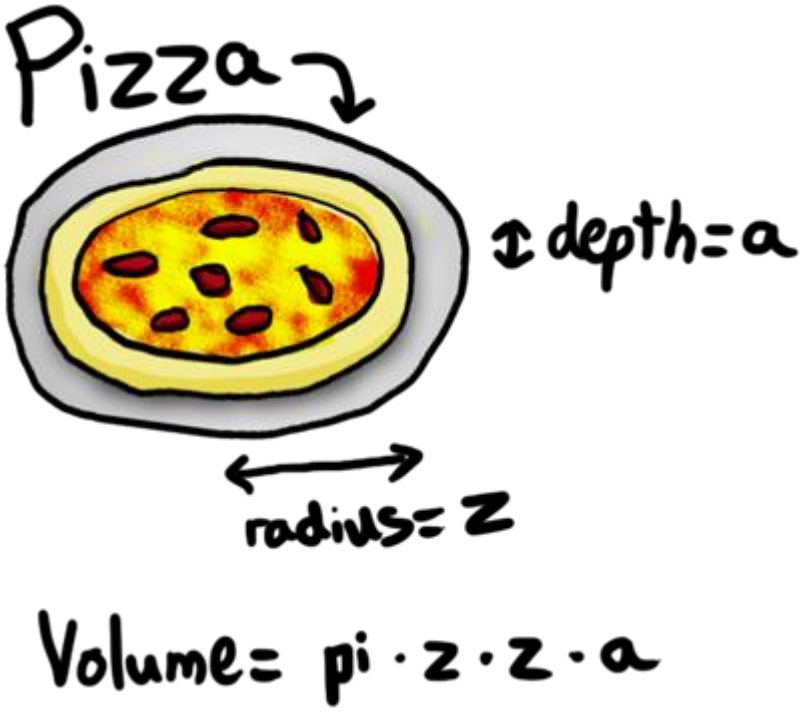
Name: _____

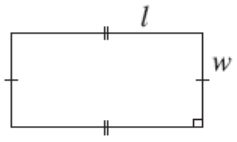
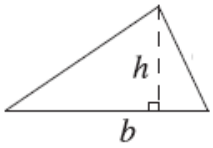
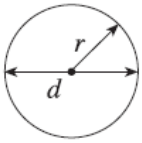
Unit 3 – Surface Area and Volume



3.1 Areas of 2D Figures – Part 1

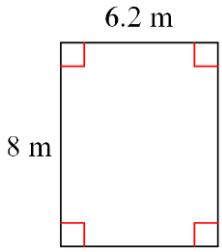
The **area** of a shape is the size of its surface. You can also think of this as how much paint would cover the shape. We use square units for area, such as _____, _____, _____ etc.

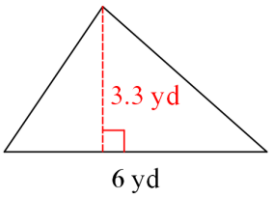
We will start by finding the area of simple shapes such as rectangles, triangles and circles, as these are the building blocks of other shapes. We find these areas using these formulas:

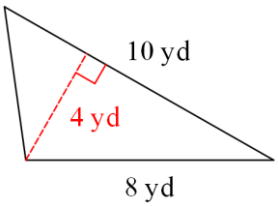
2D Figure	Rectangle 	Triangle 	Circle 
Area	$A = lw$	$A = \frac{bh}{2}$	$A = \pi r^2$

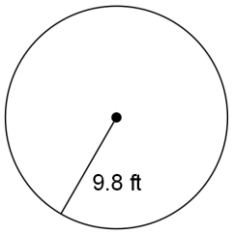
Examples

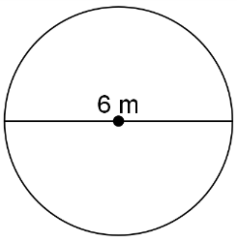
Ex 1. Find the area of each. Round to the nearest tenth where necessary.

a) 

b) 

c) 

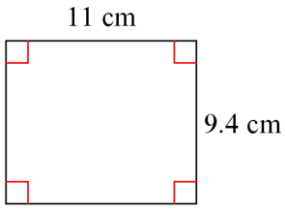
d) 

e) 

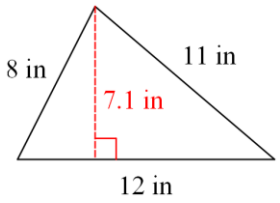
3.1 Practice – Part 1

1. Find the area of each of the following shapes. Round to the nearest tenth where necessary.

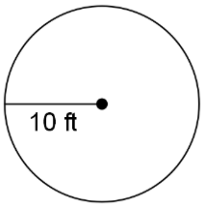
a)



