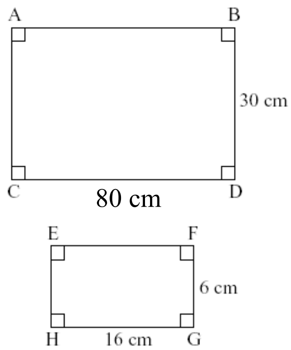
SCALE FACTOR

Similar Figures

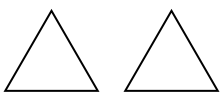
<u>Similar Figures:</u> Figures that are the same shape, but not always the same size



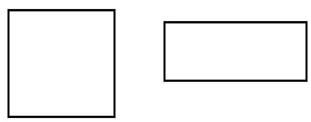
The ratio of corresponding sides must be equal for the rectangles to be similar.

$$\frac{80\text{ cm}}{16\text{ cm}} = \frac{30\text{ cm}}{6\text{ cm}}$$

CONGRUENT:
Same shape, Same size



NOT SIMILAR:



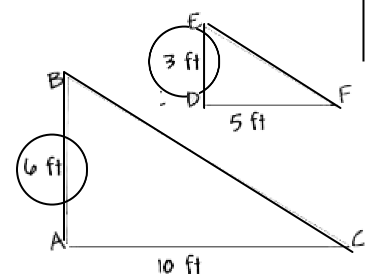
Scale Factor

<u>Scale factor:</u> The ratio of corresponding sides for a pair of similar figures.
<u>Corresponding sides:</u> Sides that have the same relative position on similar figures. Sides that "*match*"

Example:
Scale factor

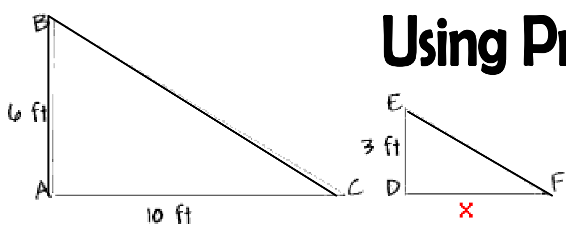
$$\frac{6}{3} = 2$$

The triangles at right have a scale factor of 2, because the corresponding sides are 6 and 3. 6 ÷ 3 = 2. The larger triangle is 2 times the size of the smaller triangle.



How to Find the Missing Sides of Similar Figures

Using Proportions



$$\frac{3}{6} = \frac{x}{10}$$

Step 1: Write a Proportion using corresponding parts (2nd Shape to 1st shape)

$10\text{ ft} \cdot 3\text{ ft} = 6\text{ ft} \cdot x$

Step 2: Cross Multiply and Divide to find the missing side

$10\text{ ft} \cdot 3\text{ ft} = 6\text{ ft} \cdot x$

$$\frac{30\text{ ft}^2}{6\text{ ft}} = \frac{6x}{6\text{ft}}$$

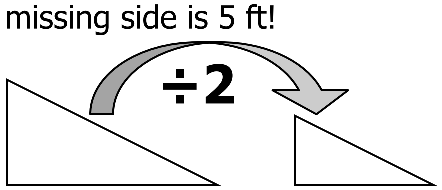
$5\text{ ft} = x$

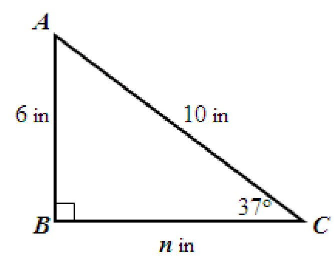
$DF = 5\text{ ft}$

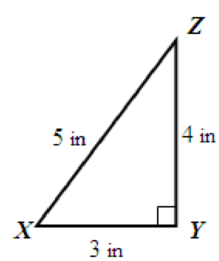
The missing side is 5 ft.

Using Scale Factor

The scale factor for the two triangles is 2, because 6 ÷ 3 = 2. So divide the side that corresponds to x, 10 ft, by 2. The missing side is 5 ft!







Sometimes the corresponding sides are rotated.

<u>3 in</u> corresponds to 6 in

<u>5 in</u> corresponds to 10 in

<u>4 in</u> corresponds to n in

SCALE MODELS & DRAWINGS

Scale Drawings- Drawings that represent real objects or places and are drawn to proportion

How to find the scale factor of a scale drawing or model:

- Identify the drawing/model length and actual length.
- Write a ratio of the model over the drawing/model length to the actual length.
- EXAMPLE: *The length of a car measures 240 inches. The length of the drawing is 12 inches. What is the scale factor of the drawing?*

$$\frac{\text{length of drawing or model}}{\text{real length}} = \frac{12 \text{ inches}}{240 \text{ inches}} = \frac{\div 12}{\div 12}\ \frac{1 \text{ in}}{20 \text{ in}}$$

The scale factor for the drawing of the car is 1:20, or one inch on the drawing represents 20 inches on the real car.

