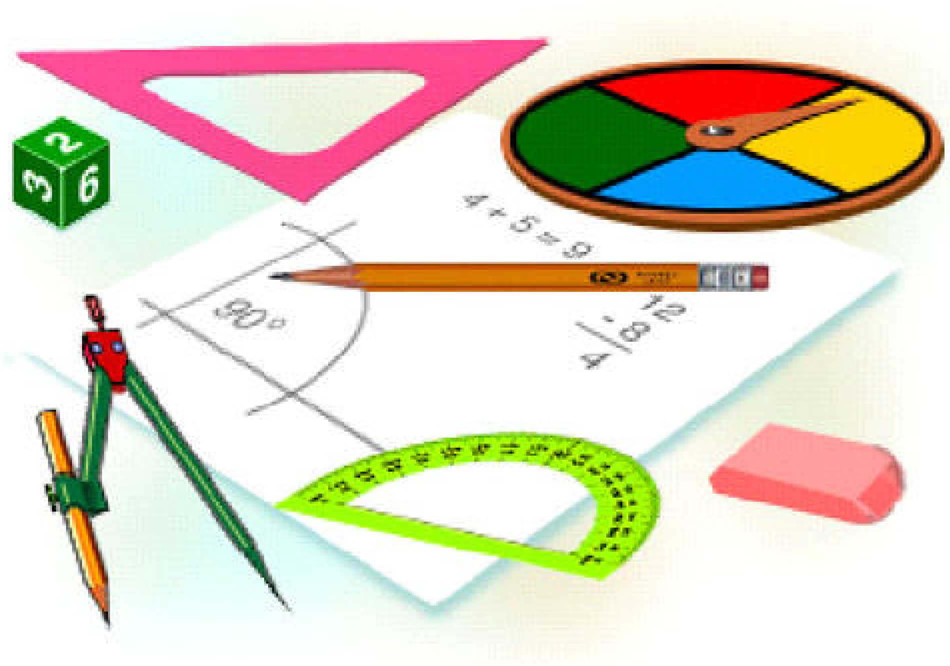
The Next Step

Mathematics Applications for Adults



Book 14019 – Measurement

OUTLINE

Mathematics - Book 14019

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.

THE NEXT STEP

Book 14019

Measurement

The Metric System

In the 1790s, French scientists worked out a system of measurement based on the ***meter***. 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

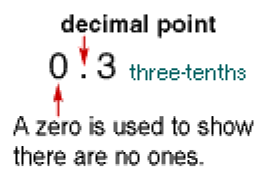
Metric Unit	Abbreviation	Metric Equivalent
milliliter	ml	.001 liter
centiliter	cl	10 milliliters

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:



Kilometers	**Hectometers**	**Decameters**	**Meters**	**Decimeters**	**Centimeters**	**Millimeters**
Kilograms	**Hectograms**	**Decagrams**	**Grams**	**Decigrams**	**Centigrams**	**Milligrams**
Kiloliters	**Hectoliters**	**Decaliters**	**Liters**	**Deciliters**	**Centiliters**	**Milliliters**

To use this chart, 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.

Þ 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.

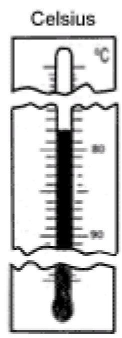
1.	2.19 cl = ________ ml	2.	2000 L = ________ kl	3.	40 mg = ________ cg
4.	8 g = ________ cg	5.	12.7 cm = ________ mm	6.	8 kg = ________ g

7.	9.824 cg = ________ mg	8.	127 cl = ________ L	9.	4000 m = ________ km
10.	950 cm = ________ m	11.	4400 g = ________ kg	12.	71.46 mm = ________ cm
13.	6.8 m = ________ mm	14.	99.28 ml = ________ cl	15.	12000 L = ________ kl
16.	4 L = ________ cl	17.	4900 ml = ________ L	18.	1100 cm = ________ m
19.	10.8 cl = ________ ml	20.	1272 cl = ________ L	21.	5.31 kl = ________ L
22.	5000 mm = ________ m	23.	9.4 kl = ________ L	24.	6 L = ________ ml
25.	660 cg = ________ g	26.	3.36 m = ________ mm	27.	1040 cl = ________ L
28.	1 km = ________ m	29.	12 cg = ________ mg	30.	5.3 km = ________ m
31.	6.288 cl = ________ ml	32.	683.5 cm = ________ m	33.	2.4 km = ________ m

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℃.



