CHAPTER 5

Surface Area

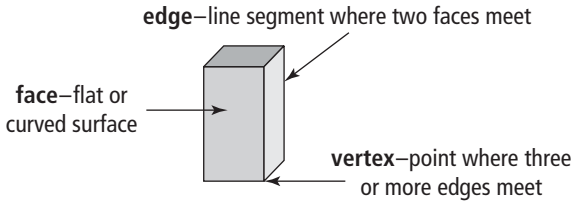
Name: _____ Date: _____

Get Ready

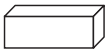
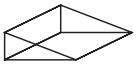
Three-Dimensional Objects

FOLDABLES™ Study Tool

three-dimensional (3-D)
- an object that has length, width, and height
- you can describe a 3-D object by its **faces**, **edges**, and **vertices**



1. Write the name and the number of edges, faces, and vertices for each object.

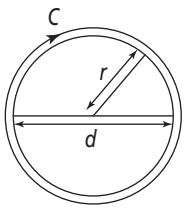
Object	Name	Faces	Edges	Vertices
				
				
				

Circles

FOLDABLES™ Study Tool

radius
- the distance from the centre of the circle to the outside edge
- r shows the radius
- the radius is half the diameter: $r = d \div 2$ *or* $r = \frac{d}{2}$

diameter
- the distance across a circle through its centre
- d shows the diameter
- the diameter is twice the radius: $d = 2 \times r$ *or* $d = 2r$



circumference
- the distance around a circle (the perimeter)
- C shows the circumference
- $C = 2 \times \pi \times r$ *or* $C = \pi \times d$

π is about 3.14

area
- the number of square units needed to cover a two-dimensional shape
- A shows the area
- $A = \pi \times r^2$ *or* $A = \pi r^2$

r^2 means $r \times r$

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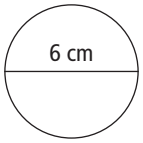
2. Find the circumference of each circle to the nearest tenth (one decimal place).

a)

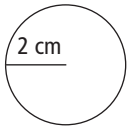


$C = \pi \times d$

$= 3.14 \times$ _____

$=$ _____ cm

b)



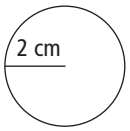
$C = 2 \times \pi \times r$

$= 2 \times$ _____ $\times$ _____

$=$ _____

3. Find the area of each circle to the nearest tenth (one decimal place).

a)



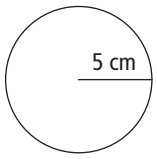
$A = \pi \times r^2$

$A = \pi \times r \times r$

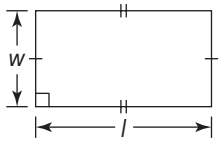
$=$ _____ $\times$ _____ $\times$ _____

$=$ _____ cm^2

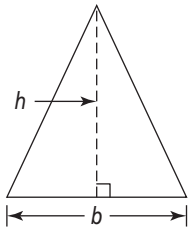
b)



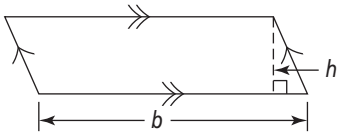
Area Formulas



Area of a rectangle = $l \times w$

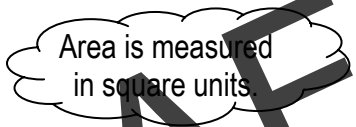


Area of a triangle = $b \times h \div 2$

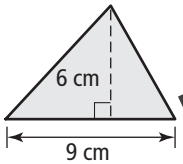


Area of a parallelogram = $b \times h$

4. Find the area of each shape.



a)

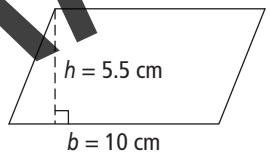


$A = b \times h \div 2$

$=$ _____ $\times$ _____ $\div 2$

$=$ _____

b)



$A = b \times h$

$=$ _____ $\times$ _____

$=$ _____

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MATH LINK

City Planning

When city planners design communities, they think about many things, such as:

- types of buildings
- width of streets
- where to put bus stops

Imagine you are a city planner for a miniature community.

Literacy Link

miniature

- a small version of something

1. A community needs different buildings. For example, food stores, banks, and hospitals are often on the main street of a community.

Use the table to organize information about the buildings a community needs.

Type of Building	Where the Building Is Located in the Community	Shapes of Its Faces
Bank	main street	square, rectangle

Discuss your answers to #1 with a partner. Then, share your ideas with the class.

2. What else does a community need? (e.g., streets, fire hydrants, and telephone wires)

_____

_____

3. Imagine you are in an airplane. Using grid paper, sketch part of an aerial view of a community. Draw the buildings, roads, and any other features from #2 that are important.

Aerial means from the air or from above.

