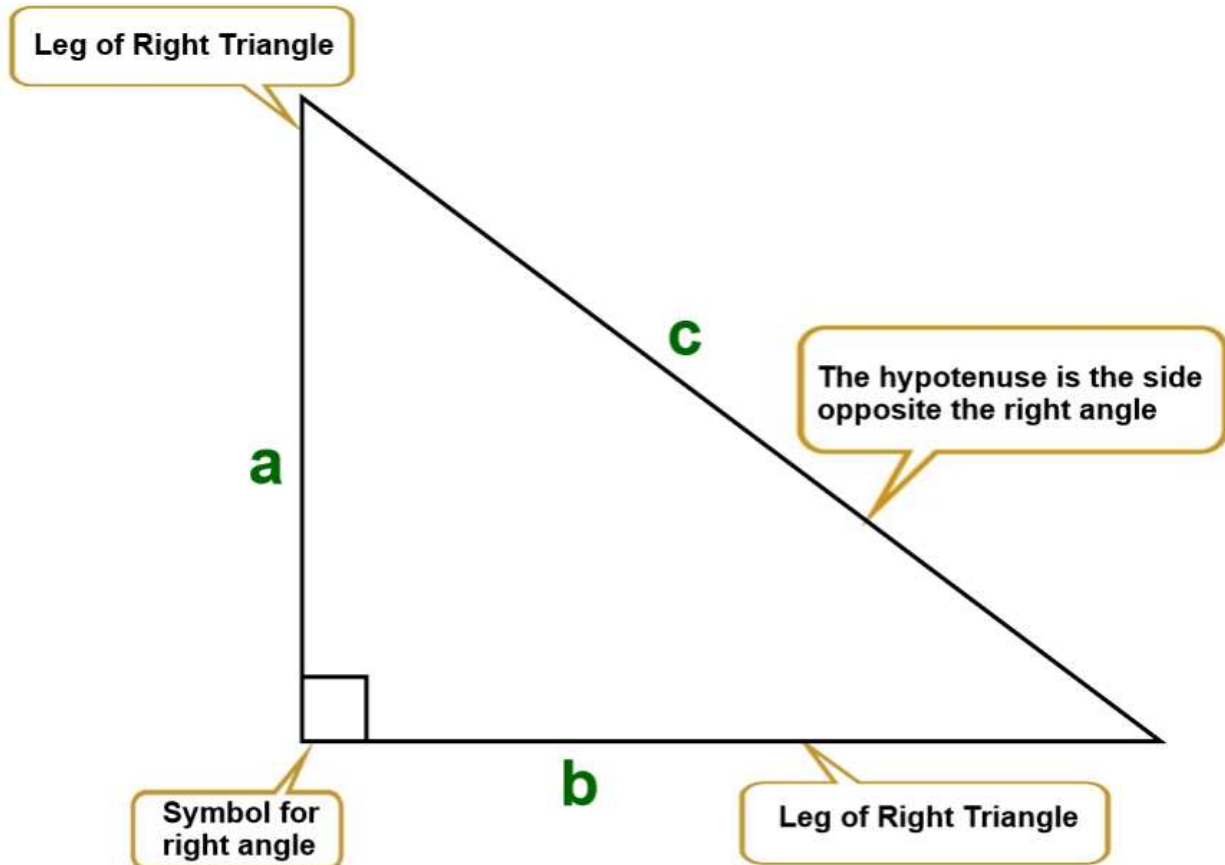
2. Calculate the total Surface Area of the object. The units of surface area are cm<sup>2</sup>. How many of each side are present in the triangular prism?

Surface Area =

3. Fold your net and tape it together to create a 3D triangular prism. Save this object for a later activity.

## Using the Pythagorean Theorem

You might need to use Pythagorean Theorem when solving for height or side lengths of the triangular faces of a triangular prism. You may remember this from an earlier math course. If not, here is a quick refresher.

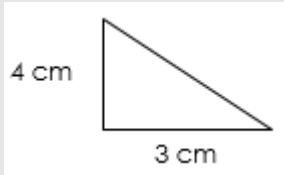


## Pythagorean Theorem

The Pythagorean Theorem describes the relationship between the lengths of the legs and the hypotenuse of a right triangle.

$$a^2 + b^2 = c^2$$

Example: Find the length of the unknown side.



$$\underline{a^2 + b^2 = c^2}$$

$$(3 \text{ cm})^2 + (4 \text{ cm})^2 = c^2$$

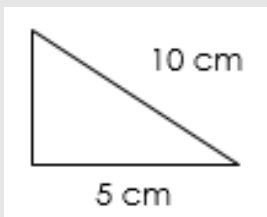
$$9 \text{ cm}^2 + 16 \text{ cm}^2 = c^2$$

$$25 \text{ cm}^2 = c^2$$

$$\sqrt{25 \text{ cm}^2} = \sqrt{c^2}$$

$$5 \text{ cm} = c \quad \text{*take the square root, } \sqrt{\text{, don't divide by 2}}$$

Example: Find the length of the unknown side.