How can I find the length of a real object when I know the scale factor and the length of the model?

- Identify the scale.
- Set up a proportion with the scale on the left and the problem on the right. Set it up each ratio with the model or drawing to the real lengths.
- EXAMPLE:

Avery has a model of a building for his architecture class. The model is 18 inches high. The scale factor of the model is 1:50. How many inches tall is the building that the model represents?

scale **problem**

$$\frac{1 \text{ model}}{50 \text{ real}} = \frac{18 \text{ model}}{x \text{ real}}$$

Use x to represent the length of the real building because this is the unknown value, or what we are solving to find!

$18 \times 50 = 1x$

$900 = 1x$

$900 = x$

The real building will be 900 inches.

How can I find the length of a scale drawing when I know the scale factor and the length of the real distance?

- Identify the scale.
- Set up a proportion with the scale on the left and the problem on the right. Set it up each ratio with the model or drawing to the real lengths.
- EXAMPLE:

Max is making a map of his hometown. The scale for the map will be 1 in on the map represents 3 miles. The distance between his house and his school is 4.5 miles. How far apart will Max need to draw his house and his school on the map?

scale **problem**

$$\frac{1 \text{ in}}{3 \text{ miles}} = \frac{x \text{ in}}{4.5 \text{ miles}}$$

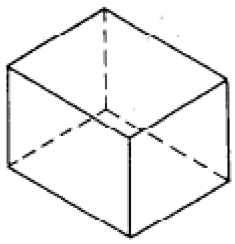
$$\frac{4.5}{3} = \frac{3x}{3}$$

$1.5 = x$

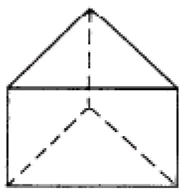
The distance on the map will be 1.5 inches.

SOLID FIGURES

PRISMS



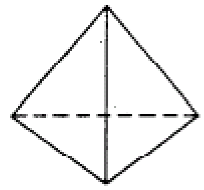
Rectangular Prism



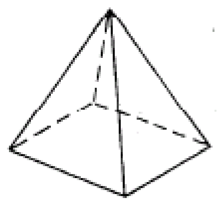
Triangular Prism

- Prisms have 2 bases.
- Prisms have mostly rectangular faces.

PYRAMIDS

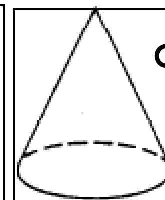


Triangular Pyramid

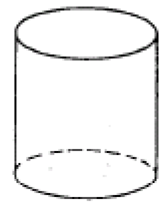


Rectangular Pyramid

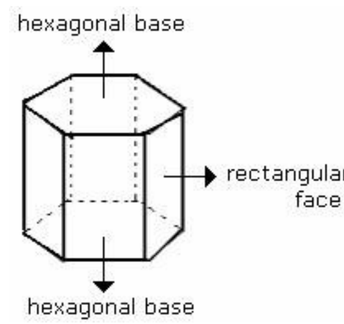
- Pyramids have one base.
- Pyramids have mostly triangular faces.



Cone



Cylinder



NAMING SOLID FIGURES
- The base of a pyramid or prism gives the shape its "first name"
- The "last name" is either prism or pyramid and is based on triangular or rectangular faces.

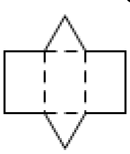
EXAMPLE: At right is a <u>Hexagonal Prism.</u>

NETS

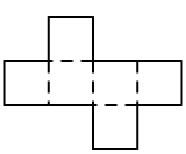
A **NET** is a pattern for a solid figure.

PRISMS

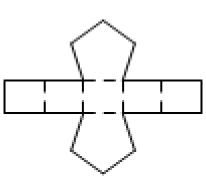
Notice, **PRISMS** have more **RECTANGLES!**