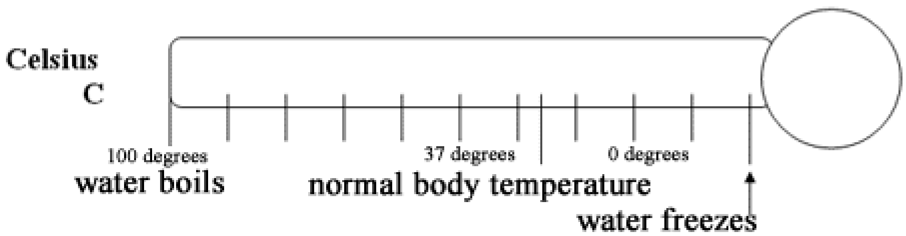
A degree Celsius memory device:

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

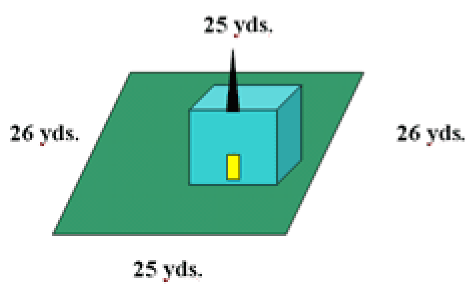


Area, Perimeter, and Volume

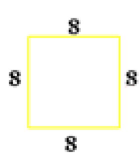
To measure flat spaces we calculate ***perimeter***. Perimeter is the distance around a two-dimensional or flat shape.

Calculating Perimeter

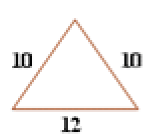
Perimeter is calculated in different ways, depending upon the shape of the surface. The perimeter of a surface outlined by straight lines is calculated by adding together the lengths of its sides.



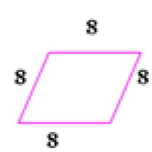
25 + 26 + 25 + 26 = 102 yds. perimeter of the rectangular lot



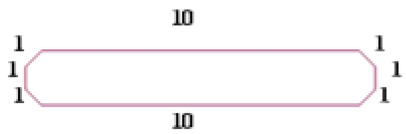
8 + 8 + 8 + 8 = 4 x 8 = 32
4s (4 sides) = perimeter of a square



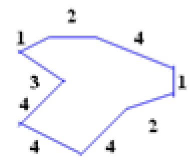
10 + 10 + 12 = 32
3s (3 sides) = perimeter of a triangle



8 + 8 + 8 + 8 = 4 x 8 = 32
4s = perimeter of a rhombus



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

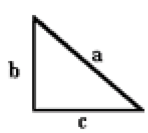
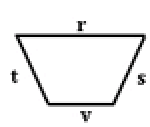


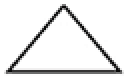
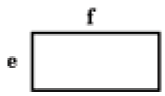
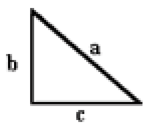
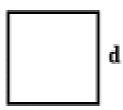
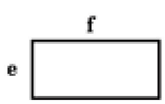
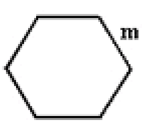
4 + 1 + 2 + 4 + 4 + 4 + 3 + 1 + 2 = 25
all sides = perimeter of an irregular polygon

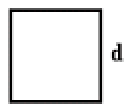
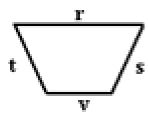
A regular polygon is a polygon whose sides are all the same length, and whose angles are all the same. To calculate the perimeter of regular polygons like squares or rhombuses, multiply the number of sides by the length of a side. This is possible, because all the sides are the same length.

Practice Exercise

Find the perimeter.