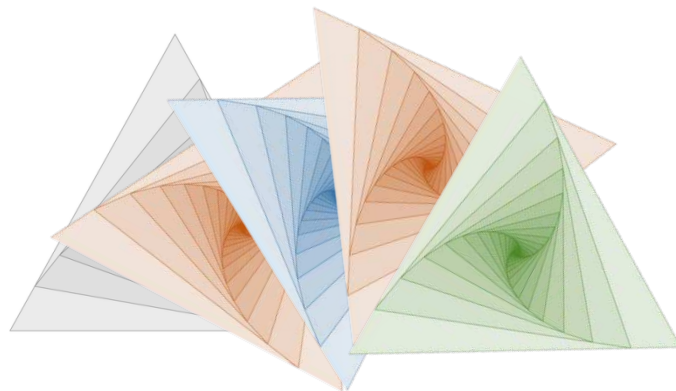


$$\underline{a^2 + b^2 = c^2}$$

$$(5 \text{ cm})^2 + b^2 = (10 \text{ cm})^2$$

$$25 \text{ cm}^2 + b^2 = 100 \text{ cm}^2$$

$$b^2 = 75 \text{ cm}^2$$

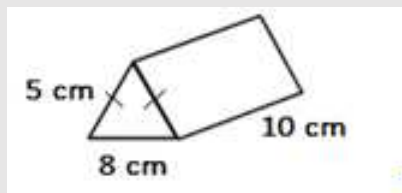


Sometimes, we are given information about a triangular prism but cannot measure the height of the triangle. In that case, we need to use Pythagoras in order to calculate the area of the two end faces.



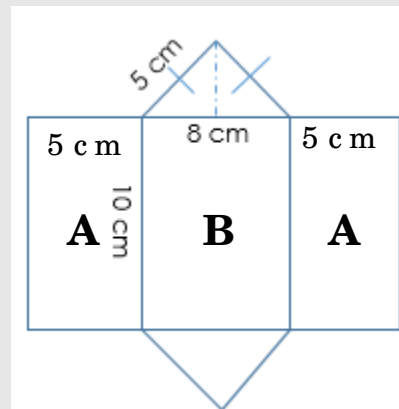
When you see short lines crossing two sides of a geometric figure, this means that the two sides are congruent, or equal.

Example: Calculate the Surface Area for the following object:

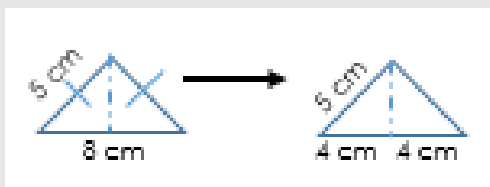


1.

First of all, we need to think about the net for this triangular prism and label the sides that we know:



The measurement that we don't know is the height of the triangular face. We can use Pythagoras to calculate it.



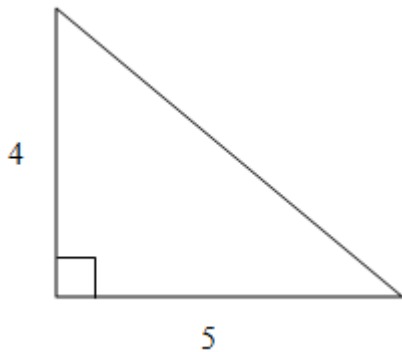
$$\begin{aligned}
 a^2 + b^2 &= c^2 \\
 (4 \text{ cm})^2 + b^2 &= (5 \text{ cm})^2 \\
 16 \text{ cm}^2 + b^2 &= 25 \text{ cm}^2 \\
 b^2 &= 9 \text{ cm}^2 \\
 b &= 3 \text{ cm}
 \end{aligned}$$

Side Measurements	Calculation	Answer for Area
<b>Face</b> 2 x triangular ends	$A = \frac{1}{2} \times \text{base} \times \text{height}$ $A = \frac{1}{2} (8 \text{ cm})(5 \text{ cm})$ $A = 20 \text{ cm}^2$	$2 \times 20 \text{ cm}^2$ $40 \text{ cm}^2$
<b>Face</b> 2 x Face A	$A = \text{side} \times \text{Height}$ $A = 5 \text{ cm} \times 10 \text{ cm}$ $A = 50 \text{ cm}^2$	$2 \times 50 \text{ cm}^2$ $100 \text{ cm}^2$
<b>Face</b> 1 x Face B	$A = \text{base} \times \text{Height}$ $A = 8 \text{ cm} \times 10 \text{ cm}$ $A = 80 \text{ cm}^2$	$80 \text{ cm}^2$
Total Surface Area		$220 \text{ cm}^2$

