1.1 Imperial Measures of Length

C 1.1 Concept: #10

FP 10.3: Demonstrate understanding of SI and imperial units of measurement including: linear measurement, surface area of spheres, and right cones, cylinders, prisms, and pyramids & volume of spheres, and right cones, cylinders, prisms, and pyramids

Online Video Lessons: https://goo.gl/Z4onuZ

- The SI system of measures is an abbreviation for *Le Systeme International d'Unites*. Since 1960, this form of the metric system has been adopted by many countries, including Canada.
- Some imperial units of measure are the inch, the foot, the yard, and the mile.

Question: Although Canada officially uses the metric system, we still commonly imperial units in many instances. Name some of those instances.

Historical Moment: The origin of the Inch

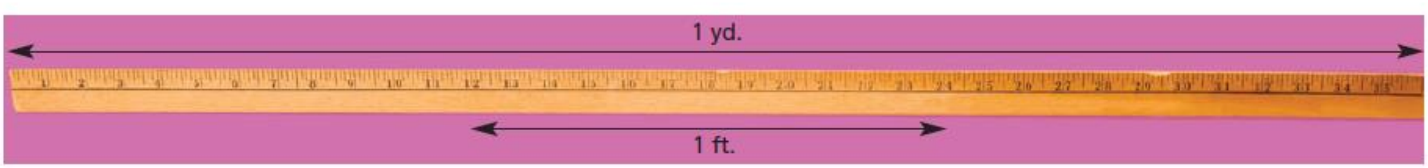
The word *inch* may be derived from the Latin word *uncia* meaning "one-twelfth part," referring to one-twelfth the length of a man's foot. Alternatively, the Anglo-Saxon term *inch* was defined as the length of 3 corns of barley. King David I of Scotland described an *ynche* as the width of a man's thumb at the base of the nail; this is supported by the similarity of the word "inch" to the word "thumb" in several languages. For example, in French, *pouce* means inch and also means thumb. In Swedish, *tum* is inch and *tumme* is thumb.

- People have been measuring for thousands of years. Early trades people created their own measuring devices and units. For example, people measured the distance between two places by the number of days it took to travel from one place to the other. Over time, these units were standardized as imperial units, and relationships between the units were determined.
- The imperial unit for measuring long distances is the mile. The length of one mile was first established as the distance a Roman soldier could walk in 1000 paces. One pace is 2 steps.

Imperial Unit	Abbreviation	Referent	Relationship between Units
Inch	in.	Thumb length	
Foot	ft.	Foot length	1 ft. = 12 in.
Yard	yd.	Arm span	1 yd. = 3 ft. 1 yd. = 36 in.
Mile	mi.	Distance walked in 20 min	1 mi. = 1760 yd. 1 mi. = 5280 ft.

On maps and scale diagrams, you may see symbols for imperial units instead of abbreviations. One inch is 1" and one foot it 1'.

- Rulers with imperial units may be different. Many rulers marked with imperial units show one inch divided into eighths, tenths, or sixteenths.



To measure the length of an object, you must first determine the smallest indicated unit by counting the number of divisions between two adjacent inch marks. The ruler below has 16 divisions between two adjacent inch marks, so the smallest indicated unit is $\frac{1}{16}$ of an inch, which is written as $\frac{1}{16}$ in.

A fraction of an imperial measure of length is usually written in fraction form, not decimal form.

A measure reported in several units should proceed from the greatest unit to the least unit; for example, yards, feet, inches

How long is the pencil?

Example #1:

Convert:

a) 5 mi. to yards

b) 100 in. to feet and inches

Relationship between Units
1 ft. = 12 in.
1 yd. = 3 ft. 1 yd. = 36 in.
1 mi. = 1760 yd. 1 mi. = 5280 ft.

c) 14 ft. to inches

d) 14 ft. to yards and feet

Example #3:

Alex purchased 7 yd. of ribbon to trim some napkins. The ribbon is sewn around a napkin, which is 14 in. wide and 16 in. long. How many napkins can Alex trim with this ribbon?

