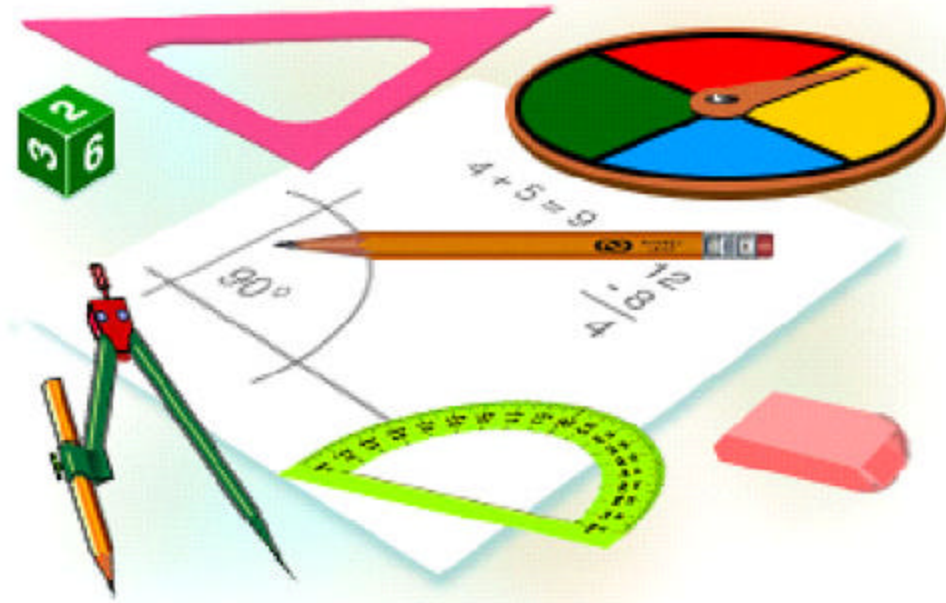# The Next Step

Mathematics Applications for Adults

Book 14018 - Measurement

OUTLINE

Mathematics - Book 14018

Measurement
The Metric System
use correct metric units to measure length, volume, capacity, mass, time, and temperature.
convert from any given metric unit to any stated metric unit.
Area, Perimeter, and Volume
find the perimeter of various regular and irregular geometric figures and shapes.
find the area of various regular and irregular geometric figures and shapes.
find the volume of various regular geometric figures.
Problem Solving Involving Measurement
solve multi-step problems requiring the performance of any combination of mathematical operations involving measurement, with or without a calculator.

THE NEXT STEP

Book 14018

Measurement

The Metric System

In the 1790s, French scientists worked out a system of measurement based on the ***meter*** that they called the Systeme International (International System). The meter is one ten-millionth of the distance between the North Pole and the Equator. The French scientists made a metal rod equal to the length of the standard meter.

By the 1980s, the French metal bar was no longer a precise measure for the meter. Scientists figured out a new standard for the meter. They made it equal to 1/299,792,548 of the distance light travels in a vacuum in one second. Since the speed of light in a vacuum never changes, the distance of the meter will not change.

The French scientists developed the ***metric*** system to cover measurement of length, area, volume, and weight.

Metric Length Equivalents

Metric Unit	Abbreviation	Metric Equivalent
millimeter	mm	.1 centimeter
centimeter	cm	10 millimeters
decimeter	dm	10 centimeters
meter	m	100 centimeters
dekameter	dam	10 meters
hectometer	hm	100 meters
kilometer	km	1000 meters

Metric Weight Equivalents

Metric Unit	Abbreviation	Metric Equivalent
milligram	mg	.001 gram
centigram	cg	10 milligrams
decigram	dg	10 centigrams
gram	g	1,000 milligrams
decagram	dag	10 grams
hectogram	hg	100 grams
kilogram	kg	1,000 grams

Metric Volume Measures

Metric Unit	Abbreviation	Metric Equivalent
milliliter	ml	.001 liter
centiliter	cl	10 milliliters

deciliter	dl	10 centiliters
liter	l	1,000 milliliters
dekaliter	dal	10 liters
hectoliter	hl	100 liters
kiloliter	kl	1,000 liters

Decimal Point

A period that separates the whole numbers from the fractional part of a number; or that separates dollars from cents

Example:

decimal point
0 . 3 three-tenths
A zero is used to show there are no ones.

Kilometers   Hectometers   Decameters   Meters   Decimeters   Centimeters   Millimeters

Kilograms   Hectograms   Decagrams   Grams   Decigrams   Centigrams   Milligrams

Kiloliters   Hectoliters   Decaliters   Liters   Deciliters   Centiliters   Milliliters

To use the chart above, if a question asks you how many grams that you can get from 200 centigrams, for example, try this:

Start by putting down the number:

200

If we don't see a decimal point, the number is a whole number; and therefore, a decimal point may be inserted to the right of the last digit:

200.

Now, using your chart, start at centigrams and count back to grams (two spaces to the left).

Move the decimal point in your number the same amount of spaces in the same direction:

2.00

The answer to the question is that 200 centigrams is equal to 2 grams.

If a question asks you to tell how many millimeters are is 8.3 decimeters, try this:

Write down the number:

8.3

We already see a decimal point, so there is no need to guess where to place it:

8.3

Now, using your chart, start at decimeters and count forward to millimeters (two spaces to the right).

Move the decimal point in your number the same amount of spaces in the same direction:

830.

The answer to the question is that 830 millimeters is equal to 8.3 decimeters.

⟹ Change larger to smaller units by multiplying.

3 meters = ? cm
3 x 100 (100 centimeters to a meter) = 300 centimeters

Þ Change smaller to larger units by dividing

5000 grams = ? kg
5000 ¸ 1000 grams = 5 kg

Practice Exercise

Fill in the answer.