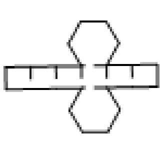
Tri-angular Prism



Cube/ Rectangular prism

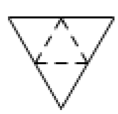


Pentagonal Prism

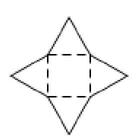


Hexagonal Prism

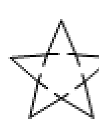
PYRAMIDS



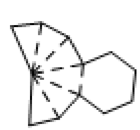
Triangular Pyramid



Rectangular Pyr-amid

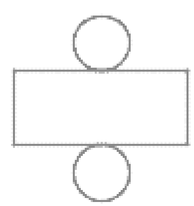


Pentagonal Pyramid

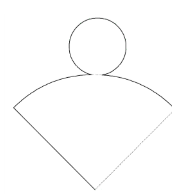


Hexagonal Pyramid

Notice, **PYRAMIDS** have more **TRIANGLES!**



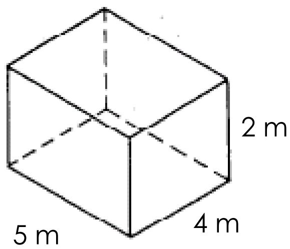
Cylinder



Cone

VOLUME OF A PRISM OR CYLINDER

RECTANGULAR PRISM



V = Bh

L x w

5 x 4 x 2

20 x 2

40 m³ → $40\ m^3$

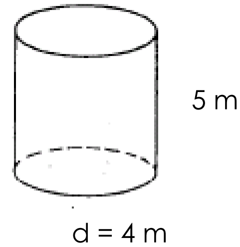
The base is a rectangle, so under "Big B" write "l x w" for the area of a rectangle.

V = Bh

Area of the base

Choose an area formula to plug into "Big B"

CYLINDER



Make sure you find the radius first!

If the diameter is 4 m, then the radius is 2 m!

V = Bh

$\pi \times r^2$

$3.14 \times 2^2 \times 5$

3.14 x 2 x 2 x 5

6.28 x 2 x 5

12.56 x 5

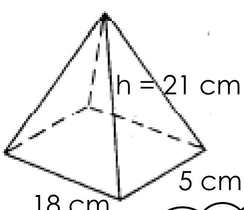
$62.8\ m^3$

The base is a circle, so under "Big B" write "$\pi \times r^2$" for the area of a circle.

VOLUME OF A PYRAMID OR CONE

RECTANGULAR PYRAMID

$V = \frac{1}{3}Bh$



L x W x h

18 x 5 x 21

90 x 21

1890

Don't forget 1/3 means divide by 3

$1890 \div 3 = 630$

$630\ cm^3$

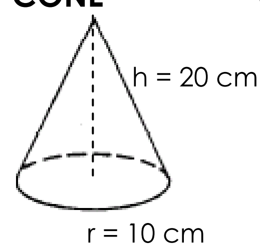
$V = \frac{1}{3}Bh$

Area of the base

$\frac{1}{3}$ Means DIVIDE by 3

CONE

$V = \frac{1}{3}Bh$



$\pi \times r^2 \times h$

$3.14 \times 10^2 \times 20$

3.14 x 2000

6280

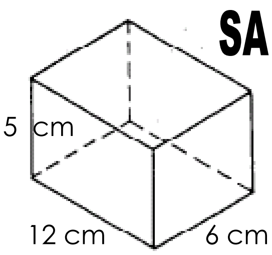
Don't forget 1/3 means divide by 3

$6280 \div 3 = 2093$

$2093\ cm^3$

SURFACE AREA OF PRISMS

$SA = 2(lw) + 2(wh) + 2(lh)$



2(lw)	2(wh)	2(lh)
2 x 12 x 6	2 x 6 x 5	2 x 12 x 5
24 x 6	12 x 5	24 x 5
144	60	120

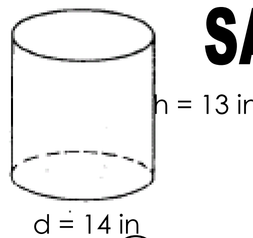
144 + 60 + 120

204 + 120

$324\ cm^2$

SURFACE AREA OF CYLINDERS

$SA = 2\pi r^2 + 2\pi rh$



Don't forget if you're given the diameter to divide by 2 for the radius!

$2\pi r^2$	$2\pi rh$
$2 \times \pi \times r^2$	$2 \times \pi \times r \times h$
$2 \times 3.14 \times 7^2$	2 x 3.14 x 7 x 13
2 x 3.14 x 49	2 x 3.14 x 91
6.28 x 49	6.28 x 91
307.72	571.48

307.72 + 571.48

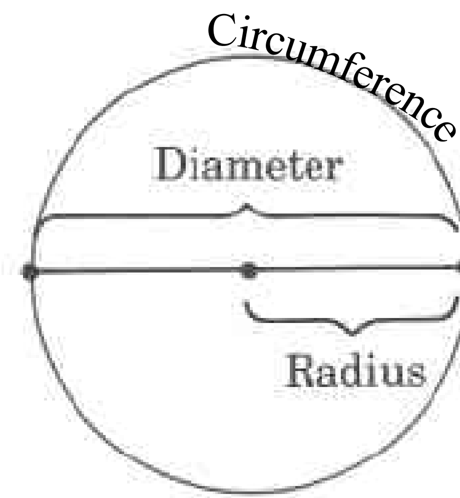
$879.2\ in^2$

CIRCLES AND CIRCLE GRAPHS

Circle: All points same distance from center point
Radius: line segment from the center to the side of the circle
Diameter: line segment from side to side of the circle passing through the center
Circumference: distance around the circle
Pi (Π): ratio of the circumference to the diameter; 3.141592.....