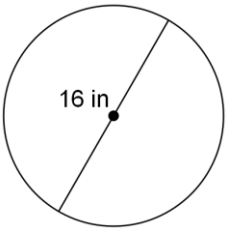
b)



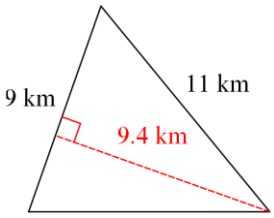
c)



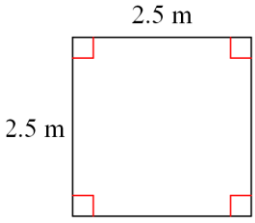
d)



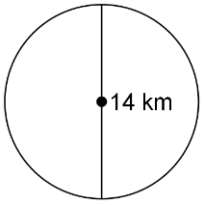
e)



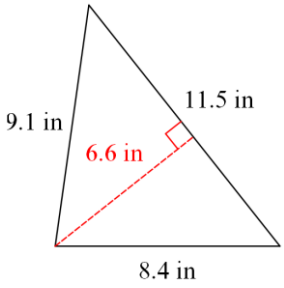
f)



g)



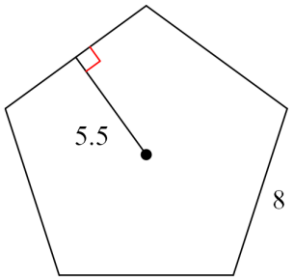
h)



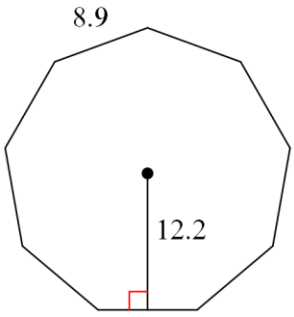
3.1 Areas of 2D Figures – Part 2

Ex 2. Find the area of each **regular polygon** (a shape where all sides are equal length and all angles are equal in measure) by breaking it into more simple shapes. Round to the nearest tenth where necessary.

a)



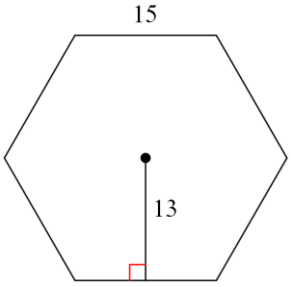
b)



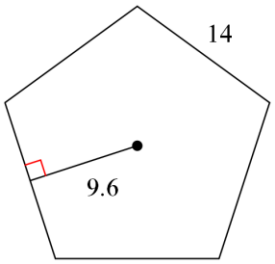
3.1 Practice – Part 2

2. Find the area of each regular polygon.

a)



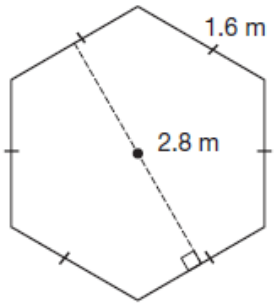
b)



3. A loonie looks like a regular polygon with 11 sides. It is called a hendecagon. What is the area of a loonie if the length of a side is 7.9 mm and the distance from a side to the middle of the coin is 13.3 mm? Round to the nearest mm^2.

4. Lionel wants to stain the floor of his gazebo that is shaped like a regular hexagon, as shown. The label on a can of stain says that 1 L covers about 6 m^2.

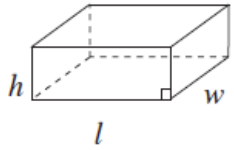
   a) What is the area of the floor of the gazebo?



   b) How many cans must he purchase if he wants 2 coats of stain?

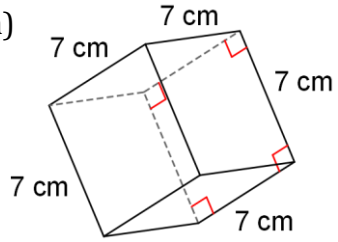
3.2 Surface Areas of Prisms and Pyramids – Part 1

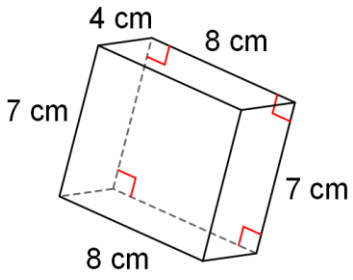
The **surface area** of a 3-dimensional figure is the total area of its surface. Since the **faces** of a 3D figure are made up of the basic shapes we looked at in 3.1, all we have to do is find the area of these faces and _____ them together.