1. 2200 m =
   _____ km

2. 11.43 cg =
   _____ mg

3. 6.419 g =
   _____ cg

4. 10258 g = _____ kg

5. 6.869 cm = _____ mm

6. 170 cl = _____ L

7. 2 cl = _____ ml

8. 12866 L = _____ kl

9. 1000 cm = _____ m

10. 30 mm = _____ cm

11. 11220 g = _____ kg

12. 6 cm = _____ mm

13. 5500 m = _____ km

14. 1 cl = _____ ml

15. 8800 L = _____ kl

16. 3 m = _____ cm

17. 5 g = _____ mg

18. 12.772 kg = _____ g

19. 91 mg = _____ cg

20. 301.2 cl = _____ L

21. 9 m = _____ mm

22. 11.67 cl = _____ ml

23. 8 L = _____ ml

24. 12 L = _____ cl

25. 8.6 L = _____ ml

26. 1 L = _____ cl

27. 6.9 cl = _____ ml

28. 11 L =
_____ cl

29. 4780 mg =
_____ g

30. 8.094 cl =
_____ ml

31. 9.564 L =
_____ ml

32. 4000 m =
_____ km

33. 7275 ml =
_____ L

The Centigrade Scale

In 1742, Swedish astronomer Anders Celsius (1701 – 1744) invented a scale for measuring heat. His scale is called the *centigrade* or *Celsius* scale. Celsius's scale is based on the freezing and boiling points of water. The freezing point of water is equal to 0 degrees Celsius. The boiling point is 100 degrees Celsius. While the Fahrenheit scale is used in the United States, the centigrade scale is used in most countries throughout the world. It is the scale preferred by scientists.

The markings on a thermometer are in degrees.
We read the degrees as:
above zero   +1, +2, +3, ……
below zero   -1, -2, -3, ……..

The temperature on the Celsius thermometer below is -78 degrees. This can be written as -78°C.
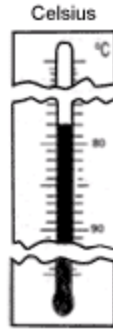
Celsius

A degree Celsius memory device:

There are several **memory aids** that can be used to help the
novice understand the degree Celsius temperature scale.
One such device is:

> *When it's **zero** it's **freezing**,*
> *when it's **10** it's **not**,*
> *when it's **20** it's **warm**,*
> *when it's **30** it's **hot**!*

Or, another one to remember:

> ***30's hot***
> ***20's nice***
> ***10's cold***
> ***zero's ice***

Celsius
C

100 degrees
water boils

37 degrees
normal body temperature

0 degrees

water freezes
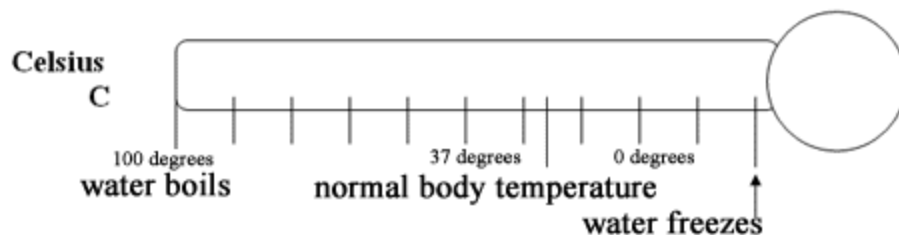
Area, Perimeter, and Volume

To measure flat spaces we calculate *perimeter*. Perimeter is the distance around a two-dimensional or flat shape.

Calculating Perimeter

Perimeter is calculated in different ways, depending upon the shape of the surface. The perimeter of a surface outlined by straight lines is calculated by adding together the lengths of its sides.

25 yds.

26 yds.   26 yds.

25 yds.
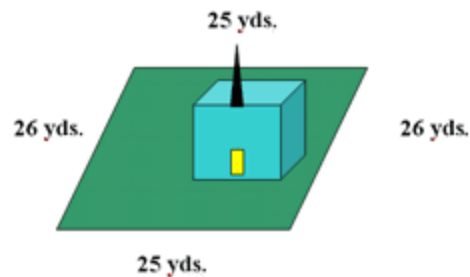
25 + 26 + 25 + 26 = 102 yds. perimeter of the rectangular lot
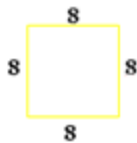
8 + 8 + 8 + 8 = 4 x 8 = 32
4s (4 sides) = perimeter of a square
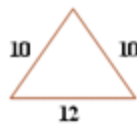
10 + 10 + 12 = 32
3s (3 sides) = perimeter of a triangle
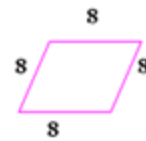
8 + 8 + 8 + 8 = 4 x 8 = 32
4s = perimeter of a rhombus

10
1
1
1
1
10
1
1
1
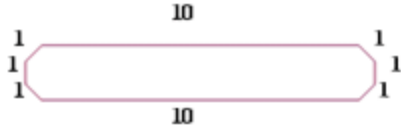
1 + 1 + 10 + 1 + 1 + 1 + 10 + 1 = 26
8s = perimeter of an irregular octagon

2
1
4
3
4
1
4
4
2
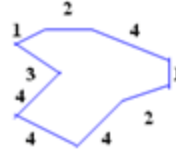
4 + 1 + 2 + 4 + 4 + 4 + 3 + 1 + 2 = 25
all sides = perimeter of an irregular
polygon

A regular polygon is a polygon whose sides are all the same length, and whose angles are all the same. To calculate the perimeter of regular polygons like squares or rhombuses, multiply the number of sides by the length of a side. This is possible, because all the sides are the same length.

