Math 10C Unit 7

Chapter 1 – Measurement

Name:_____

1.1 Referents and Systems

The Point

- Learn about *Referents* and Imperial vs SI Measures.
- Measuring basic units in each system

SI vs IMPERIAL

Check your (or a friend's) learners' permit. What does it say for height?

Even though Canada adopted *La Système Internationale d'unités* in 1976, many people still use **Imperial Units** for things like height & weight.

The focus in this lesson will be on the imperial system.

DEFINITION

Referent – A referent is something that may be compared when trying to estimate a length.

ex. The width of a pinky finger is ~1cm.
The length of your foot is ~ 1 ft.
The length of a stride is ~1 meter or 1 yd.

THE "OLD" WAYS

1. In England, the **inch** has been in use since medieval times. In 1324, Edward II decreed that the inch was the length of 3 barley corns placed end-to-end.

2. The **foot**, a length of the human foot, was anything from 9 3/4 to 19 inches.

3. Henry I (1100-1135) decreed the lawful **yard** to be the distance between the tip of his nose and the end of his thumb.

4. In the past every part of England had its own **mile.**

Do you see any problems with the "ancient" measuring system?

THE IMPERIAL SYSTEM

The inch, foot, yard, and mile are the typical units for imperial length. Fractions are used instead of decimals. (ie. 5/8 of an inch)

12 inches = 1 foot 3 ft. = 1 yard 1760 yd. = 1 mile

Feet and inches get special symbols:

$$12'' = 1'$$

An easy way to remember is by counting the syllables. Inches has two, Feet has one.

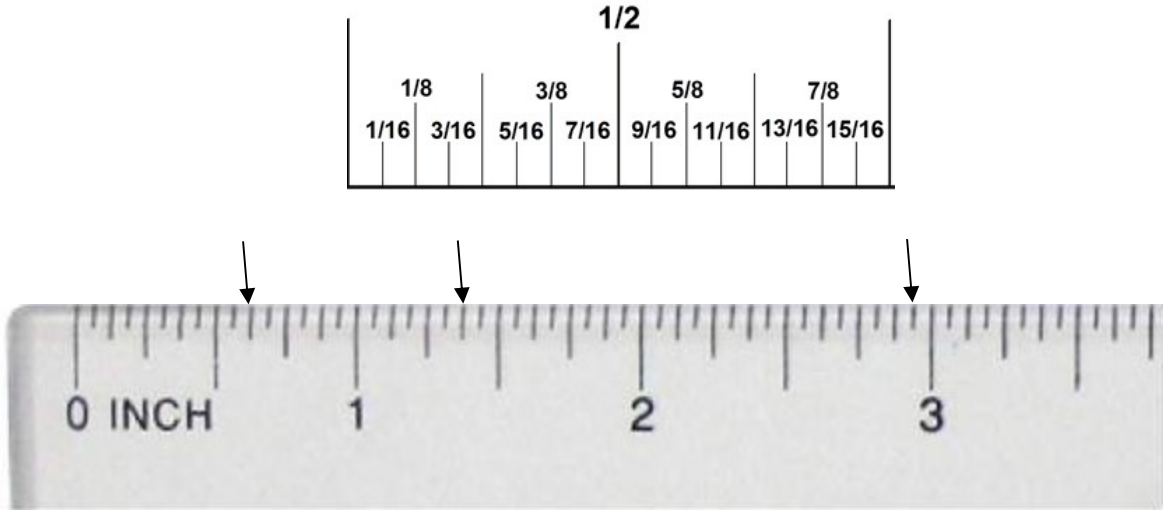
ESIMATING INCHES

You need a ruler. Measure a true inch here:

Determine a referent for 1 inch.

MEASURING INCHES

Measuring inches requires the use of fractions. Most rulers have a similar number of "ticks" per inch that become the denominator.