1.		a = 7 ft c = 6 ft b = c **19 ft**
2.		v = 5 cm t = 8 cm r = 12 cm s = t ________________

3.		All sides equal 5 cm ________________
4.		e = 8 in f = 17 in ________________
5.		a = 6 mi c = 5 mi b = c ________________
6.		The side d of this square is 27 mi ________________
7.		e = 3 ft f = 9 ft ________________
8.		m = 19 yd All sides are equal _______________

9.		The side d of this square is 28 m ________________
10.		v = 8 cm t = 11 cm r = 16 cm s = t ________________

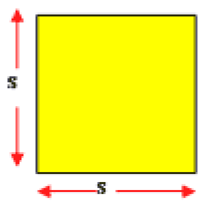
Calculating Area

The ***area*** of a figure is the size of the region it covers.

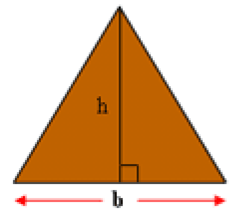
Area is a measurement of only ***two*** dimensions, usually length and width.

Area is calculated in different ways, depending on the shape of the surface. Area is expressed in squares: square inches, square meters, etc.

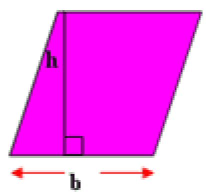
An area with a perimeter made up of straight lines is calculated in different ways for different shapes.



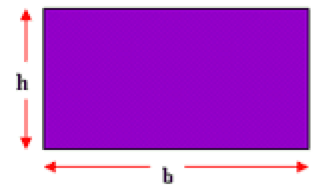
S ² = area of a square



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



base x height = area of a rhombus



b x h = area of a rectangle

- Þ ***The area of a rectangle, square, or rhombus is sometimes referred to as length x width (l x w) instead of base x height.***

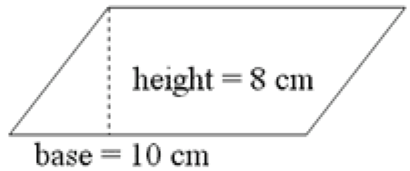
- Þ ***The area of a triangle is so metimes expressed as ½ the base x height (1/2 b x h).***

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.



Use the formula for finding the area of a parallelogram:

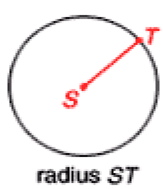
$$A = bh$$
$$= 10 \times 8$$
$$= 80 \text{ sq cm}$$

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

The area of a circle has a special calculation:

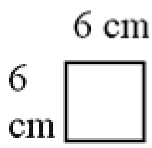
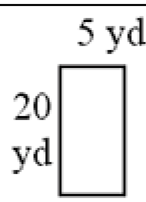
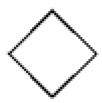
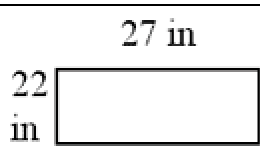
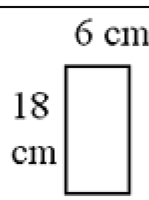
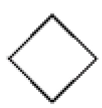
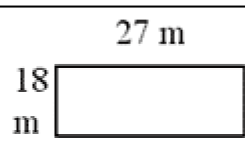
a = πr^2

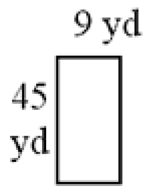
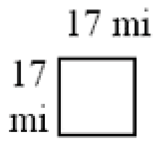
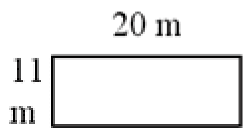
The equation is read "***area equals pi times radius squared***."



Practice Exercise

Find the area for each.

1.		**36 squared cm**
2.		________________
3.		All sides are 12 cm ________________
4.		________________
5.		________________
6.		All sides are 9 cm ________________
7.		________________

8.		______________________
9.		______________________
10.		______________________

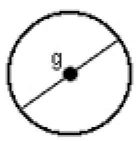
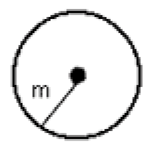
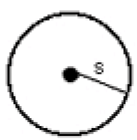
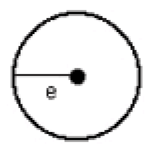
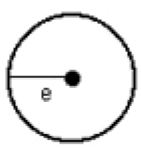
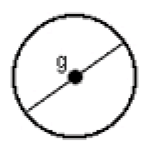
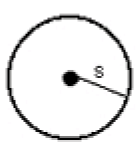
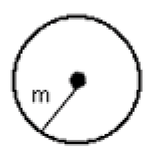
Complete the table for each triangle.
Round to the nearest hundredth.