Practice Exercise

Find the perimeter.

1. All sides equal 8 m
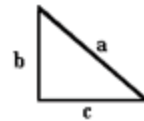
24 m
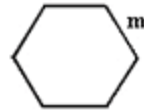
2. m = 20 in
All sides are equal

_____
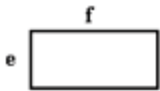
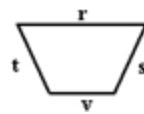3. e = 8 m
f = 11 m

_____

4. a = 3 mi
c = 1 mi
b = c

_____

5. The side d of this square is 28 mi

_____

6. v = 5 m
t = 9 m
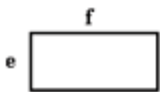r = 13 m
s = t

_____
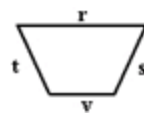
7. e = 5 mi
f = 11 mi

_____
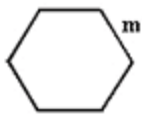
8. v = 8 mi
t = 10 mi
r = 15 mi
s = t

_____
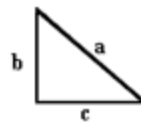
9. m = 16 mi
All sides are equal

_____

10. a = 6 ft
c = 5 ft
b = c

_____

Complete the table for each rectangle.
Round to the nearest hundredth.

|	length	width	perimeter
1.	2 mi	8 mi	_____ mi
2.	2 km	2 km	_____ km
3.	2 yd	7 yd	_____ yd
4.	5 in	7 in	_____ in
5.	11 m	6 m	_____ m
6.	12 cm	8 cm	_____ cm
7.	$12\frac{1}{4}$ mm	$6\frac{1}{4}$ mm	_____ mm
8.	6 ft	11.2 ft	_____ ft
9.	17.5 km	_____ km	63 km
10.	$19\frac{4}{5}$ ft	$10\frac{1}{10}$ ft	_____ ft
11.	14.6 mm	_____ mm	55.4 mm
12.	$10\frac{1}{2}$ m	$17\frac{1}{2}$ m	_____ m
13.	17.9 in	13 in	_____ in
14.	$9\frac{1}{2}$ mi	$9\frac{3}{10}$ mi	_____ mi
15.	8.6 yd	_____ yd	43.8 yd

Calculating Area

The *area* of a figure is the size of the region it covers.
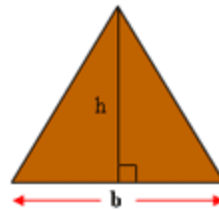
Area is a measurement of only *two* dimensions, usually length and width.

Area is calculated in different ways, depending on the shape of the surface. Area is expressed in squares: square inches, square meters, etc.
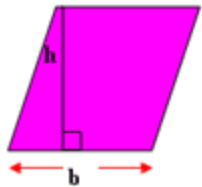
     An area with a perimeter made up of straight lines is calculated in different ways for different shapes.
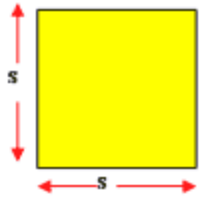
S^2 = area of a square

$$\frac{\text{base x height}}{2} = \text{area of a triangle}$$

base x height = area of a rhombus

b x h = area of a rectangle

Þ *The area of a rectangle or square can also be referred to as length x width (l x w).*

Þ *The area of a triangle is also expressed as ½ the base x height (1/2 b x h).*

The area formula for triangles is used to find the area of all triangles, ***not just right triangles,*** and the height that appears in the formula must be a line perpendicular to the base of the triangle or to its extension. Perpendicular lines meet at right angles.

Example What is the area of the triangle below?

Height

8 cm
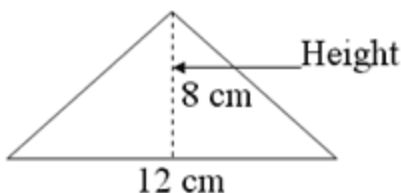
12 cm

Step 1 Identify the base (*b*) and the height (*h*).

$$b = 12 \text{ cm and } h = 8 \text{ cm}$$

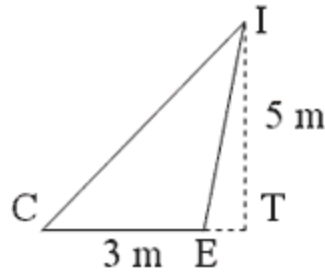**Step 2** Substitute 12 for *b* and 8 for *h* in the area formula.

$$A = \tfrac{1}{2}bh$$
$$A = \tfrac{1}{2} \times 12 \times 8$$
$$A = \mathbf{48}$$

Answer: The area is 48 square centimeters.

Example What is the area of triangle ICE?

Note that the line drawn to show height is an extension of the base.

Step 1 Identify the base (*b*) and the height (*h*). Side CE is the base and the dotted line IT is the height.

$$b = 3\text{m and } h = 5\text{m}$$

Step 2 Substitute 3 for *b* and 5 for *h* in the area formula.

$$A = \tfrac{1}{2}bh$$
$$A = \tfrac{1}{2} \times 3 \times 5$$
$$A = 15/2 = 7\,\tfrac{1}{2}$$

Answer: The area is 7 ½ square meters.

A ***parallelogram*** has 4 sides and the opposite sides are parallel. The area of a parallelogram is found by multiplying the length of the base by the height. ***Height*** is the distance straight down from a point on one non-slanting side to its opposite side, or the ***base.***

The formula for the area of a parallelogram can be written:
A = bh, where *b* = base and *h* = height.