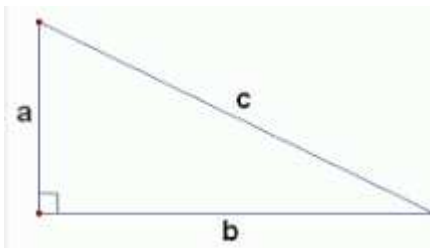


7.2B Practice Your Skills: Pythagoras

1. Find the length of the unknown side.

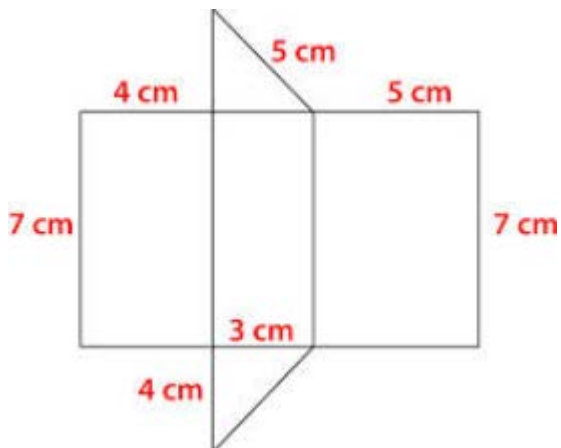


2. Find  $a$  if  $b = 13$  and  $c = 12$ .

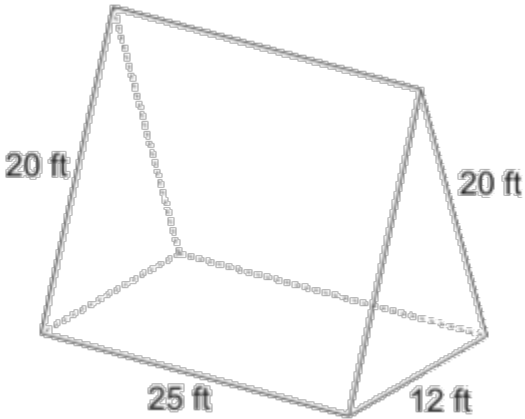


7.2B Practice Your Skills: Surface Area of Triangular Prisms

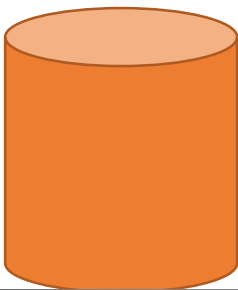
1. Calculate the surface area for the following triangular prism:



2. Calculate the surface area for the following triangular prism. (You will need to calculate the height of the end face triangle.)

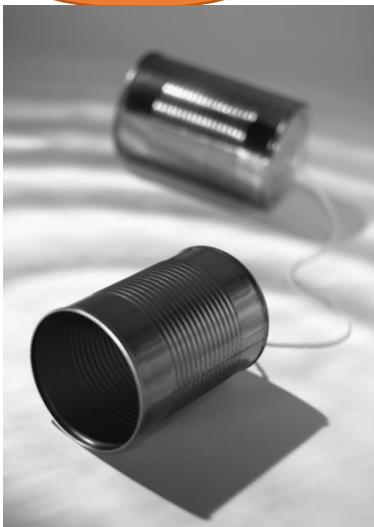


### C. Cylinder

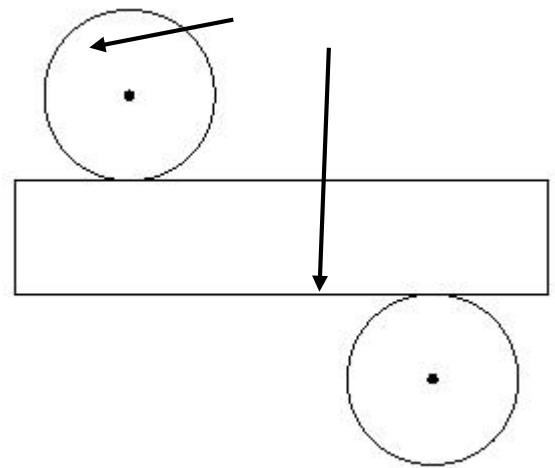


Where have you seen shapes that look like cylinders? Look around you. Can you identify some?

Cylinders are common shapes for packaging foods and beverages, pots and pans, glasses, and decorations. You can also see solid cylinders as magnets, coins, and batteries.