(not to scale)

Why will you not see $8/16''$ *as the final answer for a measurement?*

M

EASURING YOURSELF

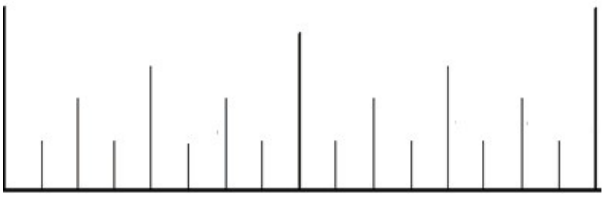
Measure the longest length in inches, with a ruler:

LENGTH:

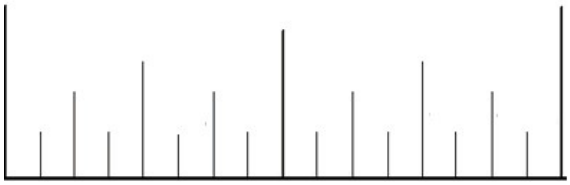
PRACTICE

Mark on the ruler below:

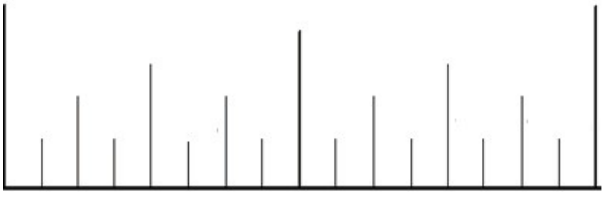
a) $\frac{5}{16}''$



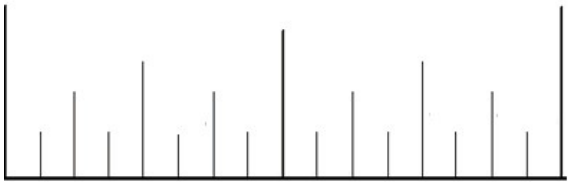
b) $\frac{3}{8}''$ inch



c) $\frac{3}{4}''$



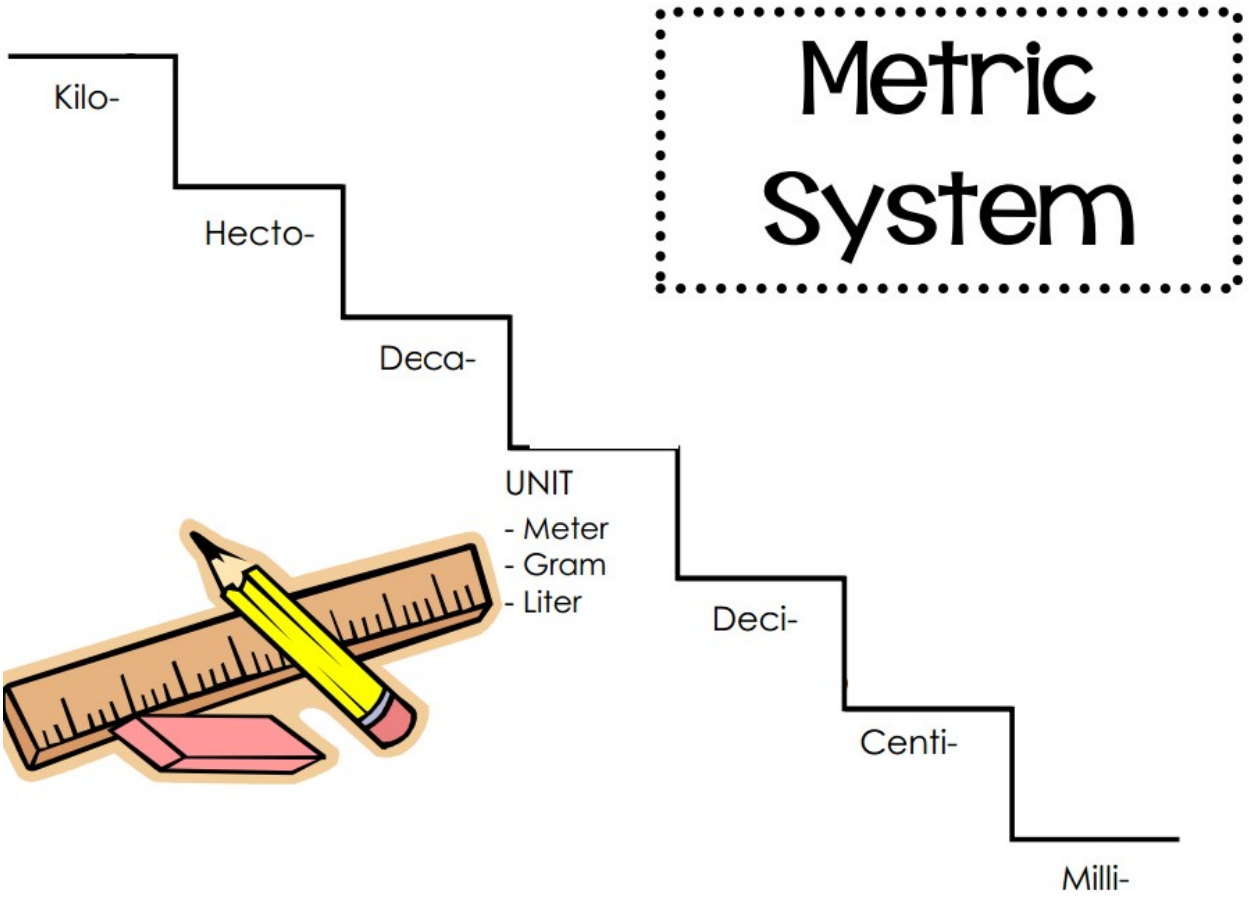
d) $\frac{3}{16}''$



Measure with a true ruler:

e) $1\frac{7}{16}''$ inch

f) $\frac{5}{8}''$



METRIC REFERENT

Using a ruler, measure 1 cm:

What is a good referent for 1 cm?

MEASURING IN METRIC (SI)

Indicate the following lengths on the metric ruler:

a) 1.2cm

b) 35mm

c) 7.7cm

EXAMPLE 1

