1.1/ 1.2 Converting Measurements Metric to Metric and Imperial to Imperial

The **SI system of measures** is an abbreviation for Le Systeme International d'Unites. Since 1960, this form of metric system has been adopted by many countries. Canada adopted the measuring system in 1976. The metric system or SI system uses base units of meter, litre and gram. The SI system is a decimal system because it is built on multiples of 10.

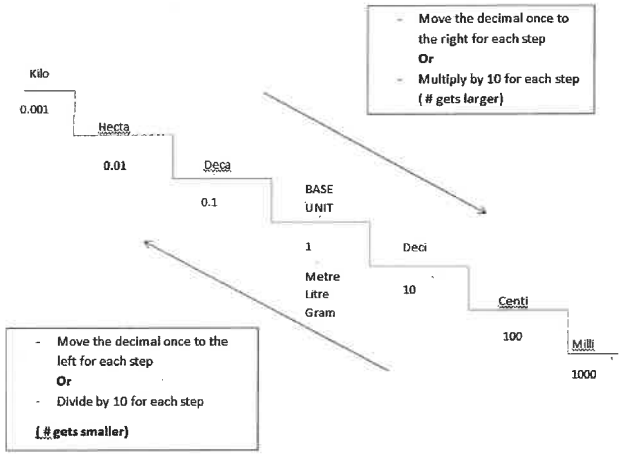
Interesting Fact: Below are just some of the units in the SI system. 10^0= The base unit (Meter, Litre , Gram or byte)

Factor	Prefix	Symbol	Factor	Prefix	Symbol
10^{15}	peta	P	10^{1}	deka	da
10^{12}	tera	T	10^{-1}	deci	d
10^{9}	giga	G	10^{-2}	centi	c
10^{6}	Mega	M	10^{-3}	milli	m
10^{3}	Kilo	K	10^{-6}	micro	η
10^{2}	Hecto	h	10^{-9}	nano	n

Part 1- The Metric System

1Km= 1000m

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



Example 1:Convert the following:

a) 34 cm = _____ m (Using Proportions)

$\frac{34\text{cm}}{x\text{ m}} \cong \frac{100\text{cm}}{1\text{m}}$

$\frac{34}{100} = \frac{100x}{100}$

$x = 0.34\text{m}$

*set up proportion so same units are on the numerators and denominators
* cross multiply, solve for x

b) 5 km = _____ cm (Using the Staircase)

5 Km

500000cm

move the decimal the number of place values you go up or down the staircase

c) 640ml = _____ L (Multiply by the conversion factor)

$640\text{mL} \times \frac{0.001\text{L}}{1\text{mL}} = 0.64\text{L}$

= ↑ Conversion factor

d) 55436g = _____ kg (Method of choice)

$\frac{55436\text{g}}{x\text{ Kg}} \cong \frac{1\text{g}}{0.001\text{Kg}}$

$x = 55.436\text{Kg}$

e)456 mm =_____m (Method of Choice)

$456\text{mm} \times \frac{1\text{ m}}{1000\text{mm}} =$

$= 10.456\text{m}$

f) 3.5km = _____mm (Method of Choice)

3.500000mm

= 3500000mm

Part 2 – The Imperial System

The imperial system uses units such as inch, foot, yard etc. Even though Canada primarily uses the SI system, there are many instances where we continue to use the imperial system. Some examples include:

- Height
-
-

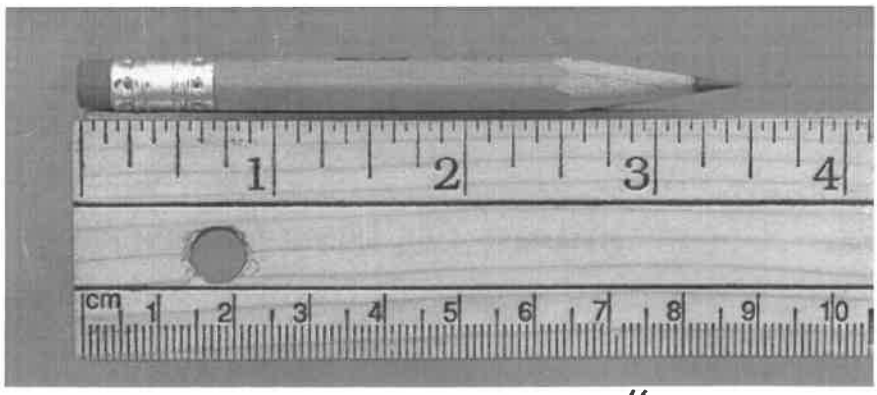
Many Units in the imperial system are based on measurements of the human body. These are now used as referents. (**Referent:** An object used to estimate a distance.)