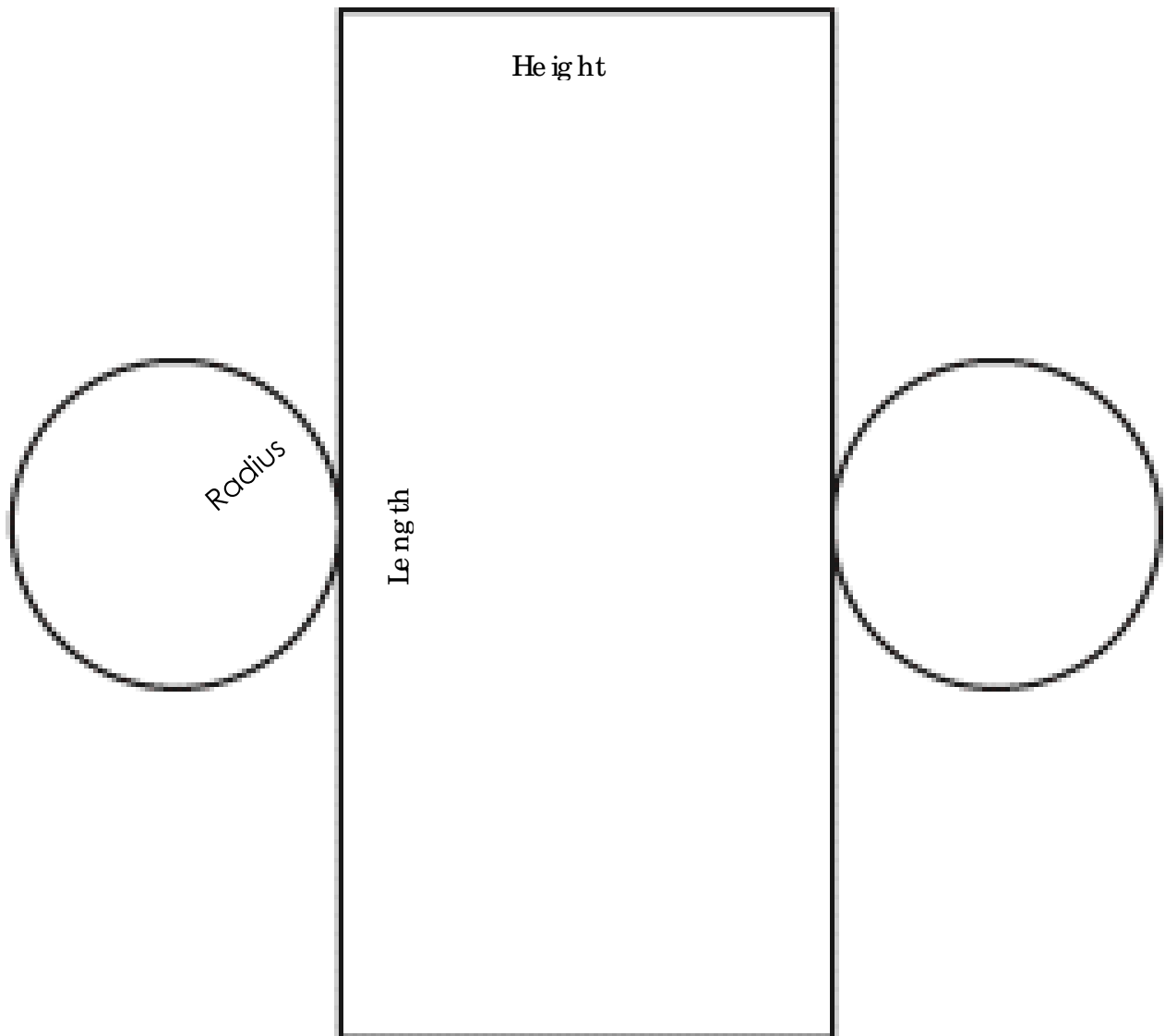


Unlike the other prisms, this shape gets its name from the Greek word that means 'to roll'. If we were to name it as a prism, what type would it be? Perhaps a circular prism, as its two end faces are circles. When you look at the net for a cylinder, you can clearly see those circular faces.



Build it: Cylinder

1. Look at the following net. Which faces are identical? Colour them the same colour. Those faces that are a different size colour a different colour.
2. Cut out the net that is given. You will be referring to it in the next section as well.
3. To find the area of the circles, measure the radius of one of them. The easiest way to do this is to measure the diameter and divide it by 2.



7.2C Practice Your Skills: Calculating Surface Area of a Cylinder

4. Calculate the area of each part of the cylinder you cut out.
- Measure each side to the closest 0.1 cm.
  - Round the calculated area of each face to the closest 0.1 cm<sup>2</sup>.