With a ruler, determine the actual length of the screw. Was your estimation close?

Actual length in cm: _____

EXAMPLE 2

Determine the width of two desks pushed together. Is cm still the best measure? Is a ruler the best device?

EXAMPLE 3

Determine the approximate width of the classroom. How can we estimate this? How can we measure this?

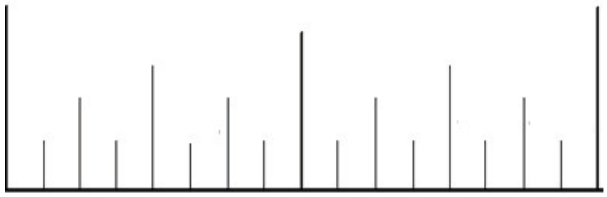
ASSIGNMENT

1. Using your ruler measure the following lines.

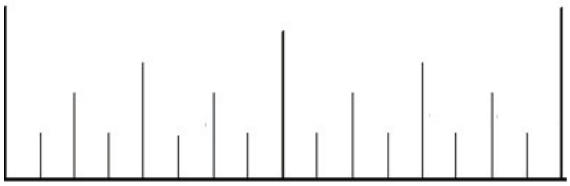
	METRIC	**IMPERIAL**
a. _____	_____	_____
b. __	_____	_____
c. _____	_____	_____
d. _____	_____	_____

2. Mark on the rulers below the indicated length:

a) $\frac{9}{16}$ ″

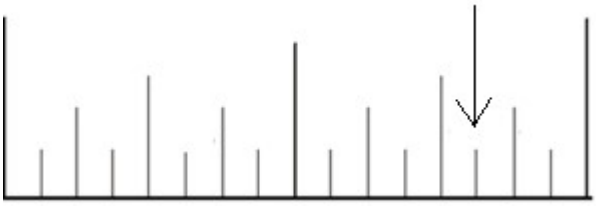


b) $\frac{5}{8}$ ″ inch

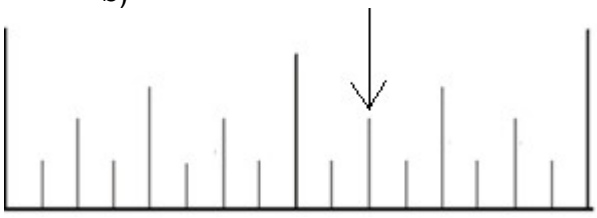


3. Read the rulers below:

a)