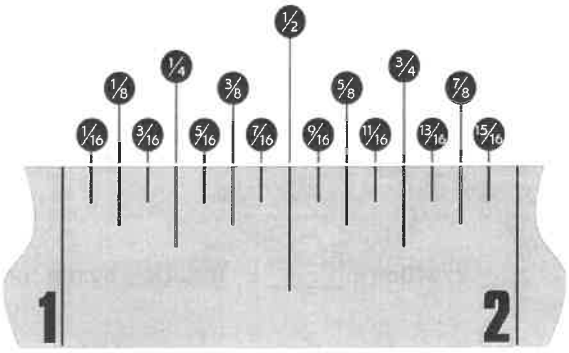
Imperial Unit	Abbreviation	Referent	Relationship between Units
Inch	in.	Thumb length	
Foot	ft.	Foot length	1 ft. = 12 in.
Yard	yd.	Arm span	1 yd. = 3 ft. 1 yd. = 36 in.
Mile	mi.	Distance walked in 20 min	1 mi. = 1760 yd. 1 mi. = 5280 ft.

Note: Another common abbreviation for 1 foot is 1' and 1 inch is 1''.

Measuring using Imperial system:

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 $\frac{1}{16}$ an inch.





Standard Tape Measure Showing Inch Breakdown

1)HOW LONG IS THE PENCIL? $3\frac{7}{16}$" 2)How long is your pencil?_____

3)What are the dimensions of your calculator in inches? (Height, length and width) $7\frac{3}{8}$" x $3\frac{3}{16}$" x $1\frac{3}{16}$"

4) How tall are you in feet and inches?_____ (Have a friend help you measure) Remember :12in = 1ft

Example 3: Convert: a) 5 yd to feet

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

Method 1 (Multiply by the conversion factor)

$5\text{yd} \times \frac{3\text{ft}}{1\text{yd}}$

$= 15\text{ft}$

Method 2 (Solve by Proportions)

$\frac{5\text{yd}}{x\text{ ft}} = \frac{1\text{yd}}{3\text{ft}}$

$15\text{ft} = x$

b) 5 yd to inches

$5\text{y} \times \frac{36\text{in}}{1\text{yd}}$

$= 180\text{in}$

or

$15\text{ft} \times \frac{12\text{in}}{1\text{ft}}$

$= 180\text{in}$

c) 51 in to feet and inches ★ keep as a fraction ★

$\frac{51\text{in}}{x\text{ ft}} = \frac{12\text{in}}{1\text{ft}}$

$\frac{51}{12} = \frac{12x}{12}$

$12\overline{)51}$ -48 3

$4\frac{3}{12}\text{ft} = 4\text{ft }3\text{in}$

12 inches in a ft

(d) 51 in to yards, ft and in.

$= 4\text{ft }3\text{in}$ $3\text{ft} = 1\text{yd}$

$1\text{yd }1\text{ft }3\text{in}$

Example 4: Anne is framing a picture. The perimeter of the framed picture will be 136in. a) what will be the perimeter of the framed picture in feet and inches? B) The framing material is sold by the foot. It costs $1.89/ft/ What will be the cost of the material before taxes?

a) $\frac{136\text{in}}{x\text{ ft}} = \frac{12\text{in}}{1\text{ft}}$

$\frac{136}{12} = \frac{12x}{12}$

$12\overline{)136}$ -12 16 -12 4

$x = 11\frac{4}{12}\text{ft}$

which is 11ft 4in

b) $\$1.89 \times 12$

$= \$22.68$

you would need 12ft if sold by the foot

Example 5: A map of Alaska has a scale of 1 : 4 750 000. The distance on the map between Paxson and the Canadian border is $3\frac{11}{16}$ in. What is this distance to the nearest mile?