Radius –

Height –

Length –

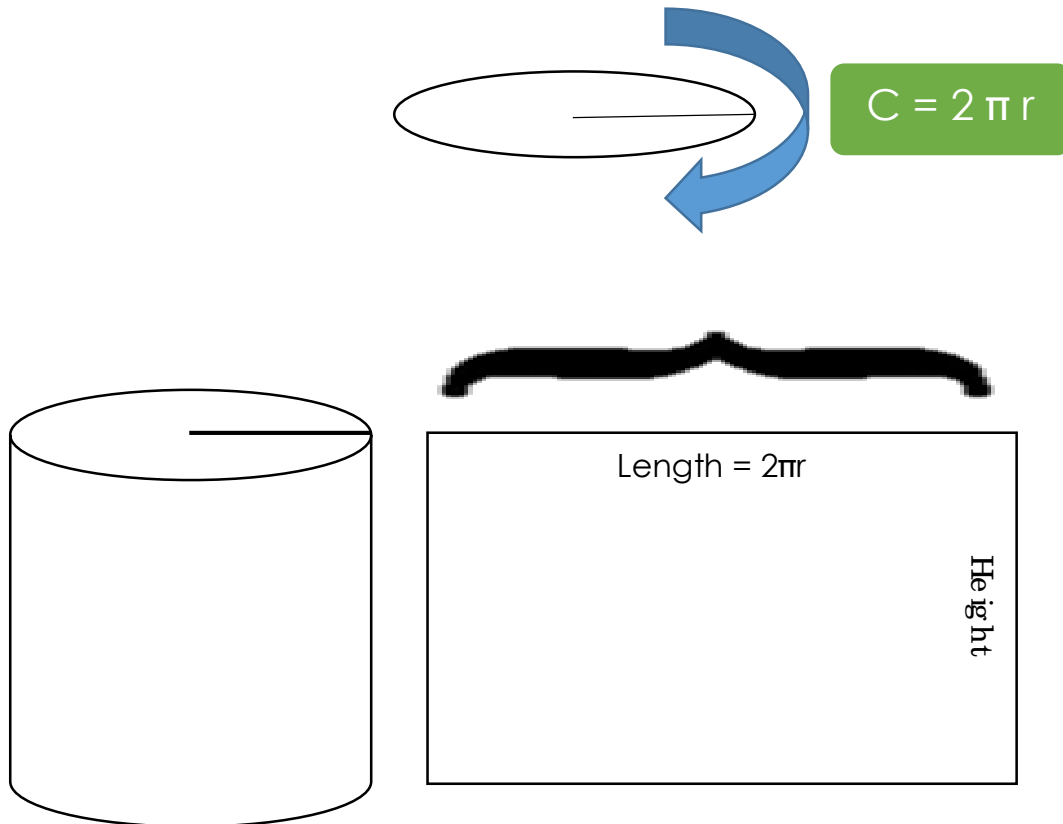
Side Measurements	Calculation	Answer for Area
<u>Face</u>		
<u>Face</u>		

5. Calculate the total Surface Area of the object. The units of surface area are cm<sup>2</sup>. How many of each side are present in the cylinder?

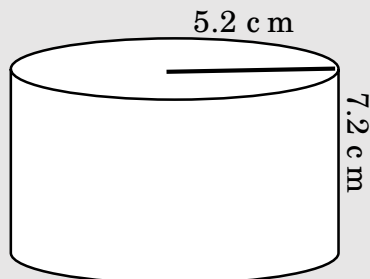
Surface Area =

6. Fold your net and tape it together to create a 3 Dimensional triangular prism. Save this object for a later activity.

Sometimes, you are not able to measure the Length of the curved face of a cylinder. Luckily, you can calculate it if you know the radius of the circle, as the curved face of a cylinder goes all the way around circle that is the top and bottom:



So, the length of the curved face of a cylinder is equal to the Circumference of the circular ends. In order to calculate the surface area of a cylinder, you only need two measurements – the radius and the height!

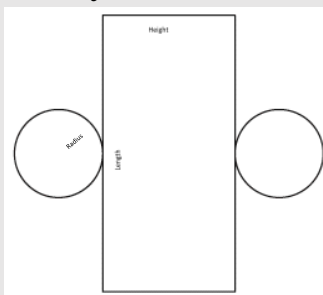


A cylinder is shown above. What is its surface area?

First record the radius and height.

- Radius ( $r$ ) – 5.2 cm
- Height – 7.4 cm

Then visualize the net for this cylinder.



The two end faces have the area:

$$\text{Area} = \pi r^2$$

$$\text{Area} = \pi(5.2 \text{ cm})^2$$

$$\text{Area} = 84.9 \text{ cm}^2$$

The length of the curved face equals the circumference of the end:

$$\text{Length} = 2\pi r$$

$$\text{Length} = 2\pi(5.2 \text{ cm})$$

$$\text{Length} = 32.7 \text{ cm}$$

The area of the curved face has an area of:

$$\text{Area} = \text{Length} \times \text{Height}$$

$$\text{Area} = 32.7 \text{ cm} \times 7.4 \text{ cm}$$

$$\text{Area} = 242.0 \text{ cm}^2$$

The Total Area of the cylinder equals the sum of all of the face areas:

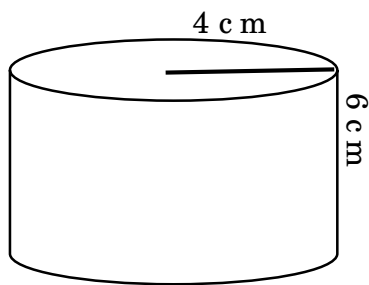
$$\text{Total Area} = 2 \times \text{Areas of Ends} + \text{Area of Curved Face}$$

$$\text{Total Area} = 2(84.9 \text{ cm}^2) + 242.0 \text{ cm}^2$$

$$\text{Total Area} = 411.8 \text{ cm}^2$$

7.2C Practice Your Skills: Surface Area of Cylinders

1. Calculate the surface area of the following object:



2. Calculate the surface area of the following barrel:





### 7.3 Volume

Volume is the amount of space a 3-dimensional object takes up. It is measured in units<sup>3</sup>. Volume is useful when deciding how much concrete needs to be poured to create a foundation for a shed, or how much rain a barrel can hold.