	base	*height*	*area*	
1.	9 in	2 in	__________	square in
2.	9 cm	5 cm	__________	square cm
3.	9 m	3 m	__________	square m
4.	9 mm	7 mm	__________	square mm
5.	12 yd	8 yd	__________	square yd
6.	16 ft	13 ft	__________	square ft
7.	$18\frac{3}{5}$ mi	$20\frac{3}{5}$ mi	__________	square mi
8.	8.7 km	19.8 km	__________	square km
9.	$9\frac{1}{2}$ cm	$9\frac{1}{2}$ cm	__________	square cm
10.	__________ yd	12 yd	66.6	square yd
11.	__________ mm	19.6 mm	176.4	square mm
12.	8.1 ft	__________ ft	28.35	square ft
13.	17 m	__________ m	148.75	square m
14.	$14\frac{1}{2}$ in	$14\frac{1}{2}$ in	__________	square in

15.	$8\frac{3}{5}$ km	$10\frac{4}{5}$ km	__________ square km

Find the Area for each.

Round to the nearest hundredth. Assume $\pi = 3.14$

1.  g = 20 m **314 m^2**	2.  m = 61 m ____________
3.  s = 9 m ____________	4.  e = 28 cm ____________
5.  e = 27.1 mi ____________	6.  g = 10.86 yd ____________
7.  s = 7 mi ____________	8.  m = 78.094 in ____________

Complete the table for each circle.
Round to the nearest hundredth. Assume π = 3.14.

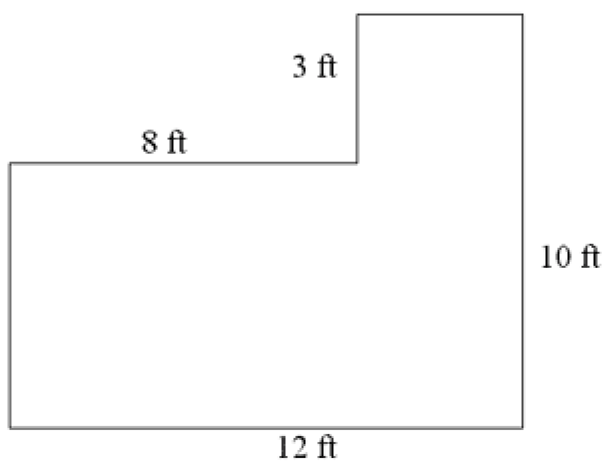
Assume π = 3 1/7 for questions 11-14.

	radius		*diameter*		*area*	
1.	3	in	______	in	__________	in^2
2.	_________	yd	10	yd	__________	yd^2
3.	6	m	12	m	__________	m^2
4.	10	ft	20	ft	__________	ft^2
5.	7	mm	14	mm	__________	mm^2
6.	_________	km	13.2	km	__________	km^2
7.	_________	mi	_________	mi	254.34	mi^2
8.	7.5	cm	_________	cm	__________	cm^2
9.	_________	yd	_________	yd	452.16	yd^2
10.	7.3	km	14.6	km	__________	km^2
11.	$5\frac{1}{5}$	ft	$10\frac{2}{5}$	ft	__________	ft^2
12.	$6\frac{1}{5}$	in	$12\frac{2}{5}$	in	__________	in^2
13.	_________	mm	$16\frac{4}{5}$	mm	__________	mm^2
14.	$7\frac{4}{5}$	m	$15\frac{3}{5}$	m	__________	m^2

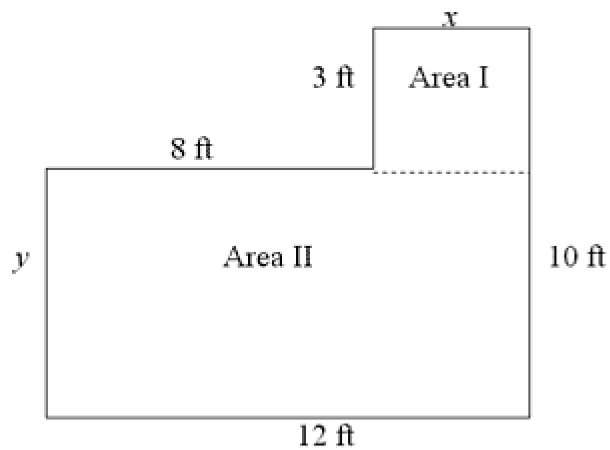
15. 17.93 cm __________ cm __________ cm²

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.