Example #4:

Ben buys baseboard for a bedroom. The perimeter of the bedroom, excluding closets and doorway, is 37 ft.

a) What length of baseboard is needed, in yards and feet.

b) The baseboard material is sold by the yard. It costs $5.99/yd. What is the cost of the material before taxes?

Example #5:

A map of Saskatchewan has a scale of 1:63 360. The straight line distance on the map between Swift Current and Regina is 1 1/16". What is the straight line distance between these two towns to the nearest mile?

CALCULATORS ARE ALLOWED!!! Label this assignment properly!

1.1 *FA (Foundational Assignment) (All C10)
P11 #3, 7, 8, 10, 17, 19

1.1 MLA (Mid-Level Assignment) (All C10)
P11 # 12, 13, 14, 15, 18, 20, 21a

1.1 Assignment for Concepts #10

1.2 The SI System of Measurement

C 1.2 Concept: #10cont.

FP 10.3: Demonstrate understanding of SI and imperial units of measurement including: linear measurement, surface area of spheres, and right cones, cylinders, prisms, and pyramids & volume of spheres, and right cones, cylinders, prisms, and pyramids

Online Video Lesson: https://goo.gl/aN0Dwg

SI System of Measurement

In the late 1700's, as scientists began to develop the ideas of physics and chemistry, it became clear that an international system of measurements would help them communicate scientific data more effectively. Scientists needed to prove their ideas with data based on measurements that other scientists could reproduce. A decimal system of units based on the meter as a standard length, the kilogram as a standard mass, and the liter as a standard volume was developed by the French. Today this system is known as the metric system, or SI system. The equations below show how the meter is related to other units in this system of measurements.

1 meter = 100 centimeters

1 cubic centimeter = 1 cm^3 = 1 milliliter

1000 milliliters = 1 liter

The metric system is easy to use because all the units are based on factors of 10. In the English system, there are 12 inches in a foot, 3 feet in a yard, and 5,280 feet in a mile. In the metric system, there are 10 millimeters in a centimeter, 100 centimeters in a meter, and 1,000 meters in a kilometer.

When you are measuring:	Use this standard unit:	Symbol of unit
mass	kilogram	kg
length	meter	m
volume	liter	l
force	newton	N
temperature	degree Celsius	°C
time	second	s

The following prefixes in the metric system indicate the multiplication factor to be used with the basic unit. For example, the prefix kilo- is a factor of 1,000. A kilometer is equal to 1,000 meters, and a kilogram is equal to 1,000 grams.

Prefix	kilo-	hecto-	deca-	Basic unit (no prefix)	deci-	centi-	milli-
Symbol	k	h	da	m, l, g	d	c	m
Multiplication Factor or Place-Value	1,000	100	10	1	0.1	0.01	0.001

Example #1:

Conversion factors are used to convert a measure from one unit to another.
This table shows the relationships among some of the units of length.

a) Convert 7.3 m to centimetres

b) Convert 225 cm to m

Example #2:

a) 150 cm to meters

b) 1.63 m to centimeters

c) 5 m to millimeters

d) 86mm to cm

CALCULATORS ARE ALLOWED!!! Label this assignment properly!

1.2 *FA (Foundational Assignment) (All C10)
The following practice questions:

C 1.2 Assignment for Concept #10 Cont

Convert

a) 8040 cm to meters
b) 8040 mm to cm
c) 8040 cm to mm
d) 8040 m to km
e) 8040 m to cm
f) 8040 km to m

1 m = 100 cm 1 m = 1000 mm
1 cm = 0.01 m 1 cm = 10 mm
1 mm = 0.001 m 1 mm = 0.1 cm

1.3 Relating SI & Imperial Units

FP 10.3: Demonstrate understanding of SI and imperial units of measurement including: linear measurement, surface area of spheres, and right cones, cylinders, prisms, and pyramids & volume of spheres, and right cones, cylinders, prisms, and pyramids

Online Video Lessons: https://goo.gl/hIZ6tt

Each measurement in the imperial system relates to a corresponding measurement in the SI system. This table shows some approximate relationships between imperial units and SI units.