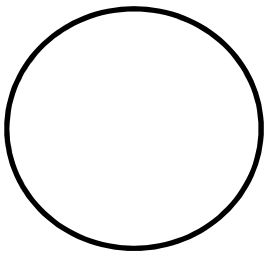


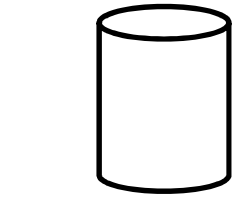
b)



4. Write your estimate and actual length of each object in the following list. You may choose to use metric or imperial

OBJECT	ESTIMATION	ACTUAL LENGTH
Width of this booklet	inches	inches
Diameter of a circle	cm	cm
Height of the soup can below	inches	inches
Length of left penguin's beak	inches	inches
Height of a penguin	cm	cm
iphone 6 plus (diagonal)	inches	inches





1.3 Converting Units (part 1)

The Point

- Converting Imperial and SI Measures.

REMINDER
List the metric measures, starting with km

____ ____ ____ ____ ____ ____ ____

Convert the following:

a) 3 000m into km

b) 900 000cm into km

b) 20 mm into cm

d) 3.7 cm into dm

d) 53 hm into dm

e) 275 mm into m

INVESTIGATE 1
How many minutes is:

a) 0.5 hours

b) 0.25 hours

Not all values are out of 10 or 100.
One hour is a total of 60 minutes.
One foot is a total of 12 inches.
One yard is a total of 3 feet.

c) 0.75 hours

d) 0.2 hours

REMINDER

Solve the following equations below by cross-multiplying.
(move diagonally to the x by itself)

$$\frac{5}{3} = \frac{x}{6}$$

INVESTIGATE 2

Can you determine how many INCHES the following feet are?

a) 0.5 feet

b) 0.25 feet

You can always cross-multiply to convert units

$$\frac{1\ foot}{} = \frac{12 inches}{}$$

c) 0.75 feet

d) $0.1\overline{6}$ feet (what is the equivalent fraction?)

CONVERTING IMPERIAL

EXAMPLE 1 (INCHES TO FEET)

If an item is $36''$ long, how many complete feet is it? Are there any leftover inches?

EXAMPLE 2 (INCHES TO FEET)

If an item is $39''$ long, how many complete feet is it? Are there any leftover inches?

EXAMPLE 3 (FEET TO INCHES)

If an item is 7 feet long, how many inches is it?

EXAMPLE 4 (FEET TO YARDS)
Convert 6 feet into yards. How many complete yards is it? Are there any leftover feet?

EXAMPLE 5 (FEET TO YARDS)
Convert 7 feet into yards. How many complete yards is it? Are there any leftover feet?

PUTTING IT TOGETHER

Show that 50 inches is: 50 inches = 1 yard 1 foot 2 inches

Guide:

1. Convert 50 inches into feet
   50 inches = 4.16666…
2. We know 4 complete feet. Convert the leftovers back into inches.
   (4 feet would be 48 inches. There are two inches left to make up.)
   50 inches = 4 feet 2 inches
3. Convert the 4 feet into yards.

   4 feet = 1.33333…. yards
4. We know 1 complete yard. Convert the leftovers back into feet.
   (1 yard would be 3 feet. There is one foot left to make up.)
   4 feet = 1 yard 1 foot
5. All together:
   50 inches = 1 yard 1 foot 2 inches

TRY

Convert 126 inches into yards, left-over feet, and left-over inches.

CONVERTING METRIC / IMPERIAL

EXAMPLE 6

Convert 6ft. 2 in. to inches, then centimeters.

EXAMPLE 7

Convert 52 km into miles

ASSIGNMENT

1. Convert:

a) 8 ft. to inches

b) 25 yd. to feet

c) 72 in. to feet

d) 87 ft. to yards

e) 248 in. to yards and feet

f) 7 ft. 5 in. to inches

g) 63 yd. to feet

h) 24 inches = _____ feet

i) 2 yards = _____ feet

j) 50 m = _____ km

k) 1300cm = _____ m

l) 450 cm = _____mm

m) 7.3 dm = _____ dam

n) 1300m = _____ hm

1.3 Converting Units (part 2)

POINT

- Continue practicing conversions
- Learn alternative approaches (unit analysis)
- Examine applications (cost)

UNIT ANALYSIS
When you want to convert **rates** (relevant info top **& bottom**),use unit analysis:

Unit analysis **focuses on units** to know how to convert

EXAMPLE 1
Convert $0.50/cm. into a price per inch:

EXAMPLE 2
Convert 100 km/hr into m/s with unit analysis.