Example Find the area of the parallelogram below.

height = 8 cm

base = 10 cm
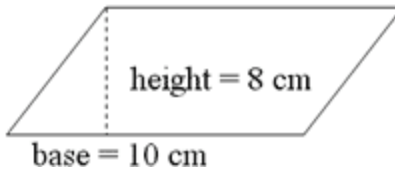
Use the formula for finding the area of a parallelogram:
$$A = bh$$
$$= 10 \times 8$$
$$= 80 \text{ sq cm}$$

Answer: The area of the parallelogram is **80 sq cm.**

The area of a circle has a special calculation:

$$a = \pi r^2$$

The equation is read "***area equals pi times radius squared***."

radius *ST*

Step 1 Substitute 22/7 for π, and 7 for *r* in the area
formula.

$$A = \frac{22}{7} \times 7 \times 7$$

Step 2 Cancel the first two "7's."

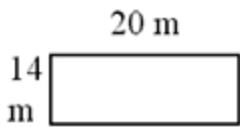$$A = \frac{22}{\cancel{7}_1} \times \cancel{7}^1 \times 7$$
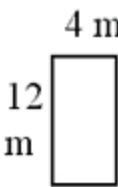
Step 3 Multiply 22 by 7.

$$A = 22 \times 7 = \mathbf{154}$$

Answer: 154 square centimeters.
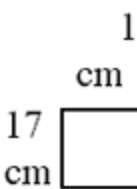
Practice Exercise

Find the area for each.

1.

20 m

14 m

36 squared cm

2.

4 m

12 m

_____

3.

All sides are 12 cm

_____

4.

17 cm

17 cm

_____

5.

29 ft

26 ft

_____

Complete the table for each rectangle.

	length	width	area
1.	9 yd	4 yd	_____ square yd
2.	5 km	6 km	_____ square km
3.	7 in	5 in	_____ square in
4.	7 cm	8 cm	_____ square cm
5.	7 ft	11 ft	_____ square ft
6.	16 mi	8 mi	_____ square mi
7.	14 m	20.7 m	_____ square m
8.	$8\frac{1}{2}$ mm	$8\frac{1}{2}$ mm	_____ square mm
9.	$10\frac{2}{5}$ mi	$16\frac{1}{2}$ mi	_____ square mi
10.	_____ ft	14 ft	155.4 square ft
11.	13.3 in	_____ in	182.21 square in
12.	$6\frac{1}{2}$ m	$7\frac{1}{2}$ m	_____ square m
13.	$16\frac{4}{5}$ mm	$13\frac{1}{2}$ mm	_____ square mm
14.	_____ km	18.9 km	245.7 square km
15.	_____ yd	16 yd	200 square yd

Find the area for each.

1.

$i = 5$ ft
$j = 13$ ft
$h = 12$ ft

30 ft^2

2.
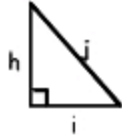
$s = 15$ in
$r = 8$ in
$t = 17$ in
$q = 16$ in
$v = 29$ in

_____

3.

$a = 28$ in
$c = 53$ in
$f = 90$ in
$e = c$
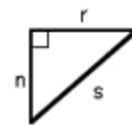
_____

4.

$s = 41$ m
$r = 9$ m
$n = 40$ m

_____

5.

$s = 4$ m
$r = 3$ m
$t = 5$ m
$q = 6$ m
$v = 10$ m

_____

6.

$s = 17$ yd
$r = 8$ yd
$n = 15$ yd

_____

7.

$a = 3$ in
$c = 5$ in
$f = 8$ in
$e = c$

_____

8.

$i = 24$ cm
$j = 51$ cm
$h = 45$ cm

_____
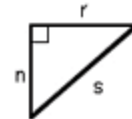
Complete the table for each triangle.
Round to the nearest hundredth.

base	height	area
1. 4 in	5 in	_____ square in
2. 2 mi	3 mi	_____ square mi
3. 3 cm	5 cm	_____ square cm
4. 3 yd	7 yd	_____ square yd
5. 7 mm	9 mm	_____ square mm
6. 12 km	12 km	_____ square km
7. 17.6 ft	8 ft	_____ square ft
8. 7 m	20.3 m	_____ square m
9. 16.4 m	_____ m	81.18 square m
10. $14\frac{1}{2}$ yd	$6\frac{1}{2}$ yd	_____ square yd
11. $16\frac{1}{4}$ mi	$9\frac{1}{4}$ mi	_____ square mi
12. $11\frac{1}{4}$ cm	$20\frac{1}{4}$ cm	_____ square cm
13. _____ ft	13.7 ft	78.78 square ft
14. $12\frac{1}{5}$ km	$12\frac{3}{10}$ km	_____ square km
15. 19 in	_____ in	112.1 square in

Find the Area for each.
Round to the nearest hundredth. Assume $\pi = 3.14$

1. g = 6 ft **28.26 ft²**	2. s = 4 mi _____
3. e = 39 yd _____	4. m = 71 yd _____
5. m = 41.589 cm _____	6. e = 18.5 m _____
7. g = 8.28 yd _____	8. s = 2 cm _____

Complete the table for each circle. Assume $\pi = 3.14$
Round to the nearest hundredth. Assume $\pi = 3\ 1/7$ for
questions 11-14.

	radius	diameter	area	
1.	2 cm	4 cm	_____	cm²
2.	_____ in	12 in	_____	in²
3.	8 yd	_____ yd	_____	yd²
4.	5 mm	10 mm	_____	mm²
5.	10 mi	20 mi	_____	mi²

6. _____ m   19.4 m   _____ m²

7. _____ km _____ km 38.47 km²

8. 8.5 ft   _____ ft   _____ ft²

9. _____ yd _____ yd 408.07 yd²

10. 9.2 m   18.4 m   _____ m²

11. $7\frac{1}{2}$ mm   _____ mm _____ mm²

12. $7\frac{3}{5}$ ft $15\frac{1}{5}$ ft   _____ ft²

13. _____ cm $10\frac{4}{5}$ cm   _____ cm²

14. $5\frac{1}{10}$ in $10\frac{1}{5}$ in   _____ in²

15. 16.73 mi   33.46 mi   _____ mi²

In some problems you may be asked to find the area of irregular shapes. These figures are often made up of two or more simple figures.