Name: _____ Date: _____

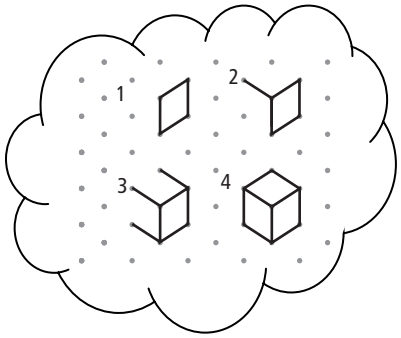
5.1 Warm Up

1. Draw a square and a rectangle.

a) square

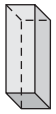
b) rectangle

2. Use isometric dot paper to make it easier to draw 3-D shapes. Follow the steps to draw each solid.



a) cube

b) rectangular prism



3. Draw the top, front, and side view of your cube and rectangular prism.

a) cube

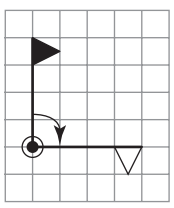
top front side

b) rectangular prism

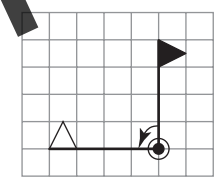
top front side

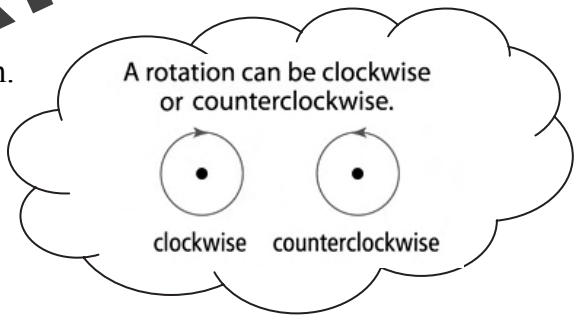
4. Circle the diagram that shows a 90° clockwise rotation.

a)



b)





Name: _____ Date: _____

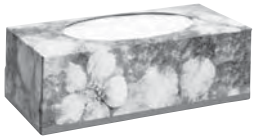
5.1 Views of Three-Dimensional Objects

A 3-D object has length, width, and height.

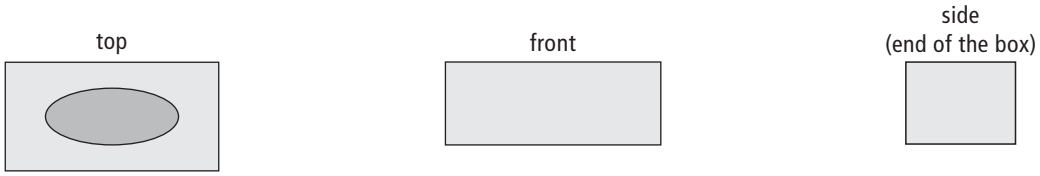
Working Example 1: Draw and Label Top, Front, and Side Views

Draw the top, front, and side view of each item.
Label each view.

a) Tissue box

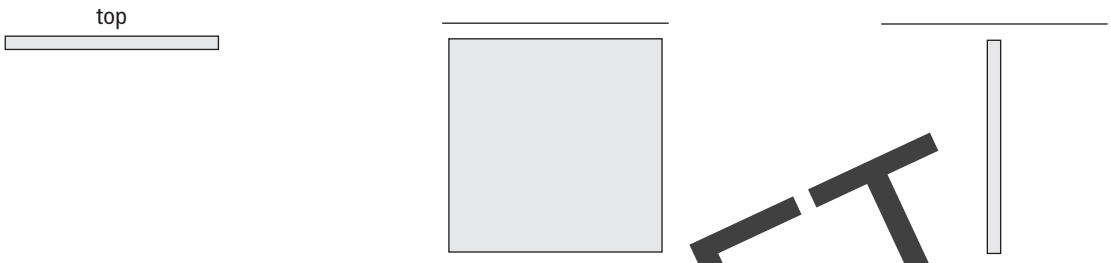


Solution



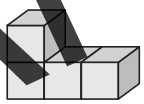
b) Compact disc case

Solution



Show You Know

Draw the top, front, and side views of this object.



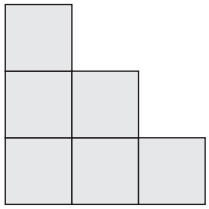
top front side

Name: _____ Date: _____

Working Example 2: Sketch a Three-Dimensional Object When Given Views

An object made of six blocks has these views.
Sketch the object.

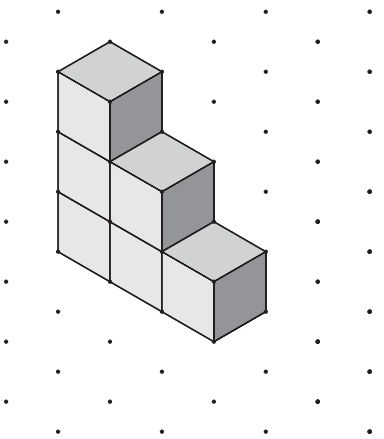

top


front


side

Solution

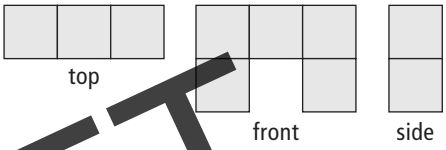
Sketch the object on isometric paper.



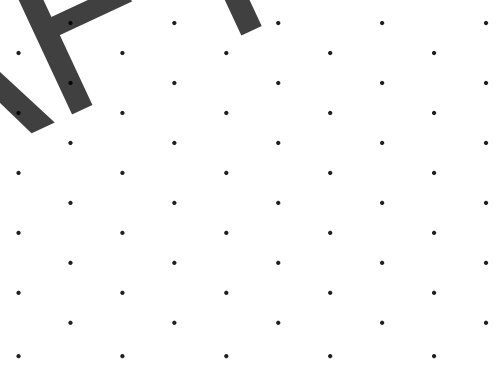
Draw the same object on the grid.

Show You Know

An object is made using five blocks.
The top, front, and side views are shown.


top front side

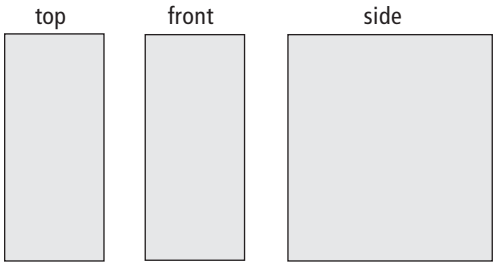
Sketch the object on isometric dot paper.