TRY 1
Convert 50 miles/hour into meters/second

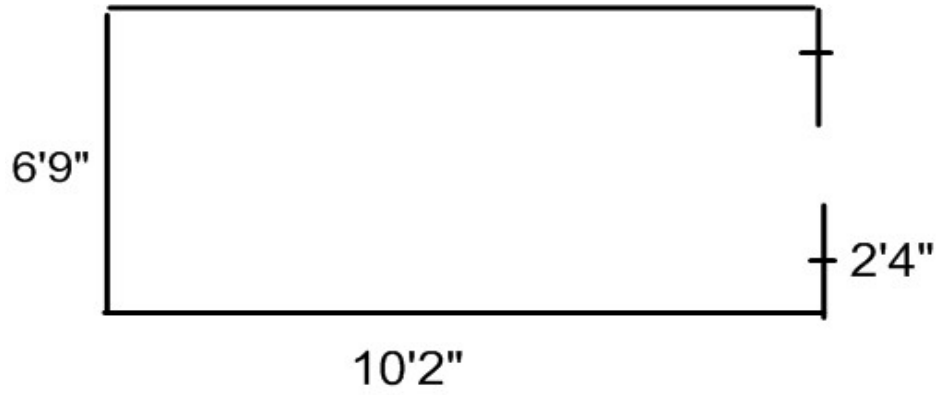
TRY 2

Mr. Lemko stubbornly refused to buy pepperoni above $0.15 per cm. Sobeys has a sale, trying to trick Mr. Lemko at $0.25 per inch.

Will he buy the pepperoni stick?

TRY 3

Baseboards cost $0.35/ft. How much would it cost to finish the following room?



TRY 4

Maps use scales like 1: 2000, which means 1 unit on the map is equal to 2000 units in the real world. If you measure 6 cm on the map, how much does that refer to in the real world?

Assignment
pg. 22-23 # 4, 6, 7, 8, 10, 11, 13a, 14, 15

1.4 Surface Area of Right Pyramids and Cones

The Point

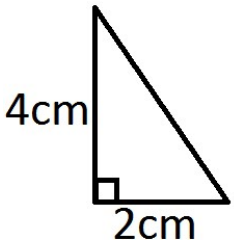
Learn how to calculate the Surface Area of Pyramids and Cones.

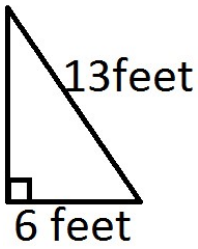
REMINDER 1

Pythagorean Theorem:

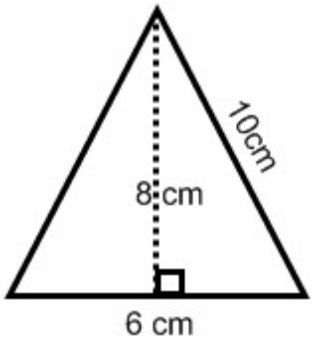
=

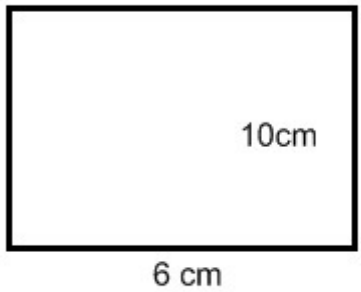
a) Determine the missing side lengths

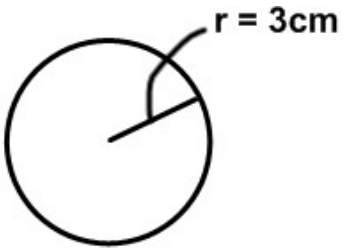




REMINDER 2



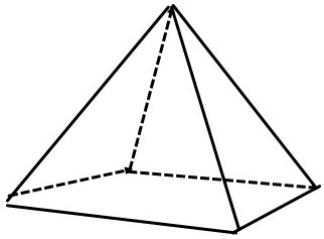
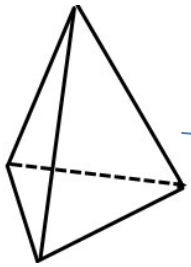