SI Units to Imperial Units	Imperial Units to SI Units
$1 \text{ mm} \doteq \frac{4}{100} \text{ in.}$	$1 \text{ in.} \doteq$ 2.54 cm
$1 \text{ cm} \doteq \frac{4}{10} \text{ in.}$	$1 \text{ ft.} \doteq$ 30.48 cm $1 \text{ ft.} \doteq$ 0.3048 m
$1 \text{ m} \doteq 39 \text{ in.}$ $1 \text{ m} \doteq 3\frac{1}{4} \text{ ft.}$	$1 \text{ yd.} \doteq$ 91.44 cm $1 \text{ yd.} \doteq$ 0.9144 m
$1 \text{ km} \doteq \frac{6}{10} \text{ mi.}$	$1 \text{ mi.} \doteq$ 1.6093 km

Some conversions are exact; for example.
1 in. = 2.54 cm
1 yd. = 91.44 cm

Example #1:

Convert the following (Remember the 3 decimal AP standard!)

a) 19 m to feet

b) 98 km to miles

c) c) 11 feet 5 inches to meters

Example #2:

Maheen knows she is 5 ft. 4 in. tall.

What height in centimetres will she will she list on her driver's license application?

Example #3:

a) 350 cm to feet and inches

b) 7200 in. to the nearest meter

c) 8 yd. to the nearest centimeter

d) 3250 mm to inches

e) 512 inches to cm

CALCULATORS ARE ALLOWED!!! Label this assignment properly!

1.3 *FA (Foundational Assignment) (All C10)
P23 #4, 5, 6, 8

1.3 MLA (Mid Level Assignment) (All C10)
P23 #9, 11, 13, 14

1.3 ULA (Upper Level Assignment)
P23 # 15-18

C 1.3 Assignment for Concepts #10

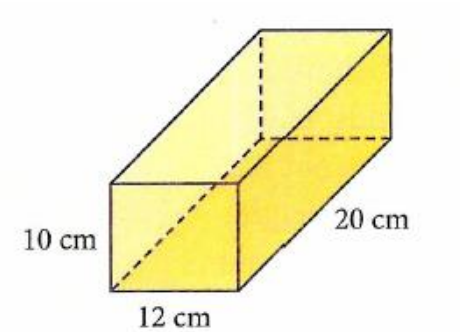
1.4 Surface Area of Right Pyramids & Cones

C 1.4 Concept: #11

Online Video Lesson: **https://goo.gl/J8bXxE**

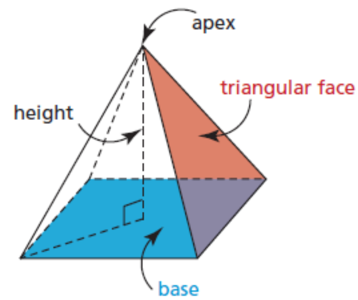
SURFACE AREA: the total area of the surface of an object measured in square units

Review Example #1: What is the least amount of wrapping paper needed to wrap this box?

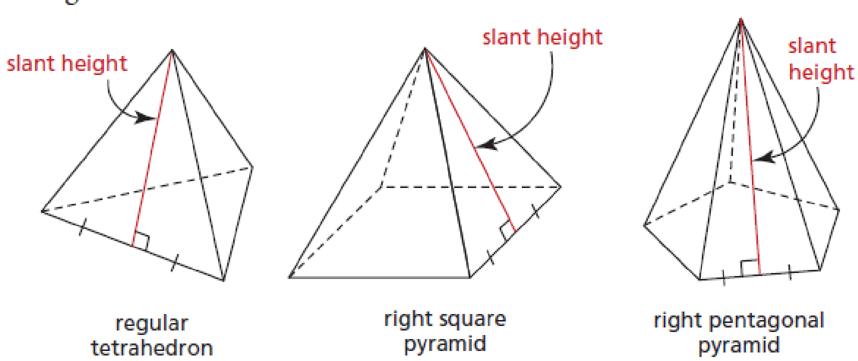


SURFACE AREA OF A RIGHT PYRAMID:

A **right pyramid** is a 3-dimensional object that has triangular faces and a base that is a polygon. The shape of the base determines the name of the pyramid. The triangular faces meet at a point called the **apex**. The *height* of the pyramid is the perpendicular distance from the apex to the centre of the base.