3D Figure	Surface Area	What shapes are the faces?
Rectangular Prism 	$SA =$ sum of areas of all faces	

Examples

Ex 1. Find the surface area of each of the following.

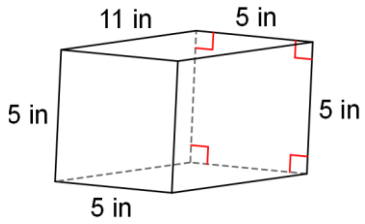
a) 

b) 

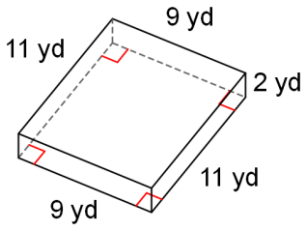
3.2 Practice - Part 1

1. Find the surface area of each of the following. Show your work.

a)

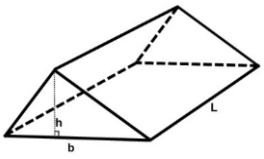
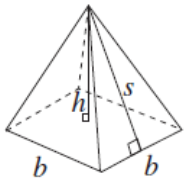


b)

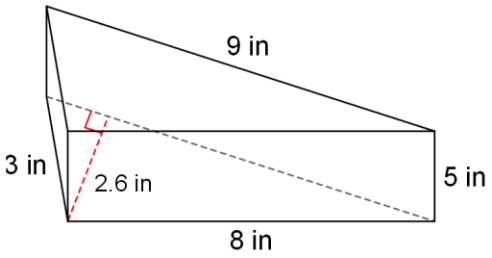


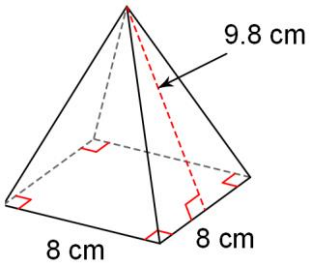
2. A toy block manufacturer needs to cover its wooden blocks with a non-toxic paint. The blocks are square-based pyramids with a base length of 2 in and a slant height of 3 ½ in. There are 10 000 blocks. If each container of paint covers 3000 in^3, how many containers of paint are required?

3.2 Surface Areas of Prisms and Pyramids – Part 2

3D Figure	Surface Area	What shapes are the faces?
Triangular Prism 	SA = sum of areas of all faces	
Square-Based Pyramid 	SA = sum of areas of all faces OR $SA = b^2 + 2bs$	

Ex. 1

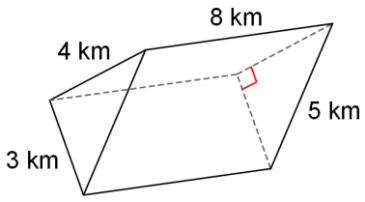
c) 

d) 

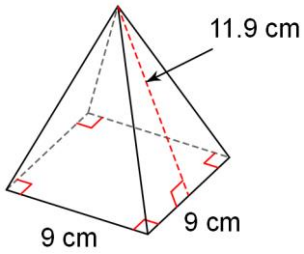
3.2 Practice - Part 1

3. Find the surface area of each of the following. Show your work.

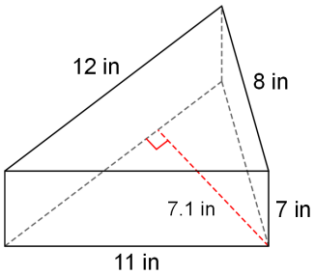
b)



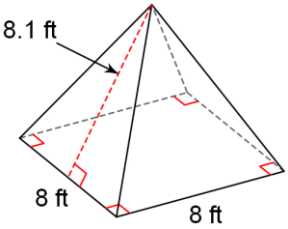
c)



e)

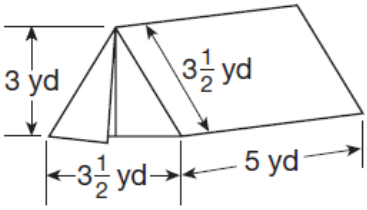


f)



4. Manny wants to make an enclosed tent with these dimensions. The two sides and the bottom are rectangular. The ends are triangular.