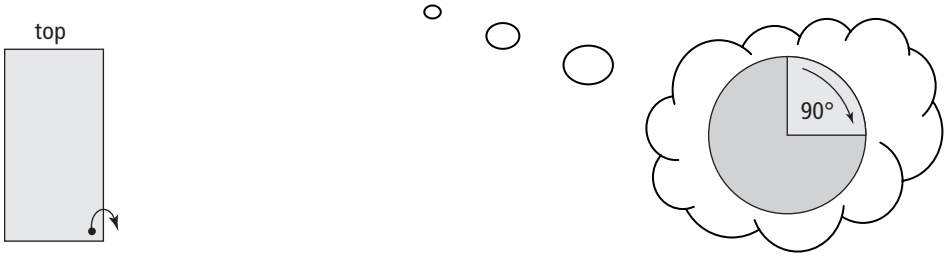
Name: _____ Date: _____

Working Example 3: Predict and Draw the Top, Front, and Side Views After a Rotation

The diagrams show the top, front, and side views of a computer tower.



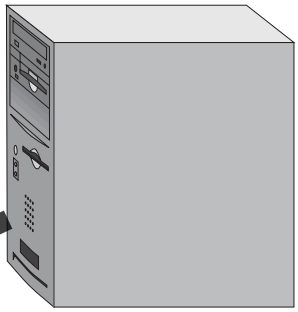
Rotate the computer tower 90° clockwise on its base.



a) Which view will become the new front view after the rotation?

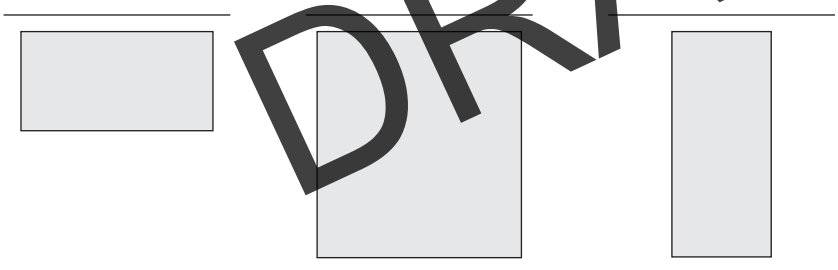
Solution

The side view will become the new front view after rotation.



b) Label the top, front, and side views after rotating the tower.

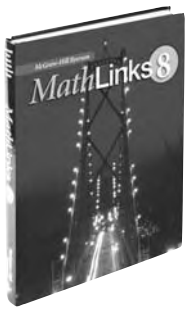
Solution



Name: _____ Date: _____

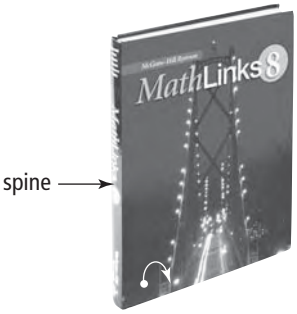
Show You Know

Stand a book on your desk.



a) Draw the top, front, and side views.

b) Rotate the book 90° clockwise around its spine.
What will the top, front, and side views look like?



The _____ view will only change its position after the rotation.

The _____ view will become the *side* view after the rotation.

The _____ view will become the *front* view after the rotation.

c) Draw the top, front, and side views after rotating the book.

top | front | side

Name: _____ Date: _____

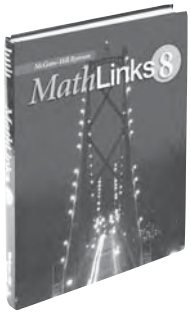
Communicate the Ideas

1.

front

top

side



Are these views of a book correct? Circle YES or NO.

Give one reason for your answer.

_____

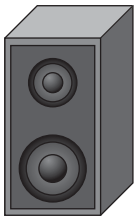
_____

Check Your Understanding

Practise

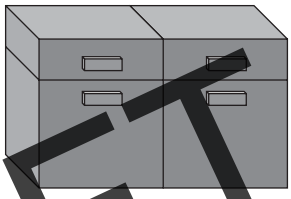
2. Draw and label the top, front, and side views.

a)



top front side

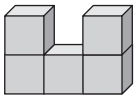
b)

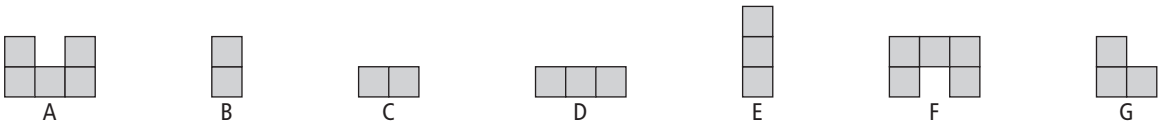


top front side

Name: _____ Date: _____

3.





a) Circle the top view.

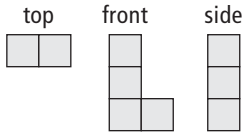
b) Put a square around the front view.

c) Put an X on the side view.

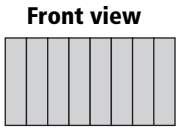
4. Draw each 3-D object using the views.

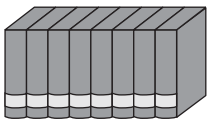
a)

b)



5. Circle the object that has this front view after a rotation of 90° clockwise onto its *side*.





Name: _____ Date: _____

6. A microwave has these views.

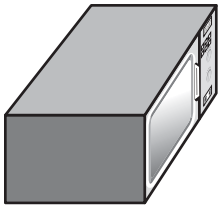
top

front

side

Turn the microwave 90° counterclockwise.

Draw each new view.



top front side

Apply

7. Choose two 3-D objects from your classroom.

Draw the top, front, and side views of each one.