Area of a triangle:	Area of a rectangle:	Area of a circle:

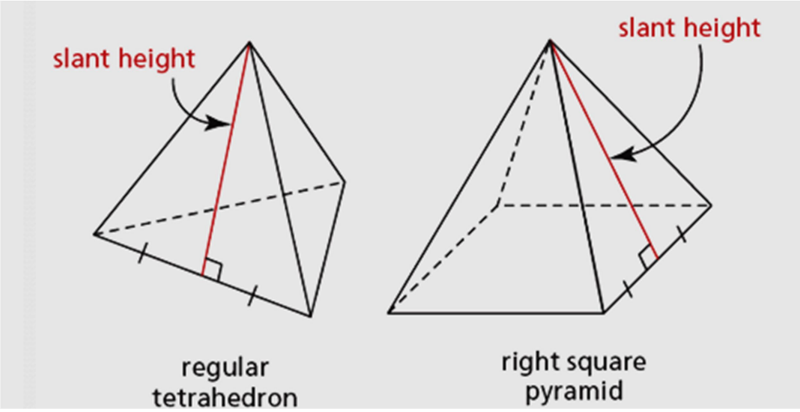
RIGHT PYRAMIDS

Draw a "net" for the each pyramid:

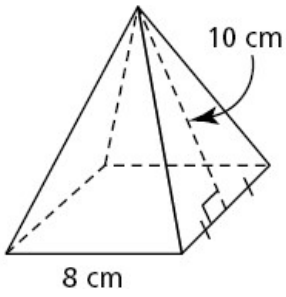
SLANT HEIGHTS

The slant height is different from the vertical height.



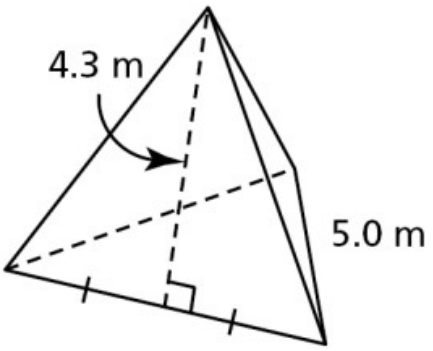
CALCULATING SURFACE AREA

EXAMPLE 1
This right square pyramid has a slant height of 10 cm and a base side length of 8 cm. Find its surface area.



SA = 4 △ + 1 □

TRY 1
Calculate the area of this **REGULAR TETRAHEDRON.**
(A "regular" shape means each face is identical)



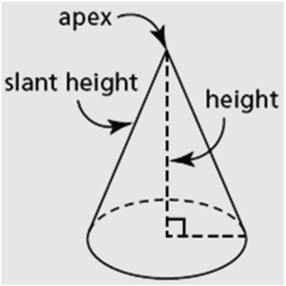
DEFINITION

Lateral area is the total area of the vertical face(s) of a pyramid (everything but the base OR the "wrap-around").

What is the lateral area of "try 1"?

SA_{cone} =

RIGHT CONES



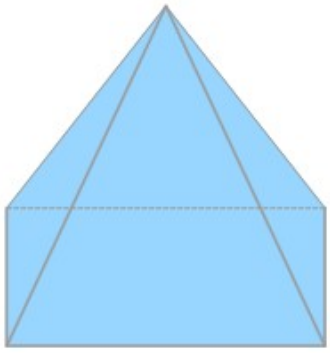
EXAMPLE 3

A right cone has a base radius of 4 metres and a vertical height of 10 metres. Calculate the surface area of this cone to the nearest square metre.

DRAW:

EXAMPLE 4 (working backwards)

The lateral surface area of a square pyramid is 3000 in^2. The side length of the base if 50 inches. Determine the **vertical height** of the model, to the nearest tenth of an inch.



Super Challenge Question of the Day
(no slant height given)

A right rectangular pyramid has base dimensions 4 m by 4 m, and a vertical height of 8 m. Calculate the surface area of the pyramid to the nearest square metre.

Assignment: Pg. 34-35
#4b, 5b, 6a, 7a, 9, 11, 16

1.5 Volumes of Right Pyramids and Cones

The Point

Learn how to calculate the Volume of Pyramids and Cones.