Example Find the area of the figure shown below.

3 ft

8 ft

10 ft

12 ft
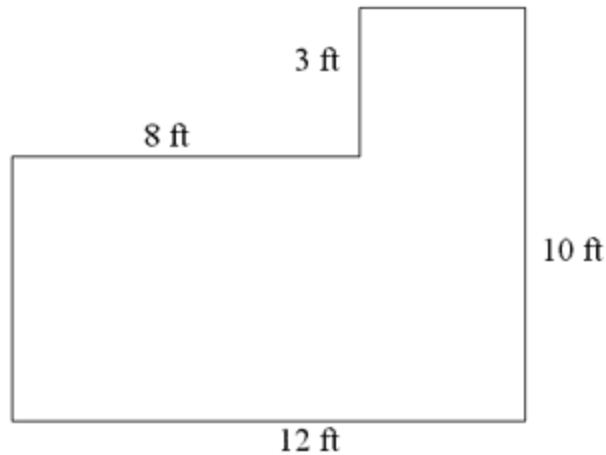
Step 1 Separate the figure into two familiar shapes---in this case rectangles. Decide what measurements you are missing and label them (x and y in this figure).

x

3 ft   Area I

8 ft

y Area II   10 ft
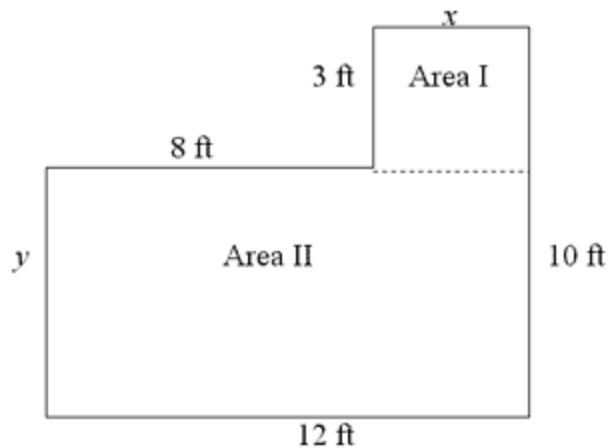
12 ft

Step 2 Find the missing lengths of the sides by subtracting values you do know.

Side x is 12 ft – 8 ft = 4 ft

Side y is 10 ft – 3 ft = 7 ft

Step 3 Find the area of each rectangle by using the correct formula. First replace l with 4 and w with 3 in the formula $A = lw$. Then replace l with 12 and w with 7 in the formula $A = lw$.

Area I = lw

$= 4$ x 3

$= 12$ sq ft

Area II = lw

$= 12$ x 7

$= 84$ sq ft

Step 4 Add the areas of the two rectangles.

Area I + Area II = 12 + 84 = 96 sq ft

Answer: The total area of the figure is **96 sq ft.**

Practice Exercise

Find the area of each figure.

1.


```
        8 m
4 m  ┌────────┐
     │        │ ·········· 20 m ················
     └────────┘
   base =
   10 m
```

2.


```
                        9 m
        19 m       ┌──────────┐    10.5 m
                   │          │
  ········18 m·····│          │····7.5 m·······
                   │   14 m   │
        19 m       └──────────┘    10 m
                        9 m
```

3.

3 cm　　　　　　　　　5 cm

6 cm

14 cm　　8 cm　　　　　　14 cm

20 cm

4.

4 cm

4 cm
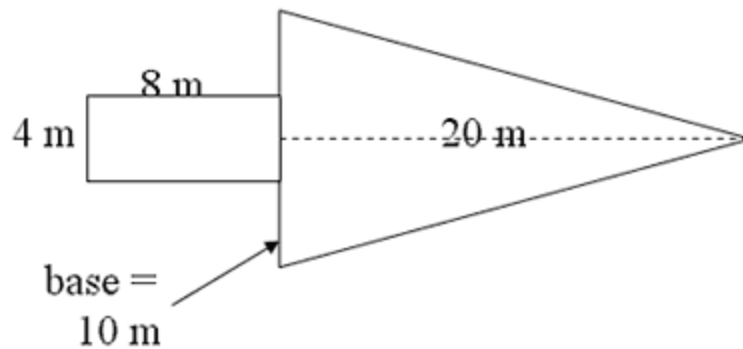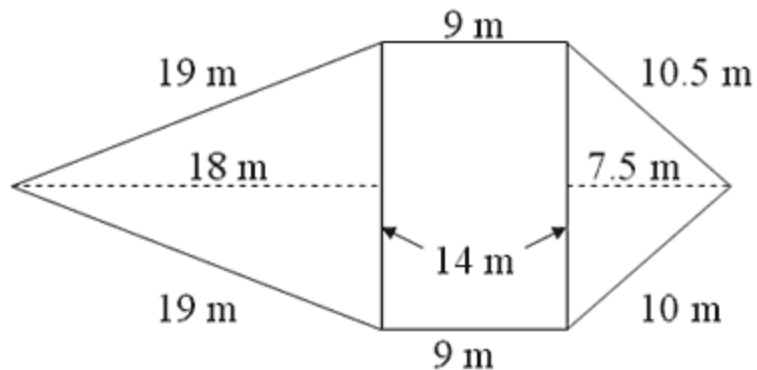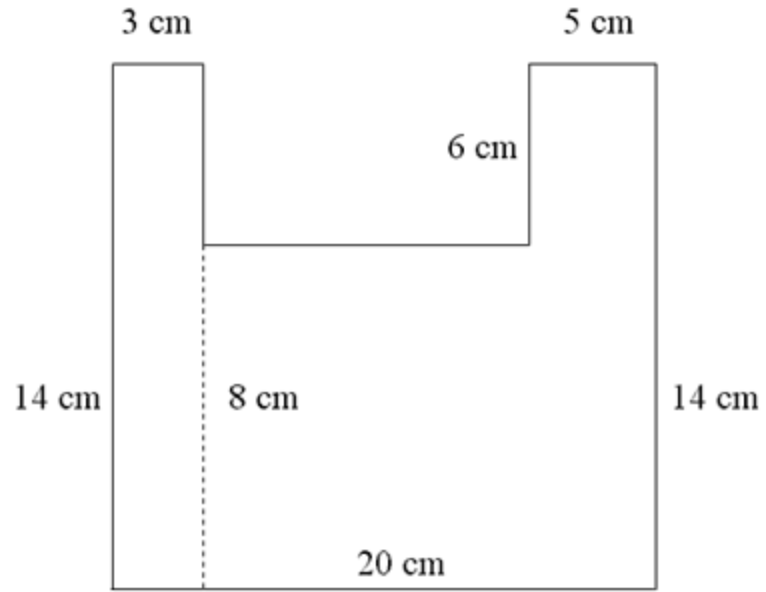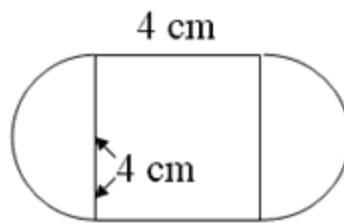
Surface Area