Object 1: _____

top front side

Object 2: _____

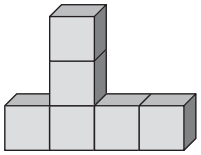
top front side

Name: _____ Date: _____

8. Draw the top, front, and side views for each.

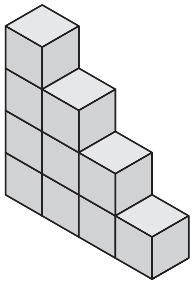
You can make the shapes out of blocks before you draw them.

a)



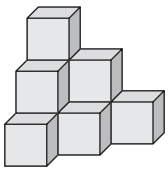
top front side

b)



top front side

c)



top front side

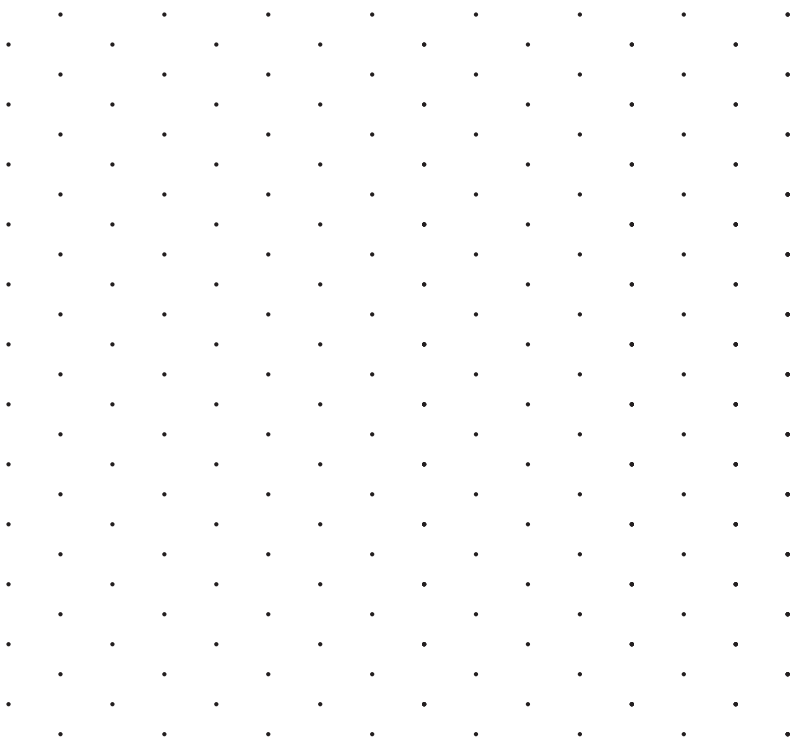
Name: _____ Date: _____

MATH LINK

a) Choose one of the important buildings from your community in the Math Link on page xx.

Name of building: _____

Sketch a 3-D view of the building.



b) Draw and label the top, front, and side views.

top front side

Name: _____ Date: _____

5 Chapter Review

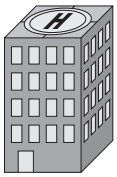
Key Words
Unscramble the letters for each puzzle. Use the clues to help you.

Puzzle	Clues	Solution
1. E T N	a flat diagram you can fold to make a 3-D object	_____
2. U S F A R E C E R A A	the sum of the areas of the faces of an object (2 words)	_____ _____
3. I R H T G R P M I S	a prism with sides perpendicular to its bases (2 words)	_____ _____
4. E C N I Y D R L	a 3-D object with two parallel circular bases	_____
5. I R A G N R U A L T S I M R P	a 3-D object with two parallel triangular bases (2 words)	_____ _____
6. L E U C A A N R G T R I R M S P	a 3-D object with two parallel rectangular bases (2 words)	_____ _____

5.1 Views of Three-Dimensional Objects, pages xx–xx

7. Draw and label the top, front, and side views for these objects.

a)



top front side

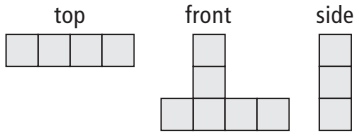
b)

top front side

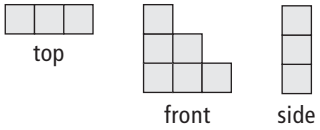
Name: _____ Date: _____

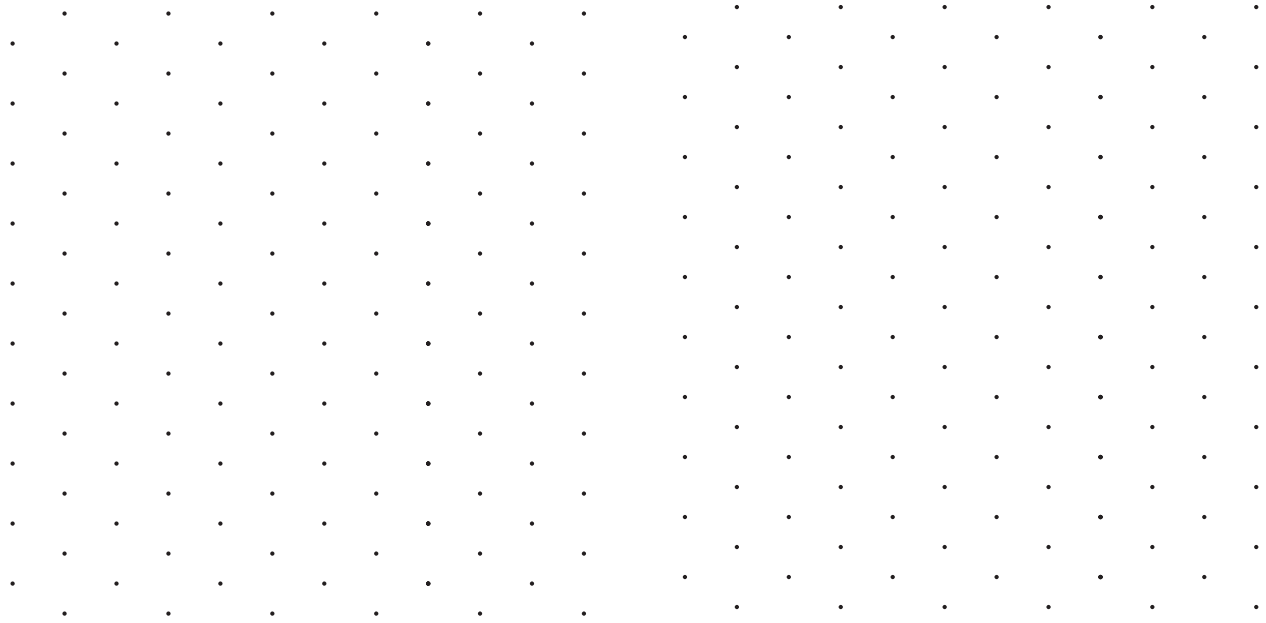
8. Draw each 3-D object on the isometric grid.