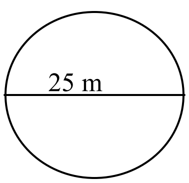
$r = \frac{1}{2} d$ The radius is 1/2 of the diameter.

$d = 2r$ The diameter is 2 times the radius.



CIRCUMFERENCE

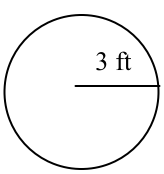
$C = \Pi d$



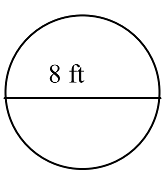
C = Πd
3.14 x 25
78.5 m

AREA OF A CIRCLE

$A = \Pi r^2$



Example with radius given:
$A = \Pi r^2$
3.14×3^2
$3.14 \times 3 \times 3$
3.14×9
$28.26\ ft^2$

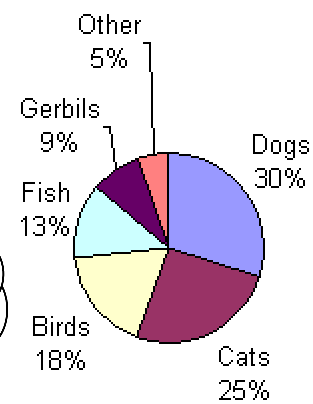


Example with diameter given:
d = 8 ft
r = 4 ft
$A = \Pi r^2$
3.14×4^2
$3.14 \times 4 \times 4$
3.14×16
$50.24\ ft^2$

CIRCLE GRAPHS

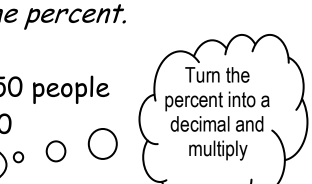
To read a circle graph, you might need to know the total number of people surveyed.

Pets Bought at Pet World



For example, if the graph represents a survey of 150 people, you could find the number of people who chose dogs by using the percent.

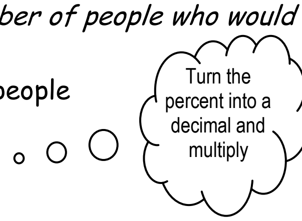
DOGS
30% of 150 people
0.30 x 150
45 people



You can also use circle graphs to make predictions about populations.

For example, if Pet World expects to see 500 customers next week, you could predict the number of people who would purchase a gerbil.

GERBIL
9% OF 500 people
0.09 x 500
45 people



You can also determine the number of each sector. You must know that there are 360 DEGREES IN ONE CIRCLE. You can think proportionally or use a percent.

Find the degrees of the bird sector:

$\frac{18}{100} = \frac{x}{360}$ $100x = 6480$
$x = 64.8$ degrees

18% of 360
0.18 x 360
64.8 degrees

FORMULAS

Below are formulas you may find useful as you work the problems. However, some of the formulas may not be used. You may refer to this page as you take the test.

Area

Rectangle and Parallelogram $A = bh$

Triangle $A = \frac{1}{2}bh$

Circle $A = \pi r^2$

Volume

Rectangular Prism/Cylinder $V = Bh$

Pyramid/Cone $V = \frac{1}{3}Bh$

Circumference

$C = \pi d$ $\pi \approx 3.14$

Surface Area

Rectangular Prism $SA = 2(lw) + 2(wh) + 2(lh)$

Cylinder $SA = 2\pi r^2 + 2\pi rh$

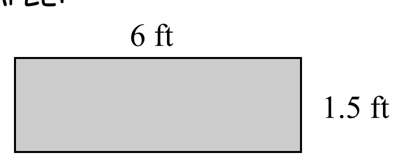
AREA OF A RECTANGLE

The formula above for finding the area of a rectangle is A = bh. An alternate formula for area of a rectangle is:

$$A = \ell \times w$$

when A represents area, ℓ represents length, and w represents width.

EXAMPLE:



$A = \ell \times w$
6 x 1.5
9.0

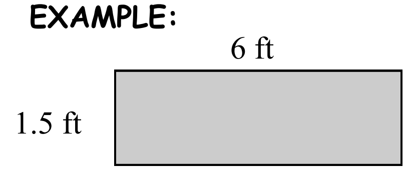
$A = 9 \text{ ft}^2$

PERIMETER

Perimeter: distance around a plane figure

ADD ALL THE SIDES

EXAMPLE:



P = 1.5 + 1.5 + 6 + 6

P = 15 feet

What do these variables stand for?

B = area of the base

h = height

π = 3.14

r = radius