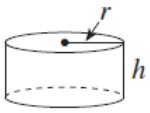
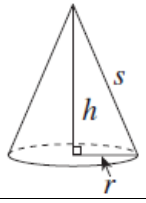
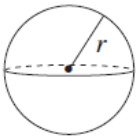
   a) How much canvas fabric would he have to buy?



   b) If canvas costs \$4.89/yd^2, how much will the fabric cost to make the tent?

3.3 Surface Areas of Cylinders, Cones and Spheres

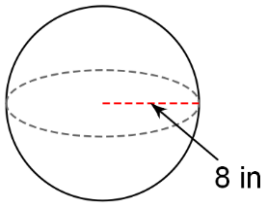
It is more difficult to find the areas of the faces of cylinders, cones and spheres, so you will be given these formulas:

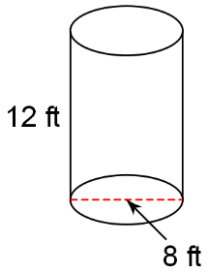
3D Figure	Surface Area
Cylinder 	$SA = 2\pi r^2 + 2\pi rh$
Cone 	$SA = \pi r^2 + \pi rs$
Sphere 	$SA = 4\pi r^2$

Use the pi (π) button on your calculator. If you don't have one, you can use the approximation $\pi \cong 3.14$, but your answers may be off slightly from the given correct answers.

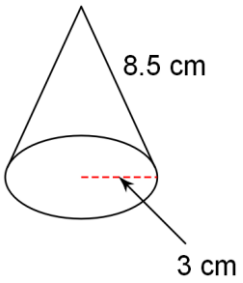
Examples

Ex 1. Find the surface area of each of the following. Round to the nearest hundredth.

a) 

b) 

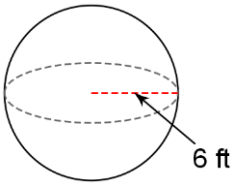
c)



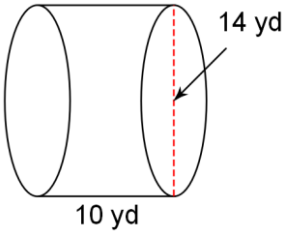
3.3 Practice

1. Find each surface area. Round to the nearest hundredth.

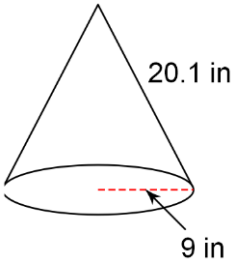
a)



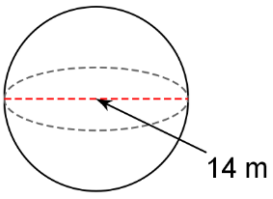
b)



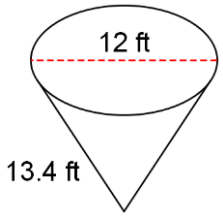
c)



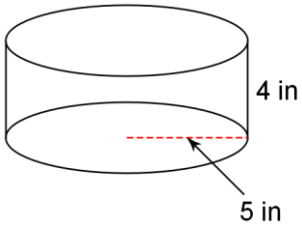
d)



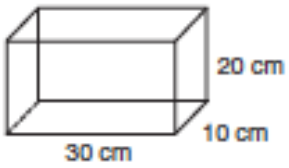
e)

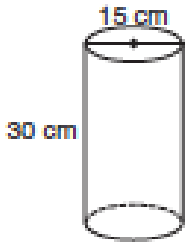


f)



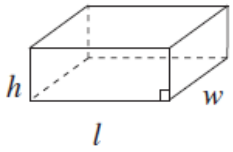
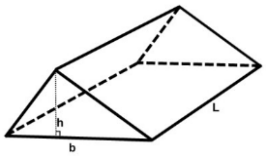
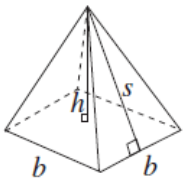
2. Trish painted two objects with dimensions shown. Find how much paint was needed for each and which shape required more paint. Round to the nearest hundredth where necessary.