1 in on the map is equal to 4 750 000 in in real life

$3\frac{11}{16}$ in (4750 000 in)

$\frac{59}{16}(4750000)$

$= 17515625$ in in real life

Change to ft then miles.

$\frac{17515625 \text{ in}}{x \text{ ft}} \Leftrightarrow \frac{12 \text{ in}}{1 \text{ ft}}$

$\frac{17515625}{12} = \frac{12x}{12}$

$\frac{1459635.417 \text{ ft}}{x \text{ mi}} \Leftrightarrow \frac{5280 \text{ ft}}{1 \text{ mi}}$

$x = 276.45$

$x \approx 276 \text{ mi}$

1.1 Assignment Pg 11 #7,8,10b,11a,12 , 16 , choose one: (Level 4 questions) 14 or 15

↓

Ex#5

1.3 Relating SI and Imperial Units

Each measurement in the imperial system relates to a corresponding measurement in the SI system. This table shows some approximate values:

SI to Imperial	Imperial to SI
1mm ≈ 0.0394 in	1 in = 25.4 mm
1 cm ≈ 0.394 in	1 in = 2.54 cm
1 m ≈ 3.2808 ft	1 ft ≈ 0.3048 m
1 m ≈ 1.0936 yd	1 yd = 0.9144 m
1 km ≈ 0.6214 mi	1 mi ≈ 1.6093 km
	1yd = 91.44cm

Example1 : A bowling lane is 19m long, what is the length to the nearest foot?

$\frac{19m}{x\,ft} = \frac{1m}{3.2808ft}$ or $\frac{19m}{x\,ft} = \frac{0.3048m}{1ft}$

$x = 62.335ft$ $x = 62.336ft$

Example 2: After a wedding in Minot, North Dakota Mrs. Sundeen drove 99km north and her cousin, Brad, drove 62mi south. Who drove farther? And how much farther?

$\frac{99Km}{x\,mi} \rightleftarrows \frac{1.6093Km}{1mi}$ or $\frac{62mi}{x\,Km} = \frac{0.6214mi}{1Km}$

$x = 61.517mi$ $x = 99.775Km$

Mrs. Sundeen's cousin Brad drove further by approx. 0.517miles or 0.775Km.

Example 3: Tommy is 6 ft and 2 in tall. He needs this converted to cm for his drivers license. What is his height in cm? (round to the nearest cm)

Step1: Convert 6ft to inches

$\frac{6ft}{x\,in} = \frac{1ft}{12in}$

$x = 72in$

$+ 2in$

Tommy's height is 74in

Step2: Convert in to cm

$\frac{74in}{x\,cm} = \frac{0.394in}{1cm}$ or $\frac{74in}{x\,cm} = \frac{1in}{2.54cm}$