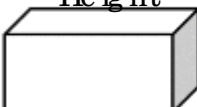
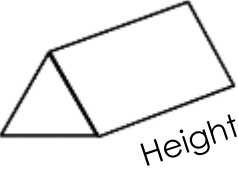
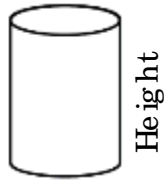
Volume and surface area are often confused. An example to help you understand the difference is when you think about wrapping a birthday present. The size of box you chose is determined by how much will fit inside of it – will it hold the present? This is when you think about its volume. The present has to fit into the interior of the box. Once you have chosen a box, then you need to worry about how much wrapping paper you need to cover it. Now you are thinking about its surface area.



There are formulae for various 3D figures so that we are able to figure out how much space each object takes up. Generally, though, you can think of:

$$\text{Volume of a prism} = \text{Area of the Base} \times \text{Height}$$

You have already been working with the Area of the Base, as it is simply the end face!

Shape	Image	Area of the Base	Volume formula
Rectangular Prism		Area = Length x Width $A = LW$	$V = LWH$
Triangular Prism		Area = $\frac{1}{2}(\text{base} \times \text{height})$ $A = \frac{1}{2}bh$	$V = \frac{1}{2}bhH$
Cylinder		Area = $\pi \times (\text{radius})^2$ Area = $\pi r^2$	$V = \pi r^2H$

## Calculating Volume

When you are calculating the volume of an object that is shaped like a prism, you need to calculate the area of its base and multiply that by its height.

**Example: Calculating the Volume of a Barrel**

You are given the following barrel to use as a rain barrel for your house.

- The barrel's height is 90 cm and its
- radius is 30 cm.

How much water will it hold?

First of all, you need to decide what shape the two end faces are. In this case, they are circles. Calculate the area of the end faces:

$$\begin{aligned}\text{Area of a Circle} &= \pi r^2 \\ \text{Area} &= \pi(30 \text{ cm})^2 \\ \text{Area} &= 2827.4 \text{ cm}^2\end{aligned}$$

Next, use the general formula:

$$\begin{aligned}\text{Volume} &= \text{Area of Base} \times \text{Height} \\ \text{Volume} &= (2827.4 \text{ cm}^2)(90 \text{ cm}) \\ \text{Volume} &= 254466 \text{ cm}^3\end{aligned}$$

This may not be a useful unit of volume for you! Some important conversion factors for you are:

$$\begin{aligned}1 \text{ cm}^3 &= 1 \text{ mL} \\ 1000 \text{ mL} &= 1 \text{ L}\end{aligned}$$

In this example, then:

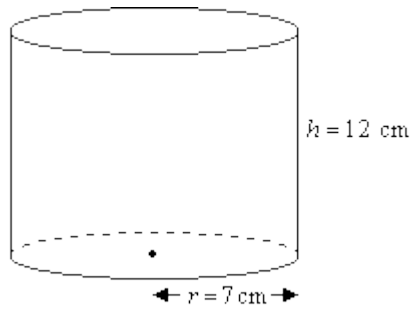
$$254466 \text{ cm}^3 \times \frac{1 \text{ mL}}{1 \text{ cm}^3} \times \frac{1 \text{ L}}{1000 \text{ mL}} = 254.466 \text{ L, or } 254.5 \text{ L}$$

So this rain barrel would hold 254.5 L of rain water.

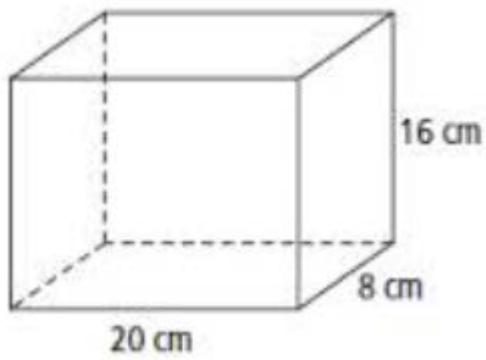
7.3 Practice Your Skills: Calculating Volume

Find the volume of the following objects.

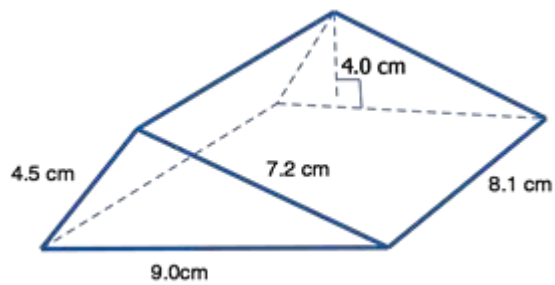
1.



2.



3.