The ***surface area*** is the sum of the areas of the outside surface of a three-dimensional shape.

Surface Area of a Cube = 6 a^2
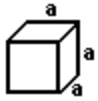
(a is the length of the side of each edge of the cube)

In words, the surface area of a cube is the area of the six squares that cover it. The area of one of them is aa, or a^2. Since these are all the same, you can multiply one of them by six, so the surface area of a cube is 6 times one of the sides squared.

Example Find the total area of a cube whose edges measure 15 inches.

$A = 6a^2$

$A = 6 \times (15)^2$

$A = 6 \times 225$

$A = 1,350$ square inches.

Surface Area of a Rectangular Prism = 2ab + 2bc + 2ac
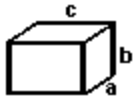
(a, b, and c are the lengths of the 3 sides)

In words, the surface area of a rectangular prism is the area of the six rectangles that cover it. But we don't have to figure out all six because we know that the top and bottom are the same, the front and back are the same, and the left and right sides are the same.

The area of the top and bottom (side lengths a and c) = ac. Since there are two of them, you get 2ac. The front and back have side lengths of b and c. The area of one of them is bc, and there are two of them, so the surface area of those two is 2bc. The left and right side have side lengths of a and b, so the surface area of one of them is ab. Again, there are two of them, so their combined surface area is 2ab.

Example Find the total area of a rectangular prism 9 meters long, 6 meters wide, and 7 meters high.

$A = 2ab + 2bc + 2ac$

$A = 2 \times 9 \times 6 + 2 \times 9 \times 7 + 2 \times 6 \times 7$

A = 108 + 126 + 84

A = 318 square meters.

Surface Area of a Cylinder = $2(pi\ r^2) + (2\ pi\ r)h$

 (h is the height of the cylinder, r is the radius of the top)

Surface Area = Areas of top and bottom + Area of the side

Surface Area = 2(Area of top) + (circumference of top) x height

Surface Area = $2(pi\ r^{2) + (2\ pi\ r)h}$

In words, the easiest way is to think of a can. The surface area is the areas of all the parts needed to cover the can. That's the top, the bottom, and the paper label that wraps around the middle.

You can find the area of the top (or the bottom). That's the formula for area of a circle ($pi\ r^2$). Since there is both a top and a bottom, that gets multiplied by two.

The side is like the label of the can. If you peel it off and lay it flat it will be a rectangle. The area of a

rectangle is the product of the two sides. One side is the height of the can, the other side is the circumference of the circle, since the label wraps once around the can. So the area of the rectangle is $(2 \, pi \, r)h$.

Add those two parts together and you have the formula for the surface area of a cylinder.

Surface Area = $2(pi \, r^2) + (2 \, pi \, r)h$

Example   Find the total area of a cylinder whose radius is 21 feet and whose height is 30 feet.

$A = 2(pi \, r^2) + (2 \text{ pi } r)h$

$A = 2 \times 22/7 \times (21)^2 + 2 \times 22/7 \times 21 \times 30$

$A = 2{,}772 + 3{,}960$

$A = 6{,}732$ square feet

Practice Exercise

Find the total areas of each of the following rectangular prisms.

1. Find the total area of a rectangular prism measuring 4 feet by 3 feet by 2 feet.

2. Find the total area of a rectangular prism measuring 18 meters by 8 meters by 4 meters.

3. Find the total area of a rectangular prism measuring 20 centimeters by 14 centimeters by 11 centimeters.

4. Find the total area of a rectangular prism measuring 6.4 meters by 3.7 meters by 4.5 meters.

Find the total area of each cube.

1. Find the total area of a cube whose edges measure 4 centimeters.

2. Find the total area of a cube whose edges measure 1.5 feet.

3. Find the total area of a cube whose edges measure 5.6 meters.

4. Find the total area of a cube whose edges measure 2 inches.

Find the total area of each cylinder.