a)

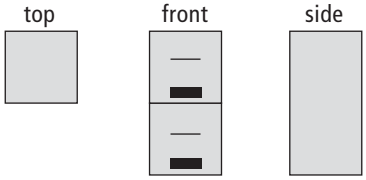


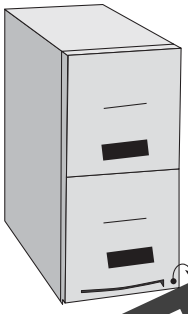
b)





9. The diagram shows the top, front, and side views of a filing cabinet.





Turn the cabinet 90° clockwise.
Draw the top, front, and side views after the turn.

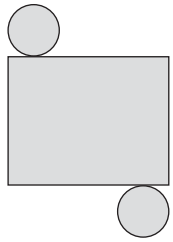
top front side

Name: _____ Date: _____

5.2 Nets of Three-Dimensional Objects, pages xx–xx

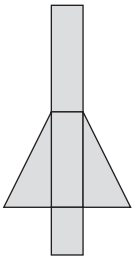
10. Name the object formed by each net.

a)



_____

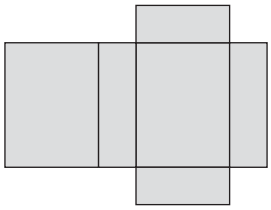
b)



_____

_____

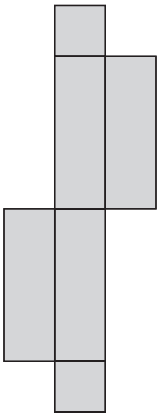
c)



_____

_____

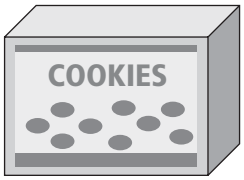
d)



_____

11. Draw the net for each object.

a)

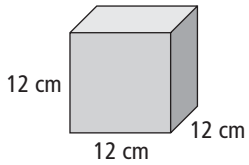


b)

Name: _____ Date: _____

5.3 Surface Area of a Prism, pages xx–xx

12. What is the surface area of the object?



This object is a _____. All the faces are the same size.

There are _____ faces.

Draw and label one face.

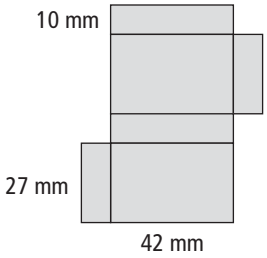
Area of one face:

Surface Area (S.A.) = 6 × _____

= _____

13. Calculate the surface area of the rectangular prism.

net of rectangular prism:



Draw and label the dimensions for each view.

top or bottom	**front or back**	**ends**

Find the area of each view:

Area of top and bottom

= 2 × _____

= _____

Area of front and back

= 2 × _____

= _____

Area of two ends

= 2 × _____

= _____

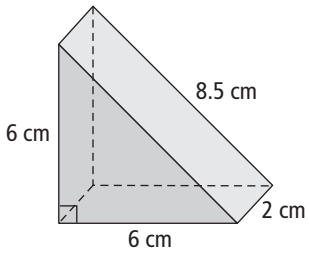
Surface Area = (area of front and back) + (area of top and bottom) + (area of ends)

= 2 × _____ + _____ + _____

= _____

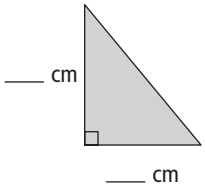
Name: _____ Date: _____

14. a) Find the surface area of each triangular prism.

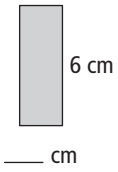


Label the dimensions from each view.