REMINDER

Draw a **rectangular pyramid** **cone**

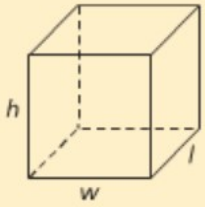
VOLUME VS SURFACE AREA

What is the difference between volume and surface area? What are some typical units?

CALCULATING VOLUME

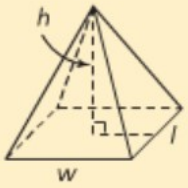
A right rectangular prism with length l, width w, and height h, has volume:

$V = lwh$



A right rectangular pyramid with base length l, base width w, and height h, has volume:

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



Essentially, it is the area of the Base, times the height:

Volume of a pyramid:

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

EXAMPLE 1

a) A right rectangular prism has base dimensions of 5.3 cm and 2.6 cm and a height of 10.7 cm. Determine its volume.

a) The same dimensions exist for a right rectangular PYRAMID. Determine its volume.

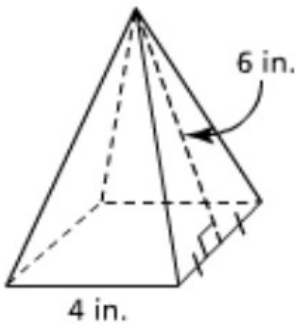
EXAMPLE 2

Indiana Jones is trapped in a right "square" pyramid that is filling with sand. A right square pyramid has a height of 5.3 cm and a base area of 20.7 cm^2. Find the volume of sand that will fill it up.

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

APPLYING PYTHAGORAS

Determine the volume of the pyramid to the right



CONES **CYLINDERS**

Volume of a Cone:

$$V = \frac{1}{3}(\pi r^2)h$$

Surface Area of a Cone:
(from last day)

Volume of a Cylinder:

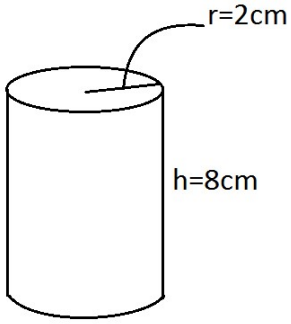
$$V = \pi r^2 h$$

Surface Area of a Cylinder:

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

EXAMPLE 2

a) Determine the surface area of the right cylinder to the nearest tenth of a squared cm.

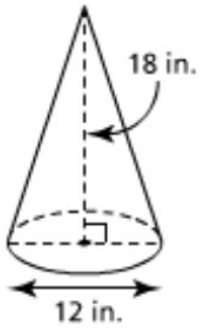


b) Determine the surface area of the right cylinder to the nearest tenth of a squared cm if it has **no top circle**.

c) Determine the volume of the right cylinder to the nearest tenths of a cubic cm.

EXAMPLE 2

Determine the volume of the right cone to the nearest cubic inch.



EXAMPLE 3

A cone has a radius of 8 m and a volume of $300m^3$. Determine the length/height to the nearest metre.

Assignment: pg. 42-43
#4b, 5b, 6a, 7a, 10, 11, 12, 18, 21

1.6 Surface Area and Volume of a Sphere

The Point

Learn how to calculate the Surface Area and Volume of Sphere.

Surface Area of a Sphere

The surface area, SA, of a sphere with radius r is:

EXAMPLE 1

The diameter of a softball is approximately 4 in. Determine the surface area of a softball to the nearest square inch.

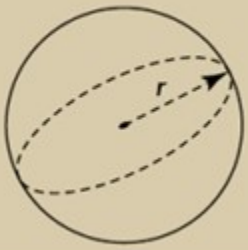
EXAMPLE 2

The surface area of a soccer ball is approximately 250 square inches. What is the **diameter** of a soccer ball to the nearest tenth of an inch?

VOLUME

Volume of a Sphere

The volume, V, of a sphere with radius r is:

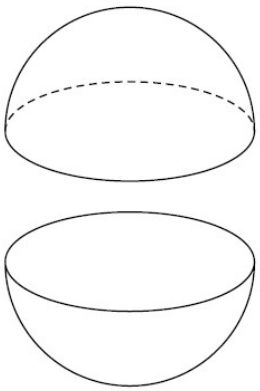


TRY 2

An orange approximates a sphere with radius of 2 in. What is the approximate volume of the orange?