$x = 187.817cm$ $x = 187.960cm$

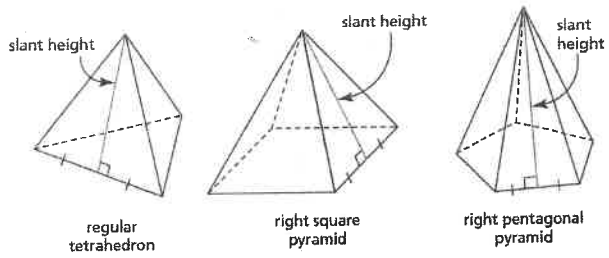
Tommy's height in cm is 188cm

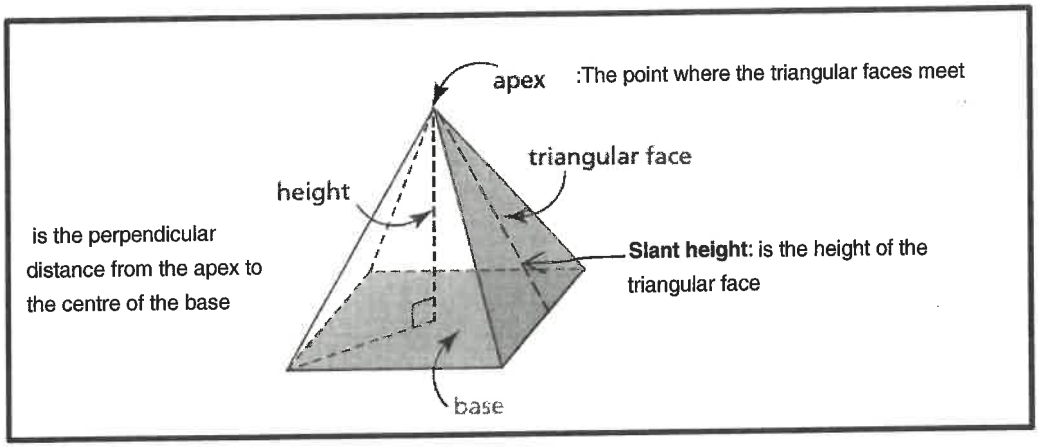
1.3 Assignment : pg 22 #4,5,6 ,9, 13ab, 15

1.4 Surface Area of Right Pyramids and Right Cones

Right Pyramid: a 3 dimensional object with triangular faces and a polygon base. The shape of the base determines the name of the pyramid.

Regular Tetrahedron: 4 congruent equilateral triangular faces

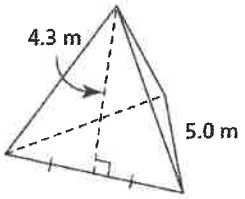




Never round until you've reached your final answer. Always round final answers to the nearest thousandth (3 decimal places) unless specified otherwise.

Surface Area of a Pyramid: The sum of the areas of the triangular faces and the base

Example 1: What is the surface area of this regular tetrahedron to the nearest square centimetre?



↳ 4 congruent equilateral triangles

$S.A. = 4\left(\frac{5 \times 4.3}{2}\right)$

$S.A = \#\text{of sides}\left(\frac{b \times h}{2}\right)$

$S.A = 43 m^2$

$S.A = 430000 cm^2$ Note: you must convert m^2 to cm^2

$43 m^2 \times \frac{(100 cm)^2}{(1 m)^2} = 43 m^2 \times \frac{10000 cm^2}{1 m^2} = 430000 cm^2$

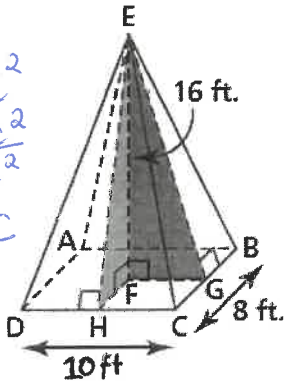
Example 2: A right rectangular pyramid has base dimensions 8ft by 10ft and a height of 16ft. Calculate the surface area of the pyramid to the nearest square foot.

Area of Base $= 10 \times 8$
$= 80 ft^2$

Need to Find slant height of each side

$16^2 + 4^2 = c^2$
$256 + 16 = c^2$
$\sqrt{272} = \sqrt{c^2}$
$\sqrt{272} = c$
↑ Distance EH

$16^2 + 5^2 = c^2$
$256 + 25 = c^2$
$\sqrt{281} = \sqrt{c^2}$
$\sqrt{281} = c$
↑ Distance EG



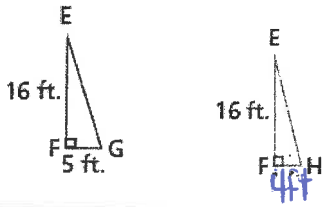
Surface Area of sides =

$= 2\left(\frac{10(\sqrt{272})}{2}\right) + 2\left(\frac{8(\sqrt{281})}{2}\right) + 80$

= Punch into Calculator all at once

$= 379.03 ft^2$

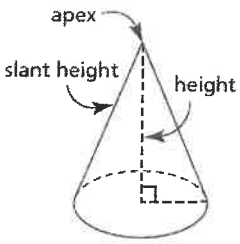
Height of each triangular face

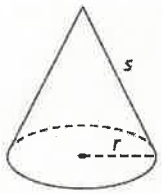


Rounded to the nearest square foot

$S.A = 379 ft^2$

Right Circular Cone: a 3 dimensional object that has a circular base and a curved surface. Usually called a right cone.