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).



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.

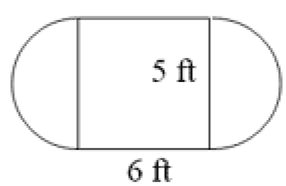
Area I + Area II = 12 + 84 = 96 sq ft

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

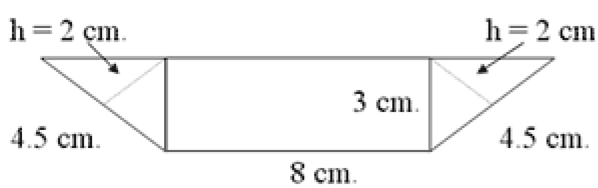
Practice Exercise

Find the area of each figure.

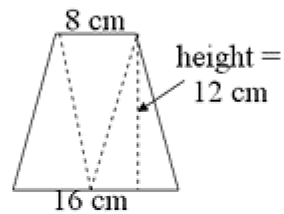
1.



2.



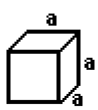
3.



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.

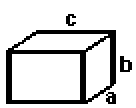
$A = 6a^2$

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

$A = 6 \times 225$

$A = 1{,}350$ 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.

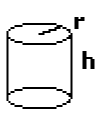
$A = 2ab + 2bc + 2ac$

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

$A = 108 + 126 + 84$

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.

$A = 2(\pi r^2) + (2 \pi r)h$

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

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

$A = 6{,}732$ 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 5 feet by 4 feet by 3 feet.

2. Find the total area of a rectangular prism measuring 16 meters by 6 meters by 2 meters.

3. Find the total area of a rectangular prism measuring 17 centimeters by 11 centimeters by 8 centimeters.

4. Find the total area of a rectangular prism measuring 16.4 meters by 13.7 meters by 14.5 meters.

Find the total area of each cube.

1. Find the total area of a cube whose edges measure 7 centimeters.

2. Find the total area of a cube whose edges measure 5.5 feet.

3. Find the total area of a cube whose edges measure 11.6 meters.

4. Find the total area of a cube whose edges measure 9 inches.

Find the total area of each cylinder.

1. Find the total area of a cylinder whose diameter is 9 inches and whose height is 15 inches.

2. Find the total area of a cylinder whose radius is 10 inches and whose height is 13 inches.

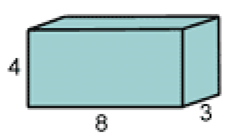
3. Find the total area of a cylinder whose radius is 27 centimeters and whose height is 32 centimeters.

4. Find the total area of a cylinder whose radius is 14 meters and whose height is 12 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.

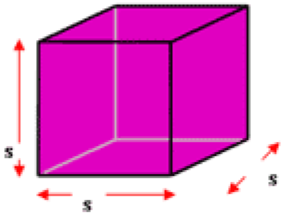
To find the volume of a ***cube*** or a ***rectangular prism***, multiply length by width by height.



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, S^3 :

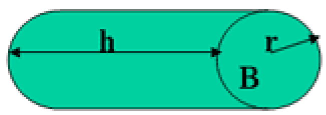


S^3 = volume of a cube

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

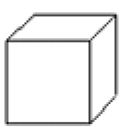
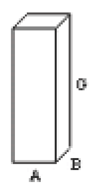
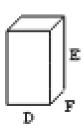
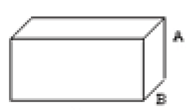
B x h = volume of a cylinder

πr^2 x h =



Practice Exercise

Find the volume.