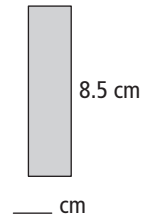
triangle



small rectangle (two are the same)



large rectangle



Area of triangle: *Area of small rectangle:* *Area of large rectangle:*

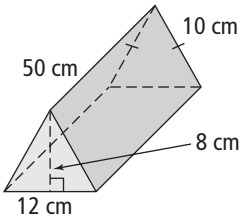
S.A. = (2 × area of triangle) + (2 × area of small rectangle) + (area of large rectangle)

= (2 × _____) + (2 × _____) + _____

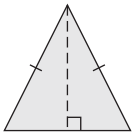
= _____ + _____ + _____

= _____

b)



Area of triangle:



Area of rectangle (three are the same):

S.A. = (2 × area of triangle) + (3 × area of rectangle)

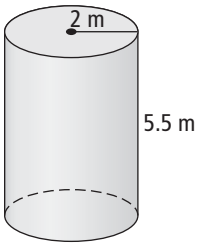
= (_____) + (_____)

= _____

Name: _____ Date: _____

5.4 Surface Area of a Cylinder, pages xx–xx

15. Find the surface area of the cylinder.



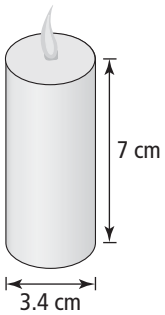
r = _____ d = _____ h = _____

Formula →

Substitute →

Solve →

16. The candle on Kay's table has a diameter of 3.4 cm and is 7 cm tall. Calculate the surface area.



Sentence: _____

Name: _____ Date: _____

5 Practice Test

For #1 to #5, circle the best answer.

1. The shape of the top view of this container shows a

A circle **B** square

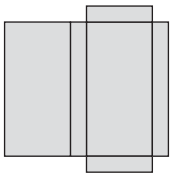
C triangle **D** rectangle

2. One face on a cube has an area of 50 cm^2. What is the surface area of the cube?

A 350 cm^2 **B** 300 cm^2

C 200 cm^2 **D** 150 cm^2

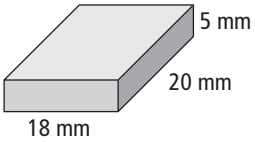
3. What 3-D object has a net like this one?



A cube **B** cylinder

C triangular prism **D** rectangular prism

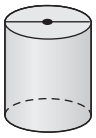
4. What is the surface area of this box?



A 550 mm^2 **B** 900 mm^2

C 1100 mm^2 **D** 1800 mm^2

5. What is the surface area of a cylinder that is 30 cm long and has a radius of 4 cm?

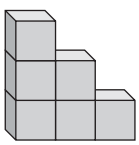


A 427.04 cm^2 **B** 477.28 cm^2

C 803.84 cm^2 **D** 854.08 cm^2

Short Answer

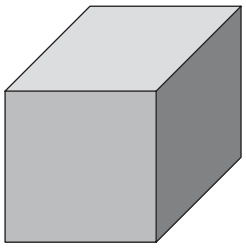
6. Label the top, front, and side views.



_____ _____ _____

Name: _____ Date: _____

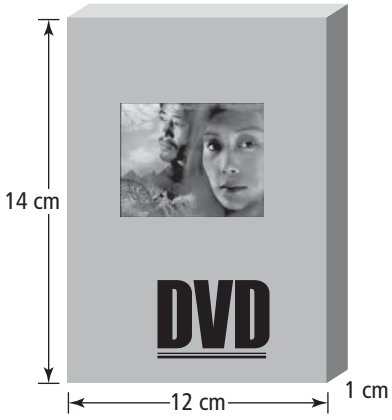
7. An object may have more than one net.
Draw two different nets for this cube.



Net 1:

Net 2:

8. A DVD case is 14 cm long, 12 cm wide, and 1 cm thick.
Calculate the surface area to the nearest tenth (one decimal place).



Draw and label the dimensions for each view.

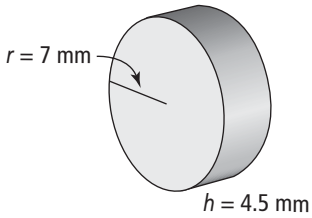
top front or back sides

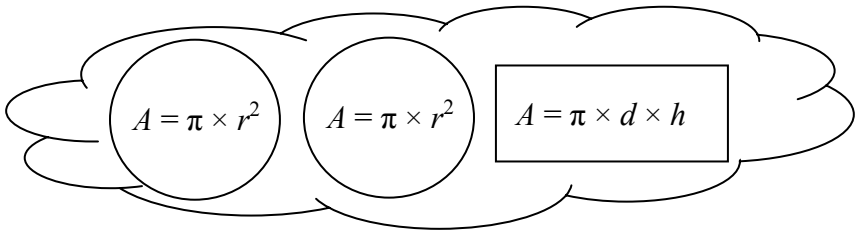
Calculate the area of each view.

Sentence: _____

Name: _____ Date: _____

9. Find the surface area of the cylinder.
Use the formula $S.A. = 2 \times (\pi \times r^2) + (\pi \times d \times h)$





Formula → $S.A. = 2 \times (\pi \times r^2) + (\pi \times d \times h)$

Substitute → $S.A. =$ _____

Solve →

WRAP IT UP!

Create your miniature community!
Work in a group to draw an aerial view for your community.

a) In the table below, list
- the names of the students in your group
- the names of the two buildings that each student sketched in the Math Link on page xx.

Student	Building 1	Building 2

Name: _____ Date: _____

b) List the buildings that a community needs.

Police station, _____, _____,

_____, _____, _____.

c) What buildings from part b) are missing from the table in part a)?

_____

d) Each student must choose a building from the list in part b).
Each student must:
- make a 3-D sketch on a sheet of isometric grid paper
- draw and label the net, including dimensions
- calculate the surface area of the walls and roof on a separate piece of paper

e) Draw the aerial view of your community with your group.
Write a description.

Aerial means the top view.

Check off the list as you complete each part:

❒ design all the required buildings

❒ Each student has done:
- a 3-D sketch
- a net
- the surface area calculations for one new building (check each other's work)

❒ streets to travel through the community

❒ environmental areas such as water sources and parks

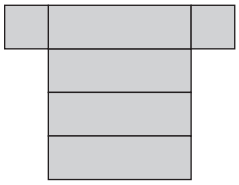
❒ a written description of the community

Name: _____ Date: _____

Key Word Builder

Use the clues to write the key words in the crossword puzzle.