1. Find the total area of a cylinder whose diameter is 4 inches and whose height is 10 inches.

2. Find the total area of a cylinder whose radius is 4 inches and whose height is 7 inches.

3. Find the total area of a cylinder whose radius is 20 centimeters and whose height is 25 centimeters.

4. Find the total area of a cylinder whose radius is 6 meters and whose height is 4 meters.

Calculating Volume

Volume is the amount of space contained in a three-dimensional shape. Area is a measurement of only *two* dimensions, usually length and width. Volume is a measurement of *three* dimensions, usually *length*, *width*, and *height*, and is measured in cubic units.

To find the volume of a *cube* or a *rectangular prism*, multiply length by width by height.
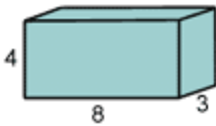
l x w x h = volume of a rectangular prism

8 x 3 x 4 = 96
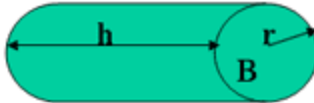
Since a cube has sides of equal length, multiply the length of one side by itself three times, S³ :
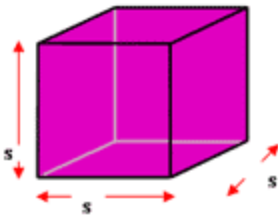
S³ = volume of a cube

To find the volume of a **cylinder**, multiply the area of the base (B) (or πr^2) by the height of the cylinder.
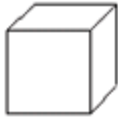
B x h = volume of a cylinder

πr^2 **x h =**
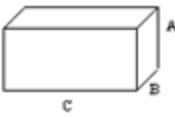
Practice Exercise

Find the volume.

1.

A = 15 mm
B = 8 mm
G = 32 mm

_____

2.

All sides
are 7 m

_____

3.

D = 26 yd
E = 10 yd
F = 4 yd

_____

4.

A = 8 mm
B = 3 mm
C = 18 mm

_____

Fill in the missing spaces and complete the table.
Round to the nearest hundredth.

	length	width	height	volume	
5.	16 mm	5 mm	10 mm	_____	cubic millimeters
6.	3 cm	15 cm	7 cm	_____	cubic centimeters
7.	28 mm	26 mm	8 mm	_____	cubic millimeters
8.	48 yd	24 yd	32 yd	_____	cubic yards
9.	11 mm	____ mm	10 mm	990	cubic millimeters
10.	____ m	6 m	9 m	270	cubic meters
11.	6 in	13 in	____ in	234	cubic inches
12.	3 ft	16.1 ft	14 ft	_____	cubic feet
13.	10 mm	15 mm	11.3 mm	_____	cubic millimeters
14.	12.41 yd	8.39 yd	14 yd	_____	cubic yards
15.	9.02 in	14 in	11.45 in	_____	cubic inches

Find the volume.
Use 3.14 for π. Round to the nearest hundredth.

1.

B = 4 in
A = 8 in

2.

B = 4 cm
A = 6 cm

3.

B = 5 mm
A = 8 mm

4.

E = 10 in
D = 17 in
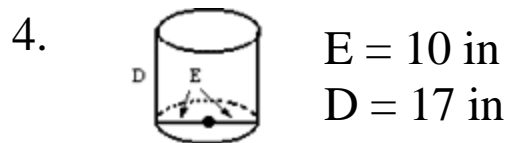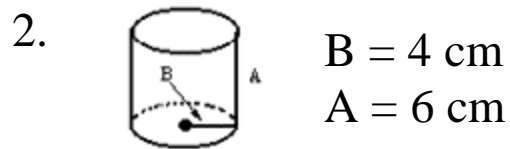
Fill in the missing spaces and complete the table.
Use 3.14 for π. Round to the nearest hundredth.

	diameter	radius	height	volume	
5.	8 ft	4 ft	9 ft	**452.16**	cubic feet
6.	____ ft	8 ft	4 ft	_____	cubic feet
7.	14 in	7 in	3 in	_____	cubic inches
8.	30 ft	15 ft	9 ft	_____	cubic feet
9.	10 cm	5 cm	____ cm	785	cubic centimeters
10.	12 ft	6 ft	____ ft	452.16	cubic feet
11.	32 ft	16 ft	8.6 ft	_____	cubic feet
12.	____ in	13 in	5.6 in	_____	cubic inches
13.	____ ft	11.5 ft	10.9 ft	_____	cubic feet
14.	19 yd	9.5 yd	8 yd	_____	cubic yards
15.	19.6 cm	9.8 cm	11 cm	_____	cubic centimeters

FORMULAS

Perimeter

Polygon	P = sum of the lengths of the sides
Rectangle	$P = 2(l + w)$

Circumference

Circle	$C = 2\pi r$, or $C = \pi d$

Area

Circle	$A = \pi r^2$
Parallelogram	$A = bh$
Rectangle	$A = lw$
Square	$A = s^2$
Triangle	$A = \frac{1}{2}bh$
Rectangular Prism	$A = 2ab + 2bc + 2ac$
Cube	$A = 6a^2$
Cylinder	$A = 2(\pi r^2) + (2\pi r)h$

Volume

Cube	$V = s^3$
Cylinder	$V = Bh$, or $V = \pi r^2 h$
Prism	$V = Bh$

Problem Solving Involving Measurement

1. Jeff and Mary are remodeling their home. On the roof, Jeff wants to put shingles on a rectangle 25 feet by 20 feet. What is the area of that part of the roof? What is the perimeter of that part of the roof?
2. Jeff bought enough shingles to cover 575 square feet. How many shingles will be left over after he covers the 25-foot by 20-foot rectangle on the roof?

3. Mary is installing new windows. Each window is 2 feet by 4 feet. She installed 120 square feet of windows. How many windows did she install?

4. If 6 people share a large pizza that has a 14 inch diameter, how much pizza will each person get? Give your answer to the nearest square inch.