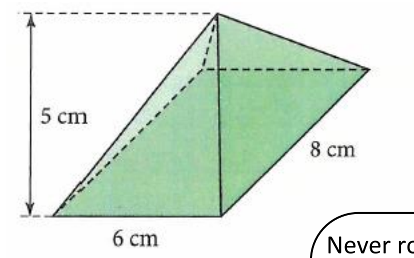
When the base of a right pyramid is a regular polygon, the triangular faces are congruent. Then the **slant height** of the right pyramid is the height of a triangular face.



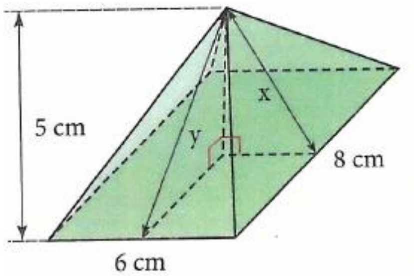
The surface area of a right pyramid is the sum of the areas of the triangular faces and the base.

Example #2:

The base of a rectangular prism has dimensions 8 cm by 6 cm. Its height is 5 cm. Find the surface area of this pyramid.

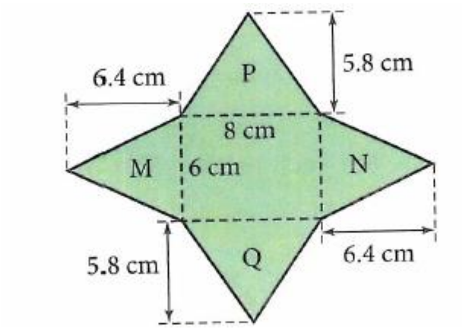


- Find the heights of the triangular faces, which are called the **slant height** of the pyramid



Never round until you've reached your FINAL answer. Use the STO function on your calculator to store previous calculations in order to find your final answer. Always round final answers to the nearest thousandth (3 decimals) unless otherwise specified.

- If you "unfold" the pyramid to show its net, you can now see all the pieces that you can find the individual areas of in order to find the combined total area.



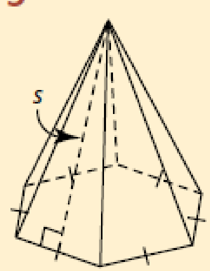
NOTE: The combined area of the triangular faces of a pyramid is called the lateral area

We can combine all these steps into a single formula to find the surface area of any right pyramid:

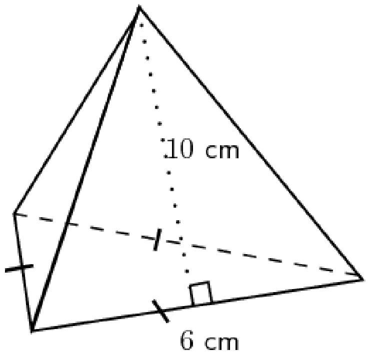
Surface Area of a Right Pyramid with a Regular Polygon Base

For a right pyramid with a regular polygon base and slant height s,

$$\text{Surface area} = \frac{1}{2}s(\text{perimeter of base}) + (\text{base area})$$



Example #3: Find the surface area of this regular tetrahedron. .



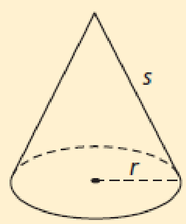
SURFACE AREA OF A RIGHT CONE:

Surface Area of a Right Cone

Surface area = lateral area + base area

For a right cone with slant height s and base radius r:

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



FORMULA DEVELOPMENT:

Example #4:
A right cone has a base radius of 2 ft. and a height of 7 ft. Calculate the surface area of this cone to the nearest square foot.

Example #5:
A cone has a diameter of 11.2 cm and a surface area of 522.51 cm^2. Sketch and find the slant height.

Example #6: The lateral area of a cone is 220cm^2. The diameter of the cone is 10 cm. Determine the height of the cone to the nearest tenth of a cm.

CALCULATORS ARE ALLOWED!!! Label this assignment properly!