Across

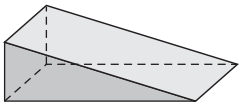
3. 

6. 

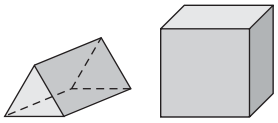
9. The line segment where two faces meet.

Down

1. The number of square units needed to cover a 3-D object.

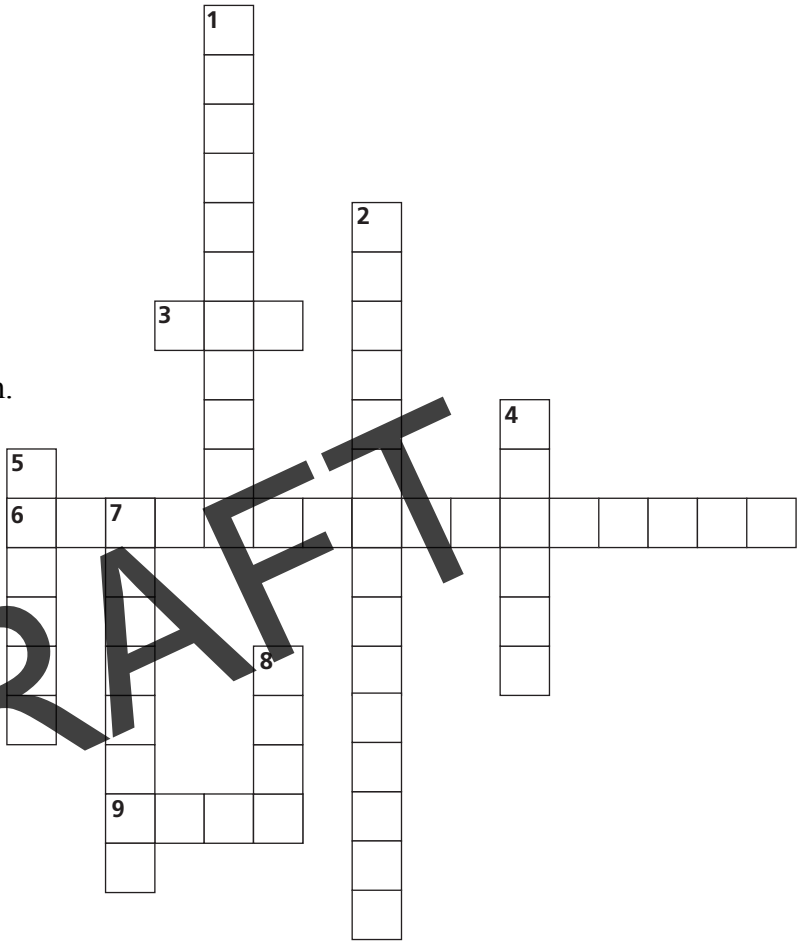
2. 

4. The point where three or more edges meet.

5. 

7. 

8. The flat or curved surface of a prism.



Name: _____ Date: _____

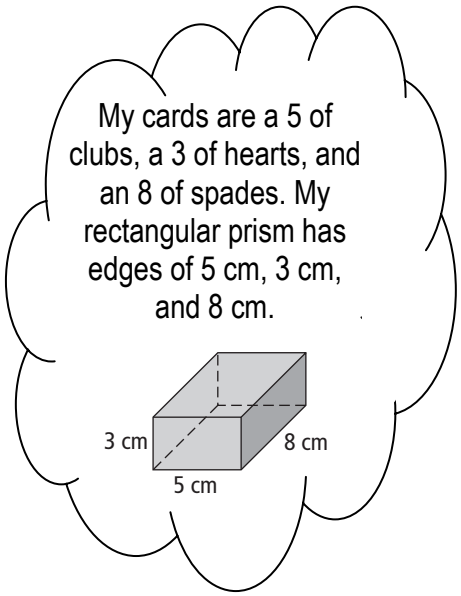
Math Games

Let's Face It!

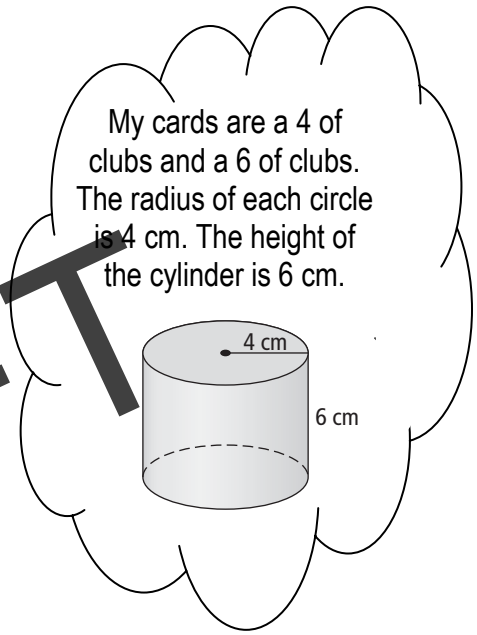
Play Let's Face It! with a partner or in a small group.

Materials
- deck of playing cards
- calculator per student

Rules:
- Remove the jacks, queens, kings, and jokers from the deck of cards.
- The aces equal 1.
- Take turns dealing the cards. Choose someone to deal first.
- Shuffle the cards and deal three cards, face up, to each player. The values of the cards are the dimensions of a rectangular prism.
- Calculate the surface area of your rectangular prism using pencil and paper.
- If you calculate your surface area correctly, you get a point (check each other's work).
- The player with the greatest surface area scores an extra point for that round.
- If there is a tie, each of the tied players scores a point.
- The first player to reach ten points wins the game.
- If there is a tie, continue playing until one person is ahead. If a player makes a mistake calculating the surface area and you catch it, you get an extra point!