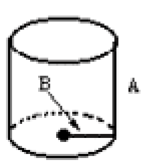
1.  All sides are 9 yd ____________	2.  A = 15 m B = 7 m G = 29 m ____________
3.  D = 28 yd E = 33 yd F = 4 yd ____________	4.  A = 12 ft B = 6 ft C = 24 ft ____________

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

	length	*width*	*height*	*volume*	
5.	5 mm	7 mm	13 mm	_______	cubic millimeters
6.	8 m	10 m	9 m	_______	cubic meters
7.	42 mm	33 mm	36 mm	_______	cubic millimeters
8.	80 yd	15 yd	30 yd	_______	cubic yards
9.	______ ft	15 ft	12 ft	720	cubic feet
10.	6 cm	______ cm	16 cm	960	cubic centimeters
11.	14 m	______ m	9 m	1512	cubic meters
12.	11 yd	13 yd	10.3 yd	_______	cubic yards
13.	13.1 ft	4.2 ft	4 ft	_______	cubic feet
14.	5.98 cm	8.41 cm	14 cm	_______	cubic centimeters
15.	9.49 m	11 m	5.92 m	_______	cubic meters

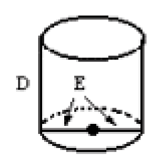
Find the volume.
Use 3.14 for π. Round to the nearest hundredth.

1.



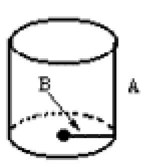
B = 3 ft
A = 6 ft

2.



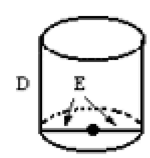
E = 4 mm
D = 9 mm

3.



B = 5 mm
A = 8 mm

4.



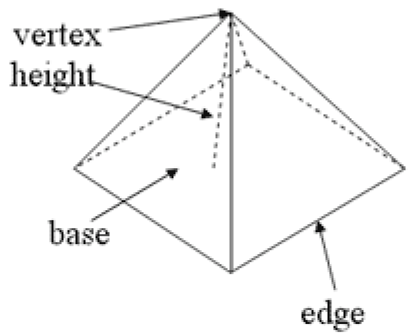
E = 10 in
D = 17 in

Fill in the missing spaces and complete the table.
Use 3.14 for π. Round to the nearest hundredth.

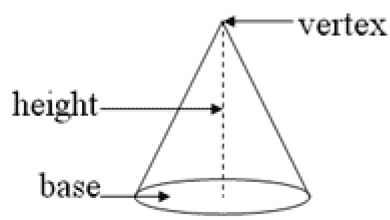
	diameter	*radius*	*height*	*volume*	
5.	10 ft	5 ft	8 ft	**628**	cubic feet
6.	6 cm	3 cm	9 cm	______	cubic centimeters
7.	16 in	8 in	3 in	______	cubic inches
8.	18 ft	______ ft	8 ft	______	cubic feet
9.	12 m	6 m	______ m	791.28	cubic meters
10.	28 yd	14 yd	______ yd	6154.4	cubic yards
11.	______ m	7 m	9 m	______	cubic meters
12.	24 m	______ m	6 m	______	cubic meters
13.	32.4 cm	16.2 cm	7.5 cm	______	cubic centimeters
14.	23.2 mm	11.6 mm	9.6 mm	______	cubic millimeters
15.	20.8 m	______ m	3 m	______	cubic meters

Pyramids and Cones

A pyramid has one base with sides of the same length. The base is connected to a single point, called a vertex, by triangular faces (sides).



A cone has one circular base and one vertex. A curved surface connects the base and vertex.



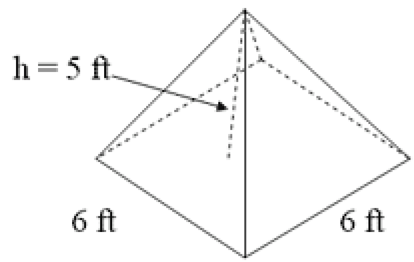
The volume of a pyramid or a cone is of the area of its base multiplied by its height.

V = x Area of base x height V = Ah

pyramid Volume = x (area of square) x height
= x (l x w) x height

cone Volume = x (area of circle) x height
= x π x radius squared x height

Example Find the volume of the pyramid shown below in cubic feet.