## 7.4 Composite Figures

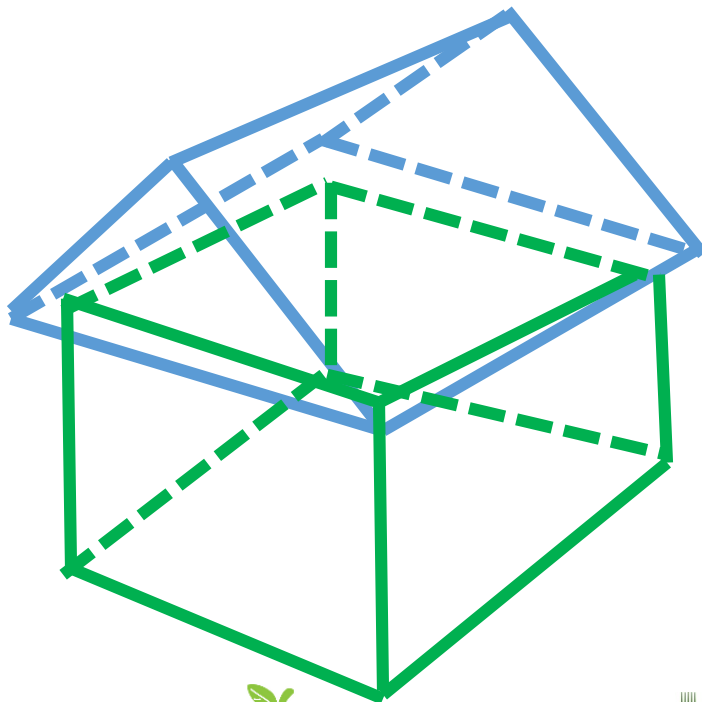
Most objects around us are not a perfect prism. They are usually a mixture of two or more object shapes. Look at this dog house, it is a combination of a triangular prism and a rectangular prism:



Sometimes, you need to know the volume of a composite figure. Other times, you need to know the surface area of the figure.

If you need to know the volume of this dog house to see if your dog would fit inside, you could simply calculate the volume of each prism and add them together.

$$\text{Total Volume} = \text{Volume of Rectangular Prism} + \text{Volume of Triangular Prism}$$



If you needed to know how much paint you need for this dog house, the calculation is not so straightforward. Some of the surfaces of the triangular prism and rectangular prism are not surfaces of the dog house to paint. Can you see which surfaces you need to count

## Calculating Surface Area and Volume for Composite Figures

What objects are used to create a new object? Sometimes it is two different types, and other times it is a combination of many objects that are the same.

You have decided to put concrete pillars at the front of your house. How much concrete will you need for each one? How much paint will you need to paint each one? The radius of the column is 0.5 ft, and it is 10 ft tall. The blocks on the top and bottom of the columns are 1.5 ft x 1.5 ft and are each 0.5 ft thick.

First of all, identify what the question is asking us to calculate.

- The amount of concrete is the volume.
- The amount of paint is the surface area.
- The column is a composite figure including:
  - 2 rectangular prisms
  - 1 cylinder
- Cylinder Measurements:
  - Radius = 0.5 ft
  - Height = 10 ft
- Rectangular Prism Measurements:
  - Length = 1.5 ft
  - Width = 1.5 ft
  - Height = 0.5 ft

Calculating Volume:

Volume of the cylinder:

$$\text{Volume} = \text{Area of the Base} \times \text{Height}$$

$$\text{Volume} = \pi r^2 \times \text{Height of the column}$$

$$\text{Volume} = \pi(0.5 \text{ ft})^2 (10 \text{ ft})$$

$$\text{Volume} = 7.9 \text{ ft}^3$$

Volume of each block:

$$\text{Volume} = \text{Area of the Base} \times \text{Height}$$

$$\text{Volume} = \text{Length} \times \text{Width} \times \text{Height of the block}$$

$$\text{Volume} = (1.5 \text{ ft})(1.5 \text{ ft})(0.5 \text{ ft})$$

$$\text{Volume} = 1.125 \text{ ft}^3 \sim 1.1 \text{ ft}^3$$

$$\text{Total Volume} = \text{Volume of Cylinder} + 2 \times \text{Volume of Block}$$

$$\text{Total Volume} = 7.9 \text{ ft}^3 + 2(1.1 \text{ ft}^3)$$



Calculating Surface Area:

Visualize the nets of the objects involved and decide which faces will be painted. Remember there are two blocks – 1 at the top and 1 at the bottom!