1.4 *FA (Foundational Assignment) (All C11)
P34 #4, 5, 6a, 7a, 11, 13b

1.4 MLA (Mid Level Assignment) (All C11)
P34 #10, 13a, 14, 15, 16, 17

1.4 ULA (Upper Level Assignment)
P34 # 9-21

C 1.4 Assignment for Concepts #11

1.5 Volumes of Right Prisms, Pyramids and Cones

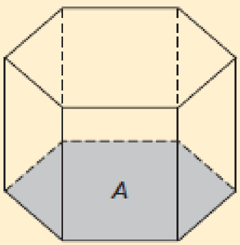
C 1.5 Concept: #12

Online Video Lesson: https://goo.gl/R1WeHB

Volumes of a Right Prism and a Right Pyramid

The volume of a right prism is:
Volume = (base area)(height)

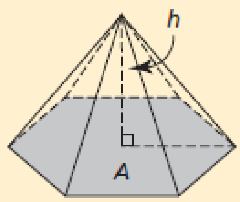
$V = Ah$



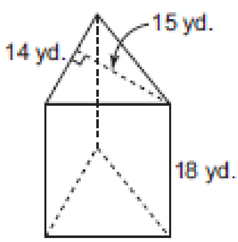
The volume of a right pyramid with the same base and the same height is:

Volume $= \frac{1}{3}$(base area)(height)

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

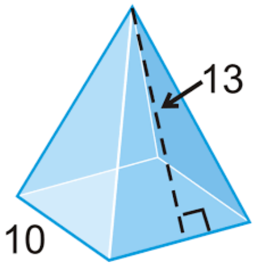


Example #1: Find the volume of the following triangular prism.



Example #2: Sketch what the above prism would look like if it was trimmed to become a pyramid. Find it's volume.

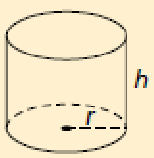
Example #3: Find the volume of the following regular pyramid (units are in inches).



Volumes of a Right Cylinder and a Right Cone

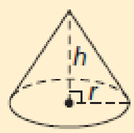
A right cylinder with base radius r and height h has volume:

$V = \pi r^2 h$



A right cone with base radius r and height h has volume:

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



Can you find the STORE function on both your regular and your graphing calculator?

- With a number you wish to be stored on the screen of your scientific calculator, Look for a button (or second function button) that says **STO**. Sometimes you just have to press this button to store a number, sometimes you have to press **STO** and a button that looks like **M+**, sometimes you have to press the STO button and then assign it to a letter (a second or third function of another button). Google your brand of scientific calculator to see how to perform this operation and write it down – you will need it!
- With a number you wish to be stored on the screen of your graphing calculator, hit the **STO** $\rightarrow$ button, then hit the green **ALPHA** button, then assign it to any letter you wish (Note that the letters are written in green on the top right hand corner of many of the regular buttons)

Example #4: Find the volume in inches of a right cylinder whose diameter is 26 cm and whose height is 7 inches. Sketch.

Example #5: Sketch and find the volume of the above cylinder if it was reduced to a cone with the same base and height..

b) How high much higher would the above cone have to be (without changing the base) in order for its volume to be the same as the cylinder in example 4?

Example #6: Find the slant height of a cone whose volume is 272.3 m^3 and whose height is 2800 cm.

CALCULATORS ARE ALLOWED!!! Label this assignment properly!

1.5 *FA (Foundational Assignment) (All C12)
P42 #4a, 5a, 8b, 9b, 18

1.5 MLA (Mid Level Assignment) (All C12)
P42 #10, 11, 14, 19

1.5 ULA (Upper Level Assignment)
P42 # 20-22

C 1.5 Assignment for Concepts #12

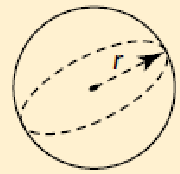
1.6 Surface Area and Volume of a Sphere

C 1.6 Concept: #12 Cont.