Surface Area of a cone:

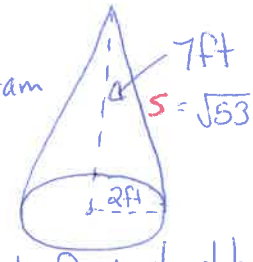
S.A = lateral area + base area

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

r – radius s– slant height

Example 3: A right cone has a base radius of 2ft and a height of 7ft. Calculate the surface area of this cone to the nearest square foot.

Draw a diagram



S.A = lateral Area + base area

$S.A = [\pi(2)(\sqrt{53})] + [\pi(2)^2]$ ← punch into Calculator

$S.A = 58.30865....$

$S.A = 58ft^2$

Need to find slant height

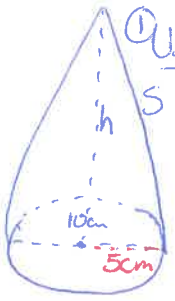
$7^2 + 2^2 = s^2$

$49 + 4 = s^2$

$\sqrt{53} = \sqrt{s^2}$

$\sqrt{53} = s$

Example 4: The Lateral area of a cone is 220cm^2. The diameter of the cones is 10cm. Determine the height of the cone to the nearest tenth of a centimtre.



① Use Lateral Area to find slant

$\pi rs = 220cm^2$

$\frac{\pi(5)s}{5\pi} = \frac{220}{5\pi}$

$s = \frac{44}{\pi}$

② Use pythagorean theorem to find height of cone

$5^2 + h^2 = \left(\frac{44}{\pi}\right)^2$

$25 - 25 + h^2 = \left(\frac{44}{\pi}\right)^2 - 25$

$h = \sqrt{\left(\frac{44}{\pi}\right)^2 - 25}$

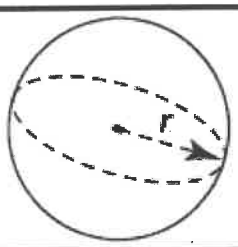
$h = 13.1cm$

1.4 Assignment Pg 34# 5, 8, 13, 16 Choose between 20 and 21

1.6 Surface Area and Volume of a Sphere

Surface Area of a Sphere

$$S.A = 4\pi r^2$$ r = radius



Example 1: The diameter of a baseball is approximately 3 in. Determine the surface area of a baseball to the nearest square inch.

$d = 3in$
$r = 1.5in$

$S.A = 4\pi(1.5in)^2$
$S.A = 4\pi(2.25in^2)$
$S.A = 28in^2$

Example 2: The surface area of a lacrosse ball is approximately 20 in^2. What is the diameter of the lacrosse ball to the nearest thousandth of an inch?

$S.A = 20in^2$

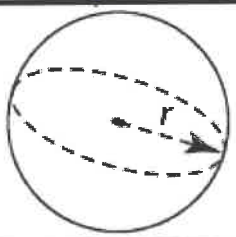
$S.A = 4\pi r^2$
$\frac{20in^2}{4\pi} = \frac{4\pi r^2}{4\pi}$
$\sqrt{\frac{5}{\pi}} = \sqrt{r^2}$

$r = \sqrt{\frac{5}{\pi}}(2)$ multiply by 2 to get the diameter
$d = 2.523in$

on my weebly

Volume of a Sphere (Watch video to derive formula)

$$V = \frac{4}{3}\pi r^3$$



Example 3: The sun approximates a sphere with diameter 870 000 mi. What is the approximate volume of the sun? (Using calc. simulator to demonstrate)

① Need to find radius

$\frac{870\,000mi}{2} = r$
$r = 435\,000mi$

② Volume

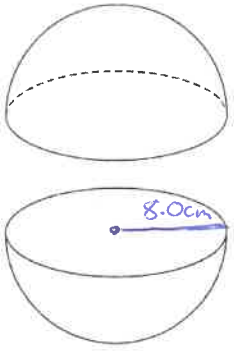
$V = \frac{4}{3}\pi(435\,000)^3$
$V = 3.4479\ldots \times 10^{17}$

The number is too large for the calculator to display so the display in Scientific Notation.