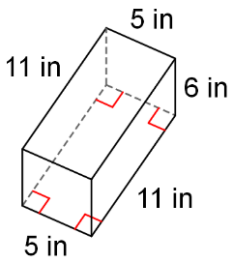
3.4 Volumes of Prisms and Pyramids

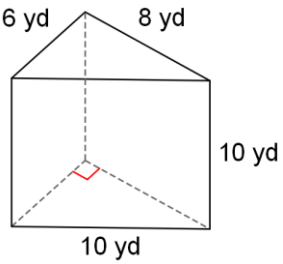
The **volume** of a 3-dimensional figure is the amount of space it takes up. To find the volume, we find the _____ and multiply it by the _____ of the object. We use cubic units for volume, such as _____, _____, _____ etc.

3D Figure	Volume
Rectangular Prism 	$V = A_{\text{rectangle base}} \times \text{height}$ OR $V = lwh$
Triangular Prism 	$V = A_{\text{triangle base}} \times \text{height}$
Square-Based Pyramid 	$V = \frac{1}{3} \times A_{\text{square base}} \times \text{height}$ OR $V = \frac{1}{3}b^2h$

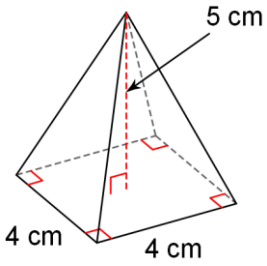
Examples

Ex 1. Find the volume of each of the following.

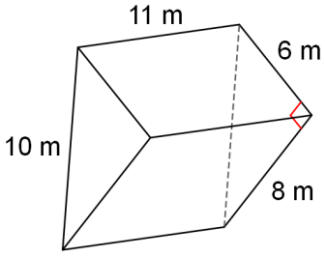
a) 

b) 

c)



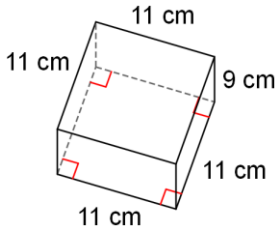
d)



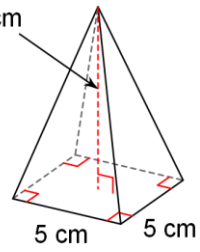
3.4 Practice

1. Find the volume of each of the following. Round to the nearest hundredth where necessary.

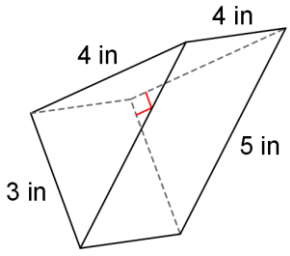
a)



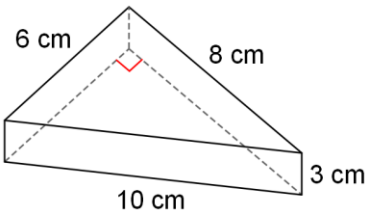
b)



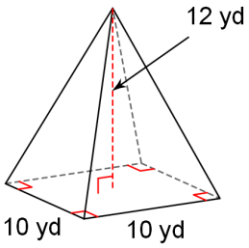
c)



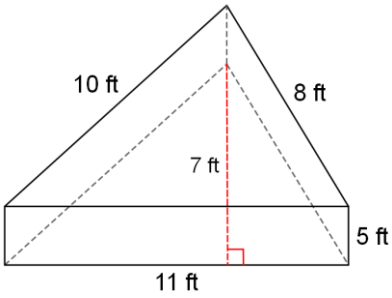
d)



e)



f)

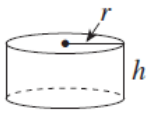
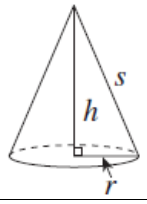
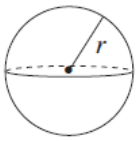


2. Alfred has a bulk container that holds 3600 in^3 of dog biscuits. He plans to sell the biscuits in small boxes that measure 5 in. by 8 in. by 6 in. How many whole boxes will he need to sell all the dog biscuits?

3. A garden bed is 4 ft by 3 ft, and a 6 inch layer of soil will be spread over the garden. A bag of soil contains 2 ft^3. How many bags are needed to cover the garden?

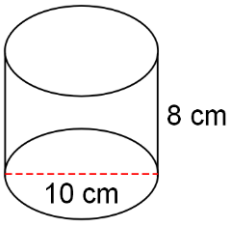
3.5 Volumes of Cylinders, Cones and Spheres

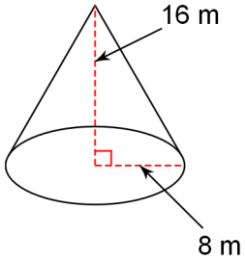
We will use these formulas to find the volumes of cylinders, cones and spheres.