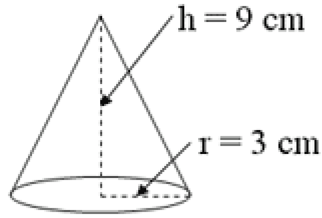
Step 1 Find the area of the base (a square).
Choose the formula.
Substitute and solve.

A = length x width
A = 6 x 6 = 36 square feet

Step 2 Choose the volume formula.
Substitute.
Solve.

V = Ah
V = (36)(5)
V = 60 cubic ft.

Example Find the volume of the cone shown below in cubic centimeters.



Step 1 Use the formula for finding the volume of a cone.

V = 1/3 x π x radius squared x height

Step 2 Substitute.

V = 1/3(3.14)(3 x 3)(9)

Step 3 Solve.

V = 1/3(3.14)(9)(9) = 84.78

The volume of the cone is **84.78 cubic centimeters.**

Practice Exercise

1. A cone has a height of 16 centimeters and a base with an area of 18 square centimeters. What is the volume of the cone in cubic centimeters?

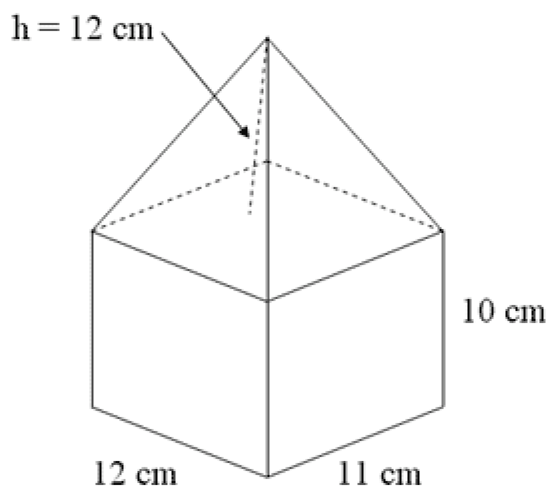
2. Find the volume of a pyramid if the area of the base is 12 square meters and the height is 4 meters.

3. Find the volume of a cone if the area of the base is 4 square centimeters and the height is 9 centimeters.

4. The base of a pyramid has an area of 9 square meters. The height of the pyramid is 12 ½ meters. What is the volume of the pyramid in cubic meters?

You may also be asked to find the volume of irregular figures made up of common solid shapes.

Example Find the volume of the object shown below.



Step 1 Find the area of the base of the pyramid.

$$\begin{aligned} A &= \text{length x width} \\ &= 12(11) \\ &= 132 \text{ square centimeters} \end{aligned}$$

Step 2 Find the volume of the pyramid.

$$\begin{aligned} V &= 1/3Ah \\ &= 1/3(132)(12) \\ &= 44(12) \\ &= 528 \text{ cubic centimeters} \end{aligned}$$

Step 3 Find the volume of the rectangular solid.

$$\begin{aligned} V &= lwh \\ &= 12(11)(10) \\ &= 132(10) \\ &= 1320 \text{ cubic centimeters} \end{aligned}$$

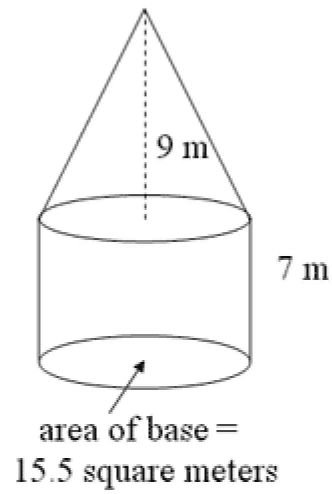
Step 4 Add the results.

$$528 + 1320 = 1848 \text{ cubic centimeters}$$

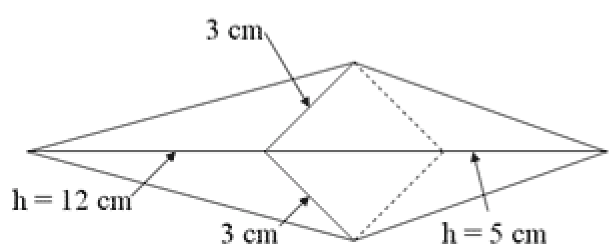
The volume of the object is **1848 cubic centimeters.**