5. Bill has a job with a company that delivers ice. He delivers 25-pound cubes of ice to various restaurants in town. Each side of each cube is 300 millimeters. What is the volume of one cube of ice?

6. A cylindrical water tower is half full of water. How many cubic feet of water are in the tower if it measures 20 feet high and has a radius of 7 feet?

7. Gloria has a new bathtub. The bathtub is 60 inches long, 31 inches wide, and 20 inches high. If she fills the tub full, what is the volume of water in the tub?

8. A swimming pool cover measures 5 meters long by 3 meters wide. At $5.25 per square meter, what is the cost of the cover?

9. Lou made a round oak table that he wants to cover with glass. How many square feet of glass are needed if the distance across the center of the table is 4 feet?

10. Jim cut a piece of plywood into the shape of a triangle. To the nearest square foot, find the area of the plywood if the base measures 8 feet and the height measures 6¼ feet.

Answer Key

Book 14018 - Measurement

1. 2.2 km   **2.** 114.3 mg   **3.** 641.9 cg
4. 10.258 kg   **5.** 68.69 mm   **6.** 1.7 L
7. 20 ml   **8.** 12.866 kl   **9.** 10 m
10. 3 cm   **11.** 11.22 kg   **12.** 60 mm
13. 5.5 km   **14.** 10 ml   **15.** 8.8 kl
16. 300 cm   **17.** 5000 mg   **18.** 12772 g
19. 9.1 cg   **20.** 3.012 L   **21.** 9000 mm
22. 116.7 ml   **23.** 8000 ml   **24.** 1200 cl
25. 8600 ml   **26.** 100 cl   **27.** 69 ml
28. 1100 cl   **29.** 4.78 g   **30.** 80.94 ml
31. 9564 ml   **32.** 4 km   **33.** 7.275 L

2. 120 in   **3.** 38 m   **4.** 5 mi   **5.** 112 mi
6. 36 m   **7.** 32 mi   **8.** 43 mi   **9.** 96 mi
10. 16 ft

1. 20 mi   **2.** 8 km   **3.** 18 yd   **4.** 24 in
5. 34 m   **6.** 40 cm   **7.** 37 mm   **8.** 34.4 ft
9. 14 km   **10.** 59 4/5   **11.** 13.1 mm
12. 56 m   **13.** 61.8 in   **14.** 37 3/5 mi
15. 13.3 yd

2. 48 square m   **3.** 121 square in
4. 289 square cm   **5.** 754 square ft

1. 36 square yd   **2.** 30 square km

3. 35 square in   **4.** 56 square cm
5. 77 square ft   **6.** 128 square mi
7. 289.8 square m   **8.** 72 ¼ square mm
9. 171 3/5 square mi   **10.** 11.1 ft
11. 13.7 in   **12.** 48 ¾ square m
13. 226 4/5 square mm   **14.** 13 km
15. 12.5 yd

2. 180 in²   **3.** 1260 in²   **4.** 180 m²
5. 18 m²   **6.** 60 yd²   **7.** 12 in²
8. 540 cm²

1. 10 square in   **2.** 3 square mi
3. 7.5 square cm   **4.** 10.5 square yd
5. 31.5 square mm   **6.** 72 square km
7. 70.4 square ft   **8.** 71.05 square m
9. 9.9 m   **10.** 47 1/8 square yd
11. 75 5/32 square mi
12. 113 29/32 square cm   **13.** 11.50 ft
14. 75 3/100 square km   **15.** 11.8 in

2. 50.24 mi²   **3.** 4775.94 yd²
4. 15828.74 yd²   **5.** 5431.09 cm²
6. 1074.67 m²   **7.** 53.82 yd²   **8.** 12.56 cm²

1. 12.56 cm²   **2.** 6 in; 113.04 in²
3. 16 yd; 200.96 yd²   **4.** 78.5 mm²
5. 314 mi²   **6.** 9.7 m; 295.44 m²
7. 3.5 km; 7.0 km   **8.** 17 ft; 226.87 ft²
9. 11.4 yd; 22.8 yd   **10.** 265.77 m²
11. 15 mm; 176 11/14 mm²

12. 181 93/175 ft²

13. 5 2/5 cm; 91 113/175 cm²

14. 81 261/350 in²   **15.** 878.86 mi²

1. 132 m²   **2.** 304.5 m²   **3.** 208 cm²

4. 28.56 cm²

1. 52 ft²   **2.** 640 m²   **3.** 1308 cm²

4. 13826 m²

(total area of a cube)   **1.** 96 cm²   **2.** 13.5 ft²

3. 188.16 m²   **4.** 24 in²

1. 150.72 in²   **2.** 276.32 in²   **3.** 5652 cm²

4. 376.8 m²

1. 3840 mm³   **2.** 343 m³   **3.** 1040 yd³

4. 432 mm³   **5.** 800   **6.** 315   **7.** 5824

8. 36864   **9.** 9   **10.** 5   **11.** 3   **12.** 676.2

13. 1695   **14.** 1457.68   **15.** 1445.91

1. 401.92 in³   **2.** 301.44 cm³   **3.** 1099 in³

4. 4019.2 cm³   **6.** 16; 803.84   **7.** 461.58

8. 6358.5   **9.** 10   **10.** 4   **11.** 6913.02

12. 26; 2971.70   **13.** 23; 4526.39

14. 2267.08   **15.** 3317.22

1. 500 ft²; 90 ft   **2.** 75 ft²   **3.** 15 windows

4. 26 in²   **5.** 27000000 m³   **6.** 1538.6 ft³

7. 37200 in³   **8.** $78.75   **9.** 12.56 ft²

10. 25 ft