The Volume of the sun is approx.
$3.4479 \times 10^{7} mi$

Example 4: A hemisphere has radius 8.0cm.

When a sphere is cut in half, two *hemispheres* are formed.



hemispheres

a) What is the surface area of the hemisphere to the nearest thousandth of a square centimeter?

b) What is the volume of the hemisphere to the nearest thousandth of a cubic centimeter?

a) S.A of a sphere

$S.A = 4\pi r^2$

$S.A = 4\pi (8cm)^2$

$S.A = 256\pi$

$\frac{256\pi}{2}$ ☆ To find half the Sphere (hemisphere) divide the S.A by 2.

S.A of the lateral Area of the Hemisphere $= 128\pi$

S.A of a circle ← Top circle of the hemisphere

$A = \pi r^2$

$A = \pi (8)^2 \rightarrow A = 64\pi$

Total Surface Area of the hemisphere

$S.A = 128\pi + 64\pi$

$S.A = 192\pi$

$S.A = 603.186cm^2$

b) Volume of a sphere

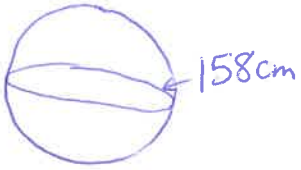
$V = \frac{4}{3}\pi r^3$

$V = \frac{4}{3}\pi (8cm)^3$

$V = \frac{2144.661cm^3}{2}$ ← Hemisphere is half of a sphere

$V = 1072.330cm^3$

Example 5: A spherical globe has a circumference 158cm. The surface of the globe is to be painted with a high gloss varnish. What is the area to be painted to the nearest square centimeter?



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

① Find the radius

$C = 2\pi r$

$\frac{158}{2\pi} = \frac{2\pi r}{2\pi}$

$\frac{79}{\pi} = r$ ← substitute in S.A Formula of a sphere

② $S.A = 4\pi r^2$

$S.A = 4\pi \left(\frac{79}{\pi}\right)^2$

$S.A = 7946cm^2$

1.6 Assignment pg 51 #3,4,5,8,10,18

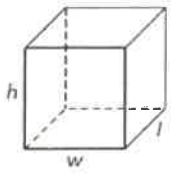
Vol. S.A. S.A+Vol

S.A SA + Vol Vol.

1.5 Volumes of Right Pyramids and Right Cones

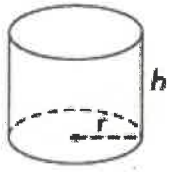
Volume: The amount of space an object occupies. It is measured in cubic units.

How do you find the volume of: a right rectangular prism? a right cylinder?



$V = (l \times w) \times h$

Area of the base

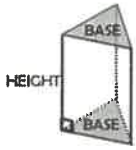


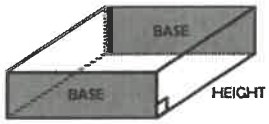
$V = (\pi r^2)h$

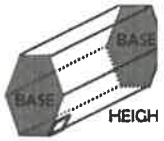
Area of the base

Volumes of any Right Prism formula:

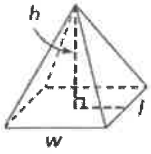
$V = (\text{Area of the base})\,\text{height}$







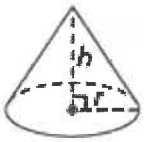
Volume of a right rectangular pyramid



$V = \frac{1}{3}(lw)h$

Area of the base

Volume of a Right Cone



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

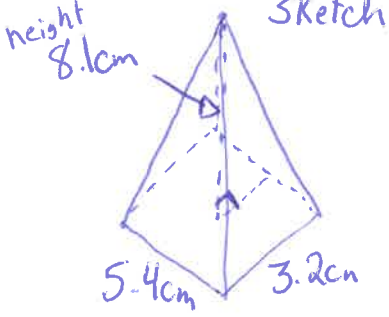
Area of the base

Volume of any Right Pyramid and Cone formula:

$V = \frac{1}{3}(\text{Area of Base})\,\text{height}$

Example 1: Determine the volume of the right rectangular pyramid with base dimensions 5.4cm by 3.2 cm and height 8.1cm. Answer the nearest thousandth of a cubic centimetre.