HEMISPHERE FORUMULAS

a) $V_{sphere=}$



b) $SA_{sphere=}$

$V_{hemisphere=}$

$SA_{hemisphere=}$

EXAMPLE 3

A hemisphere has a radius of 5.0 cm.

a) What is the surface area of the hemisphere to the nearest tenth of a square centimetre?

b) What is the volume of the hemisphere to the nearest tenth?

CHALLLENGE Qs

EXAMPLE 4

The surface area of a hemisphere is 65 cm^2. What is the radius?

CHALLLENGE Qs

EXAMPLE 5

The surface area of a hemisphere is 65 cm^2. What is the Volume of the hemisphere?

Assignment: pg.51-52
#3ac, 4ac, 5b, 8, 13, 20

1.7 Solving Problems Involving Objects

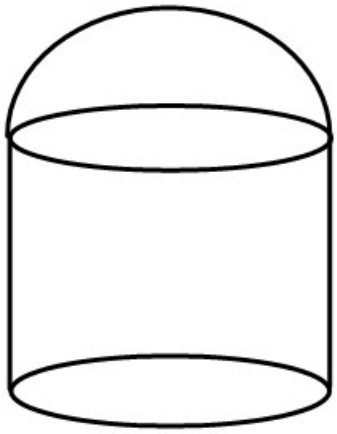
The Point

Learn how to calculate the Surface Area and Volume of Sphere.

Your confidence and knowledge of the formulas' parts will determine success in this topic.

Investigate

Determine a formula for the following composite shape

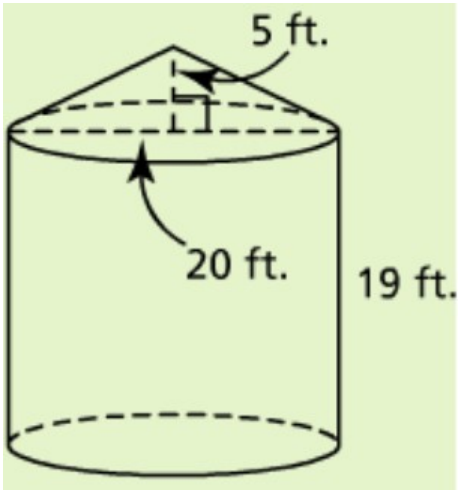


Volume:

Area:

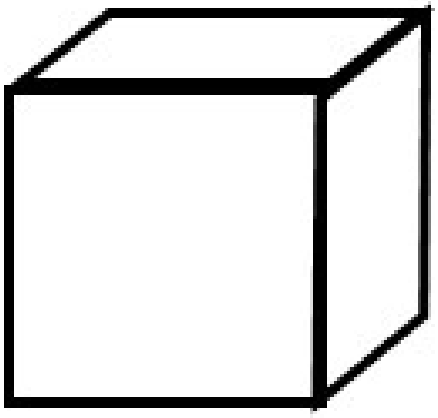
EXAMPLE 1

Determine the volume of grain that would fill this bin.



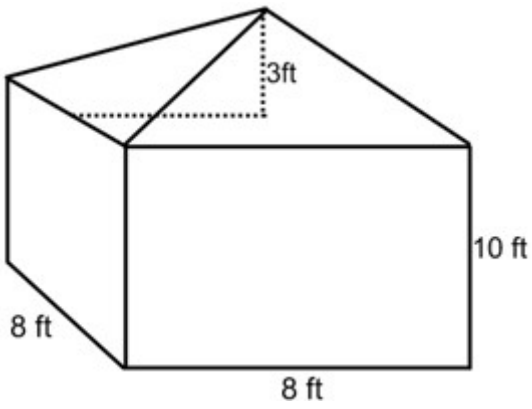
EXAMPLE 2

A ball with a diameter of 4 cm fits tightly within a square box so that the side-length equals the diameter of the ball. How much air, to the nearest tenth surrounds the ball, within the box?



TRY 1

a) Determine the Volume of the composite object.



b) Determine the surface area of the composite object

Assignment: pg. 59-60
#3, 5a, 6, 7, 8, 10, 11