Play a different version using these rules:
- Deal two cards to each player.
- Use the cards to describe the size of a cylinder.
- The first card gives the radius of each circle. The second card gives the height of the cylinder.
- Use a calculator to find the surface area of your cylinder. Use the formula $S.A. = 2 \times (\pi \times r^2) + (\pi \times d \times h)$.
- Award points and decide the winner the same way as before.



Name: _____ Date: _____

Challenge in Real Life

Design a Bedroom

Materials
- grid paper

You be the interior designer.
Design your dream bedroom!
Draw a design for a bedroom that is 4 m wide, 5 m long, and 2.5 m high.
Use a sheet of grid paper.

1. **a)** You need to place at least three objects in the room. If your bed is one, what are two others?

_____, _____

b) Draw the top view of the room on your grid paper.

c) Use the chart to draw different views of your three objects.

Object	Top, Front, and Side Views	3-D Shape
Bed		

Name: _____ Date: _____

2. You need to paint the walls and ceiling of your room.

a) Draw diagrams of the ceiling and walls. Label the dimensions.

ceiling side walls end walls

b) Find the total surface area of the walls and ceiling.

Area of ceiling *Area of side walls* *Area of end walls*

Total surface area:

c) One can of paint covers 10 m^2/L.
How many cans do you need?

$$\frac{\text{total surface area}}{10} = \frac{\square}{10}$$

$$= \_\_\_\_\_$$

You cannot buy part of a can.

Sentence:_____

Answers

Get Ready, pages xx–xx

1.

Object	Faces	Edges	Vertices
Rectangular prism	6	12	8
Triangular prism	5	9	6
Cube	6	12	8

2. a) 18.8 cm **b)** 12.6 cm

3. a) 12.6 cm^2 **b)** 78.5 cm^2

4. a) 27 cm^2 **b)** 55 cm^2

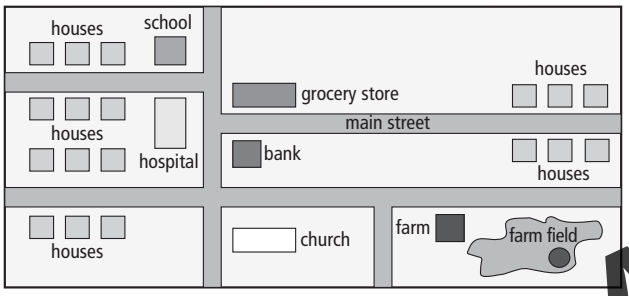
Math Link

1. Answers may vary. Example:

Type of Building	Where the Building Is Located in the Community	Shapes of Its Faces
Bank	main street	square, rectangle
Church	near houses	square, rectangle, triangle
School	near houses	square, rectangle
Hospital	near main roads, or highway	square, rectangle
Grocery store	main street	square, rectangle

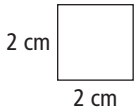
2. Answers may vary. Example: streets, houses, fire hydrants, sewers, parks

3. Answers will vary. Example:

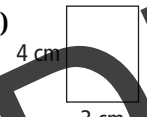


5.1 Warm Up, page x

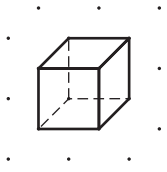
1. a)



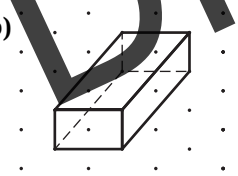
b)



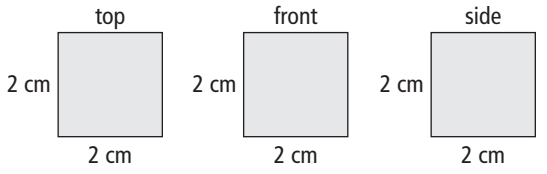
2. a)



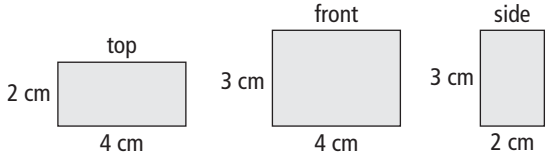
b)



3. a)



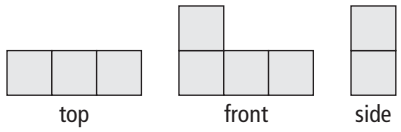
b)



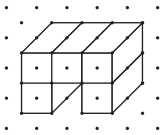
4. Part a) shows a 90° clockwise rotation.

5.1 Views of Three-Dimensional Objects, pages xx–xx

Working Example 1: Show You Know

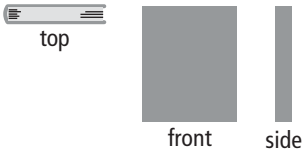


Working Example 2: Show You Know



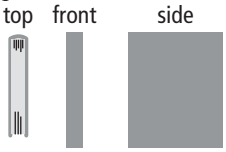
Working Example 3: Show You Know

a)



b) top, front, side

c)

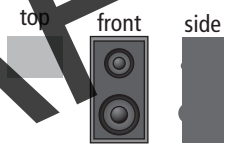


Communicate the Ideas

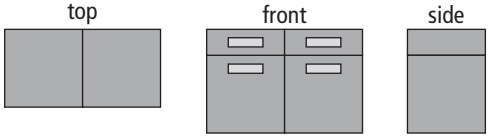
1. No. Answers may vary. Example: The top is labelled incorrectly as the front.

Practise

2. a)



b)



3. a) D **b)** A **c)** B