① Draw a sketch



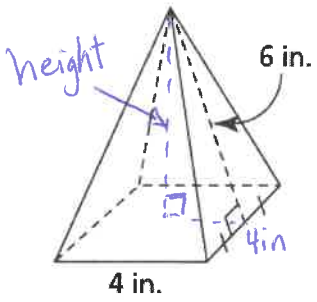
② $\text{Volume} = \frac{1}{3}(\text{Area of base})\,\text{height}$

$V = \frac{1}{3}(5.4)(3.2)(8.1)$

$V = 46.656\,\text{cm}^3$

thousanth

Example 2: Calculate the volume of this right square pyramid to the nearest cubic inch.



① Need to find the height of the Pyramind to calculate the Volume

$6^2 = 2^2 + h^2$

$36 - 4 = 4 - 4 + h^2$

$\sqrt{32} = \sqrt{h^2}$

$\sqrt{32} = h$

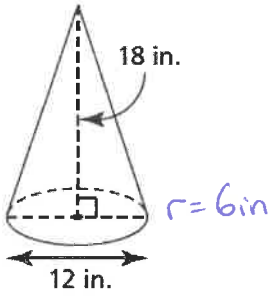
② Calculate Volume

$V = \frac{1}{3}(4in)^2\sqrt{32}\,in$

$V = 30.169889....\,in^3$

$V = 30.170\,in^3$

Example 3: Determine the volume of this cone to the nearest thousandth of a cubic inch.



$V = \frac{1}{3}(\text{Area of Base})\,\text{height}$

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

$V = \frac{1}{3}(\pi(6in)^2)18in$

$V = 678.584\,in^3$

Example 4: Find the slant height of a cone whose volume is 272.3 m^3 and whose height is 480cm.

① Notice the different units m^3 cm

Convert cm to m

$h = 480cm = 4.8m$

Find the radius

② $V = \frac{1}{3}\pi r^2 h$

$V = \frac{1}{3}\pi r^2(4.8m)$

③ Calculate slant height

$4.8^2 + \left(\sqrt{\frac{170.1875}{\pi}}\right)^2 = s^2$

$23.04 + \frac{170.1875}{\pi} = \sqrt{s^2}$

$s = 8.787m$

(3) $272.3m^3 = \frac{1}{3}\pi r^2(4.8m)$

$\frac{816.9m}{4.8\pi} = \frac{\pi r^2(4.8m)}{4.8\pi}$

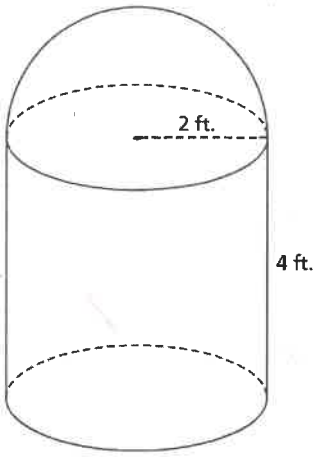
$\sqrt{\frac{170.1875}{\pi}} = \sqrt{r^2}$

$\sqrt{\frac{170.1875}{\pi}} = r$

1.5 Assignments Pg 42 #4,6,8,9,18

1.7 Composite Shapes

Example 1: Determine the surface are of this composite object to the nearest square foot



Surface Area of the Cylinder

bottom circle

$S.A_C = \pi dh + \pi r^2$

$S.A_C = \pi(4ft)(4ft) + \pi(2)^2$

$S.A_C = 16\pi + 4\pi$

$S.A_C = 20\pi$

Surface Area of the Sphere

$S.A_{HS} = \frac{4\pi r^2}{2}$ ← only half of the sphere's S.A.