Calculating Area:

Area of the curved face of the cylinder:

$$\text{Area} = \text{Length} \times \text{Height}$$

$$\text{Area} = 2\pi rH$$

$$\text{Area} = 2\pi(0.5 \text{ ft})(10\text{ft})$$

$$\text{Area} = 314.2 \text{ ft}^2$$

Area of the sides of the blocks:

$$\text{Area} = \text{Length} \times \text{Height}$$

$$\text{Area} = 1.5 \text{ ft} \times 0.5 \text{ ft}$$

$$\text{Area} = 0.75 \text{ ft}^2 \sim 0.8 \text{ ft}^2$$

Area of the top of the block:

$$\text{Area} = \text{Length} \times \text{Width}$$

$$\text{Area} = 1.5 \text{ ft} \times 1.5 \text{ ft}$$

$$\text{Area} = 2.25 \text{ ft}^2 \sim 2.3 \text{ ft}^2$$

Area of the circle:

$$\text{Area} = \pi r^2$$

$$\text{Area} = \pi(0.5 \text{ ft})^2$$

$$\text{Area} = 0.8 \text{ ft}^2$$

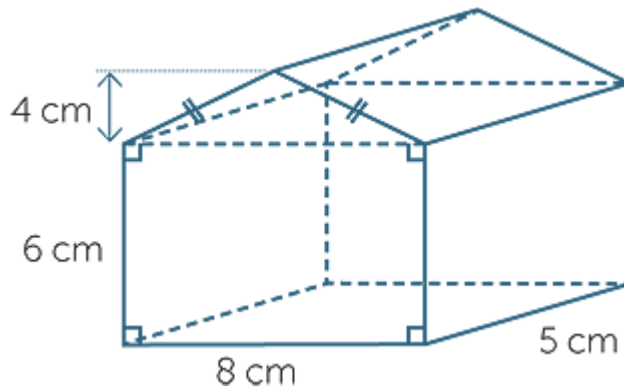
**Surface Area = Curved Face + 8(Block Side) + 2(Block Top) – 2 Circles**

$$\text{Total Surface Area} = 314.2 \text{ ft}^2 + 8(0.8 \text{ ft}^2) + 2(2.3 \text{ ft}^2) - 2(0.8 \text{ ft}^2)$$

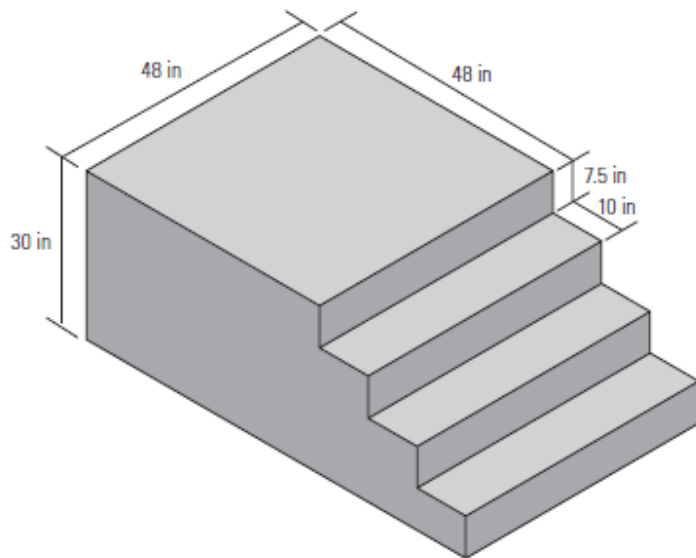
$$\text{Total Surface Area} = 323.6 \text{ ft}^2$$

7.4 Practice Your Skills: Surface Area and Volume of Composite Figures  
Find the surface area AND volume of the following composite figures:

1.



2. Below are the dimensions for the stairs of your front porch that you plan to put in. How much concrete do you need in order to construct the stairs? Imagine you wanted to paint the stairs. How much paint would you need to paint each side that's showing?





## Student Evaluation

Insufficient Evidence (IE)	Developing (D)	Growing (G)	Proficient (P)	Exceptional (E)
<i>Student has not demonstrated the criteria below.</i>	<i>Student has rarely demonstrated the criteria below.</i>	<i>Student has inconsistently demonstrated the criteria below.</i>	<i>Student has consistently demonstrated the criteria below.</i>	<i>Student has consistently demonstrated the criteria below. In addition they have shown their understanding in novel situations or at a higher level of thinking than what is expected by the criteria.</i>

Proficient Level Criteria	IE	D	G	P	E
<b>M21.1 Extend and apply understanding of the preservation of equality by solving problems that involve the manipulation and application of formulae within home, money, recreation, and travel themes.</b>					
b. I can describe, using examples, how a given formula is used in a home setting.					
c. I can create, solve, and verify the reasonableness of solutions to questions that involve a formula.					
e. I can solve questions that involve the application of a formula.					
<b>M21.7 [FM20.3] Demonstrate and extend understanding of similarity and proportional reasoning related to scale factors, scale drawing, scale models, surface area, and volume.</b>					
h. I can explain the effect of a change in scale factor on the area of a 2-D shape or the surface area or volume of a 3-D object.					
k. I can pick up a 3-D object and identify, describe and sketch top, front, and side views.					
l. I can look at nets of 3-D objects to determine if they represent a given object and explain the reasoning.					
m. I can make models of 3-D objects, given the top, bottom and side views.					
o. I can describe the relationship between the area, the base and the volume of a 3-D object.					
p. I can solve 'real life' application questions involving the volume and surface area of prisms, cylinders and related composite figure, for example, "How much soil do I need for my garden bed?" initiate					

### Learning Log

Date	Starting Point	Ending Point	