Practice Exercise

1. Find the volume of the object shown below.



2. What is the volume in cubic centimeters of the figure shown below?



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	$A = \frac{1}{2}bh$
Volume	
Cube	$V = e^3$
Cylinder	$V = Bh$, or $V = \pi r^2 h$
Prism	$V = Bh$
Cone	$V = 1/3Bh$
Pyramid	$V = 1/3Bh$

Answer Key

Book 14019 - Measurement

Page 7

1. 21.9 ml **2.** 2 kl **3.** 4 cg **4.** 800 cg
5. 127 mm **6.** 8000 g **7.** 98.24 mg
8. 1.27 L **9.** 4 km **10.** 9.5 m
11. 4.4 kg **12.** 7.146 cm **13.** 6800 mm
14. 9.928 cl **15.** 12 kl **16.** 400 cl
17. 4.9 L **18.** 11 m **19.** 108 ml
20. 12.72 L **21.** 5310 L **22.** 5 m
23. 9400 L **24.** 6000 ml **25.** 6.6 g
26. 3360 mm **27.** 10.4 L **28.** 1000 m
29. 120 mg **30.** 5300 m **31.** 62.88 ml
32. 6835 m **33.** 2400 m

Page 12

2. 33 cm **3.** 15 cm **4.** 50 in **5.** 16 mi
6. 108 mi **7.** 24 ft **8.** 114 yd **9.** 112 m
10. 46 cm

Page 17

2. 100 square yd **3.** 144 square cm
4. 594 square in **5.** 108 square cm
6. 81 square cm **7.** 486 square m
8. 405 square yd **9.** 289 square mi
10. 220 square m

Page 19

1. 9 **2.** 22.5 **3.** 13.5 **4.** 31.5 **5.** 48
6. 104 **7.** 191 29/50 **8.** 86.13 **9.** 45 1/8
10. 11.1 **11.** 18 **12.** 7 **13.** 17.5
14. 105 1/8 **15.** 46 11/25

Page 20 **2.** 11683.94 m^2 **3.** 254.34 m^2
4. 2461.76 cm^2 **5.** 2306.05 mi^2
6. 92.58 yd^2 **7.** 153.86 mi^2
8. 19149.83 in^2

Page 21 **1.** 6; 28.26 **2.** 5; 28.5 **3.** 113.04
4. 314 **5.** 153.86 **6.** 6.6; 136.78
7. 9; 18 **8.** 15; 176.63 **9.** 12; 24
10. 167.33 **11.** 84 172/175
12. 120 142/175 **13.** 8 2/5; 221 19/25
14. 191 37/175 **15.** 35.86; 1009.46

Page 24 **1.** 49.625 ft^2 **2.** 33 cm^2 **3.** 144 cm^2

Page 29 **1.** 94 ft^2 **2.** 280 m^2 **3.** 822 cm^2
4. 1322.26 m^2

Page 30 **1.** 294 cm^2 **2.** 181.5 ft^2 **3.** 807.36 m^2
4. 486 in^2

Page 30 **1.** 551.07 in^2 **2.** 1444.4 in^2
3. 10004.04 cm^2 **4.** 2285.92 m^2

Page 32 **1.** 729 yd^3 **2.** 3045 m^3 **3.** 3696 yd^3
4. 1728 ft^3 **5.** 455 **6.** 720 **7.** 49896
8. 36000 **9.** 4 **10.** 10 **11.** 12
12. 1472.9 **13.** 220.08 **14.** 704.09
15. 617.99

Page 33 **1.** 169.56 ft^3 **2.** 113.04 mm^3 **3.** 157 mm^3

4. 1334.5 in^3
6. 254.34 **7.** 602.88 **8.** 9; 2034.72
9. 7 **10.** 10 **11.** 14; 1384.74
12. 12; 2712.96 **13.** 6180.46 **14.** 4056.18
15. 1018.87

Page 37 **1.** 96 cm^3 **2.** 16 m^3 **3.** 12 cm^3
4. 37.5 m^3

Page 40 **1.** 155 m^3 **2.** 51 cm^3