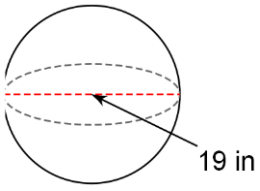
3D Figure	Volume
Cylinder 	$V = A_{\text{circle base}} \times \text{ height}$ OR $V = \pi r^2 h$
Cone 	$V = \frac{1}{3} \times A_{\text{circle base}} \times \text{height}$ OR $V = \frac{1}{3}\pi r^2 h$
Sphere 	$V = \frac{4}{3}\pi r^3$

Examples

Ex 1. Find the volume of each of the following. Round to the nearest hundredth.

a) 

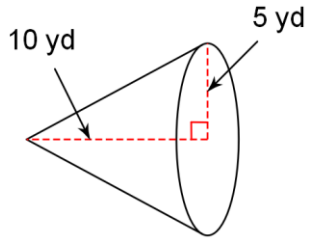
b) 

c) 

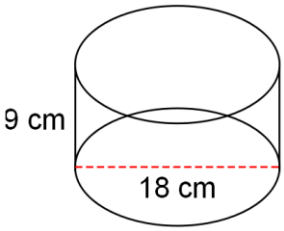
3.5 Practice

1. Find the volume of each of the following. Round to the nearest hundredth.

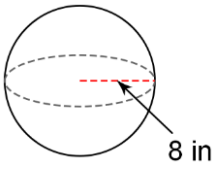
a)



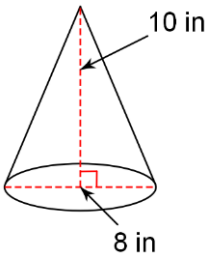
b)



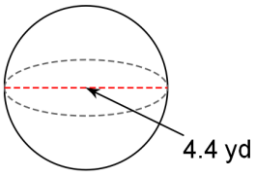
c)



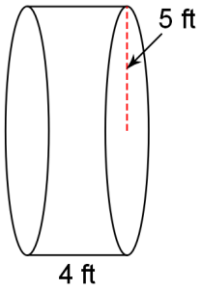
d)



e)



f)



2. A farmer unloaded grain onto a tarp. The grain formed a cone-shaped pile that he estimated to have a diameter of 12 ft and a height of 8 ft. Estimate the volume of the grain pile. Round to the nearest tenth.

3. In the rainforests of Vancouver Island, there are spherical treehouses for rent. They are called Free Spirit Spheres. One in particular has an inside diameter of 3.15 m. Find the volume of its living area, to the nearest tenth.

4. A pail of cookie dough is cylindrical, with diameter 17 cm and height 13 cm. A scoop makes a sphere of cookie dough with diameter 5 cm. About how many cookies can be made from this pail of dough?

5. A waffle cone has a height of 5 in and a base diameter of 2 in. How much ice cream can the cone hold, assuming the ice cream is level with the top of the cone? Round to the nearest in^3.

ANSWERS

Section 3.1

1. a) 103.4 cm^2
   b) 42.6 in^2
   c) 314.2 ft^2
   d) 201.1 in^2
   e) 42.3 km^2
   f) 6.25 m^2
   g) 153.9 km^2
   h) 37.95 in^2
2. a) 585
   b) 336
3. 578 mm^2
4. a) 6.72 m^2
   b) 3 cans

Section 3.2

1. a) 270 in^2
   b) 108 km^2
   c) 295.2 cm^2
   d) 278 yd^2
   e) 302.2 in^2
   f) 193.6 ft^2
2. a) 63 yd^2
   b) $308.07
3. 60 containers

Section 3.3

1. a) 452.39 ft^2
   b) 747.70 yd^2
   c) 822.78 in^2
   d) 615.75 m^2
   e) 365.68 ft^2
   f) 282.74 in^2
2. Rectangular prism: 2200 cm^2
   Cylinder: 1767.15 cm^2
   Rectangular prism required more paper.

Section 3.4

1. a) 1089 cm^3
   b) 66.67 cm^3
   c) 24 in^3
   d) 72 cm^3
   e) 400 yd^3
   f) 192.5 ft^3
2. 15 boxes
3. 3 bags

Section 3.5

1. a) 261.80 yd^3
   b) 2290.22 cm^3
   c) 2144.66 in^3
   d) 167.55 in^3
   e) 44.60 yd^3
   f) 314.16 ft^3
2. 301.6 ft^3
3. 16.4 m^3
4. 45 cookies
5. 5 in^3