$S.A_{HS} = 2\pi(2)^2$

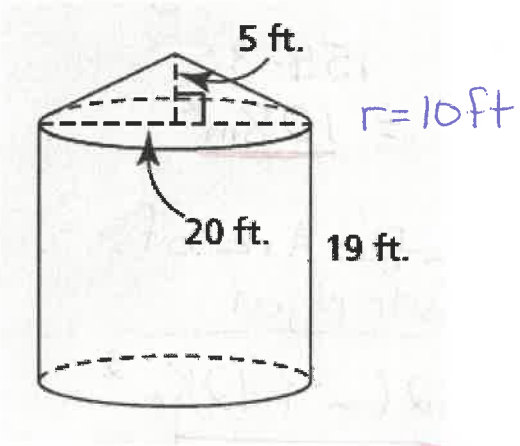
$S.A_{HS} = 8\pi$

Total surface Area of the Composite Object $= 20\pi + 8\pi$

$= 28\pi$

$= 88ft^2$

Example 2: The farmer's grain truck can hold 550 cubic feet of barley. How many truckloads are required to fill the bin?



① Find Volume of grain bin

Volume of a Cone + Volume of a Cylinder

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

$V = \frac{1}{3}\pi(10)^2(5) + \pi(10)^2(19)$

$V = \frac{500}{3}\pi + 1900\pi$

$V = 6492.624817ft^3$

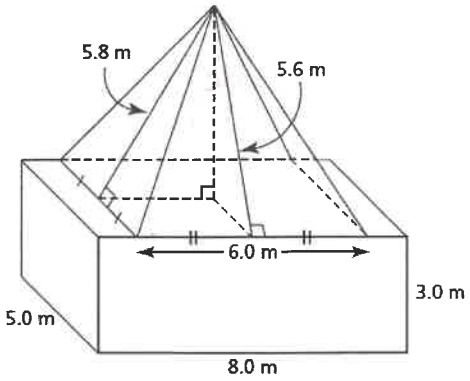
How many truckloads to fill a grain bin with $V = 6492.624\ldots$

$550ft^3 \overline{)6492.624\ldots}$

$= 11.867$

It will take 12 Truck Loads

Example 3: This composite object is a rectangular pyramid on the top of a rectangular prism. Determine the surface area and volume of the composite object to the nearest unit.



Surface Area of the Pyramids triangular face

$S.A = 2\left(\frac{bh}{2}\right) + 2\left(\frac{bk}{2}\right)$

$S.A = 2\left(\frac{6.0m \cdot 5.6m}{2}\right) + 2\left(\frac{5.0m \cdot 5.8m}{2}\right)$

$S.A. = 33.6m^2 + 29m^2$

$S.A = 62.6m^2$

Surface Area of the Rectangular Prism

$S.A = [2(5\cdot3) + 2(8\cdot3) + 2(8\cdot5)] - (6)(5)$

$S.A = [30 + 48 + 80] - 30$

$S.A = 158 - 30$

$S.A. = 128m^2$

Total Surface Area of the composite object

$S.A = 62.6m^2 + 128m^2$

$S.A = 191\ m^2$

Volume of Rectangular Prism

$V = lwh$

$V = 5(3)(8)$

$V = 120m^3$

Volume of Pyramid

$V = \frac{1}{3}(lw)h$ ← Need to calculate height of pyramid

(lw) ↑ area of the base

$5.8^2 = h^2 + 3^2$

$33.64 = h^2 + 9$ (−9 −9)

$\sqrt{24.64} = \sqrt{h^2}$

$h = \sqrt{24.64}$

$V = \frac{1}{3}(6\cdot5)(\sqrt{24.64})$

$V = 10(\sqrt{24.64})$

Total Volume of the Composite Object

$V = 120m^3 + 10(\sqrt{24.64})m^3$

$V = 169.66\ldots$ Volume $= 170m^3$

Assignment 1.7 Pg 59 #3 , #5, #9