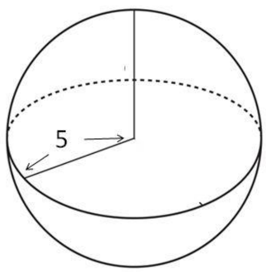
Online Video Lesson: **https://goo.gl/R1WeHB**

Surface Area of a Sphere

The surface area, SA, of a sphere with radius r is:
$SA = 4\pi r^2$



Example #1: Find the surface area of the following sphere if the measurements are given in cm.

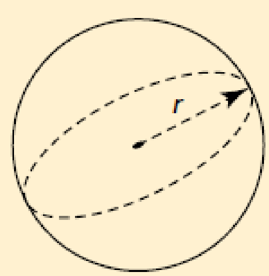


Example #2: Find the diameter of a sphere whose surface area is 345.78m^2.

VOLUME OF A SPHERE: https://www.youtube.com/watch?v=xuPl_8o_j7k

Volume of a Sphere

The volume, V, of a sphere with radius r is:
$V = \frac{4}{3}\pi r^3$



Example #3: The moon approximates a sphere with diameter 2160 mi. What is the approximate volume of the moon?

Example #4:

A hemisphere has radius 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? Leave your answer both in terms of Pi and to the nearest tenth of a cubic centimetre?

CALCULATORS ARE ALLOWED!!! Label this assignment properly!

1.6 *FA (Foundational Assignment) (All C12)
P51 #3bc, 4bc, 5b, 8, 10

1.6 MLA (Mid Level Assignment) (All C12)
P51 #11, two or more of 13, 15, 17, 20

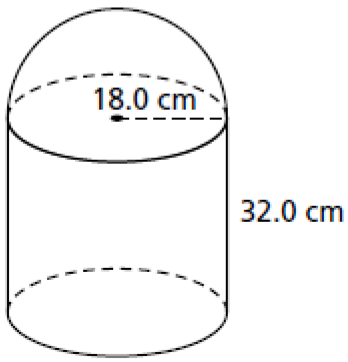
1.6 ULA (Upper Level Assignment)
P51 # 21-24

C 1.6 Assignment for Concepts #12 cont

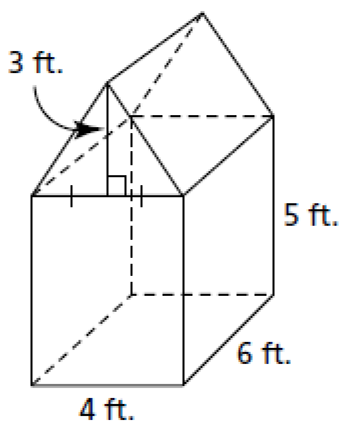
1.7 Problems involving Composite Objects

C 1.7 Concepts: #13

Example #1: Find the volume of the following composite object. Leave your answer both in terms of PI and to the nearest thousandth.



Example #2: Find the surface area of the following.



CALCULATORS ARE ALLOWED!!! Label this assignment properly!

1.7 *FA (Foundational Assignment) (All C13)
P59 #3dc, 4b (using 3cd), 5, 6

1.7 MLA (Mid Level Assignment) (All C13)
P59 #9, 10a or b, 11a or b, 12 or 13

1.7 ULA (Upper Level Assignment)
P59 #, 12, 13

C 1.7 Assignment for Concepts #13

List of Foundational Assignments for Each Concept in This Topic

Concept 10 FA: P11 #3, 7, 8, 10, 17, 19
Practice Questions in Notes
P23 #4, 5, 6, 8
Concept 11 FA: P34 #4, 5, 6a, 7a, 11, 13b
Concept 12 FA: P42 #4a, 5a, 8b, 9b, 18
P51 #3bc, 4bc, 5b, 8, 10
Concept 13 FA: P59 #3dc, 4b (using 3cd), 5, 6

Midlevel for Concept 10: P11 # 12, 13, 14, 15, 18, 20, 21a and P23 #9, 11, 13, 14
Midlevel for Concept 11: P34 #10, 13a, 14, 15, 16, 17
Midlevel for Concept 12: P42 #10, 11, 14, 19 and P51 #11, two or more of 13, 15, 17, 20
Midlevel for Concept 13: P59 #9, 10a or b, 11a or b, 12 or 13