



MEASUREMENT	TOPICS
<p>Solve problems that involve linear measurement using:</p> <ul style="list-style-type: none"> <li>• SI and imperial units of measure.</li> <li>• Estimation strategies.</li> <li>• Measurement strategies.</li> </ul>	<p>1.1 Provide referents for linear measurement.</p> <p>1.2 Compare SI and Imperial units of measure.</p> <p>1.3 Estimate a linear measure and explain the process.</p> <p>1.4 Justify the choice of units used for determining a linear measurement.</p> <p>1.5 Solve problems that involve linear measure using instruments available.</p> <p>1.6 Describe and explain a personal strategy used to determine a linear measurement.</p>
<p>Apply proportional reasoning to problems that involve conversions between SI and imperial measurement.</p>	<p>2.1 Use proportional reasoning to convert within or between SI and Imperial systems.</p> <p>2.2 Solve a problem that requires conversion between units.</p> <p>2.3 Verify using unit analysis, a conversion between units.</p> <p>2.4 Justify, using mental mathematics, the reasonableness of a solution to a conversion problem.</p>
<p>Solve problems, using SI and imperial measurement, that involve the surface area and volume of 3-D objects, including</p> <ul style="list-style-type: none"> <li>• Right cones</li> <li>• Right cylinders</li> <li>• Right prisms</li> <li>• Right pyramids</li> <li>• Spheres.</li> </ul>	<p>3.1 Sketch a diagram to represent a problem that involves surface area or volume.</p> <p>3.2 Determine the SA of a right cone, right prism, right pyramid, or sphere using an object or diagram.</p> <p>3.3 Determine the V of a right cone, right prism, right pyramid, or sphere using an object or diagram.</p> <p>3.4 Determine an unknown dimension of a right cone, right prism, right pyramid, or sphere given the SA or V and remaining dimensions.</p> <p>3.5 Solve a problem that involves SA or V.</p> <p>3.6 Compare the formula/relationship between volumes of right cones and right cylinders or right prisms and right pyramids.</p>

[C] Communication [PS] Problem Solving, [CN] Connections [R] Reasoning, [ME] Mental Mathematics [T] Technology, and Estimation, [V] Visualization

## Key Terms

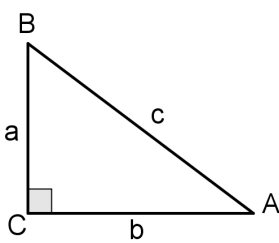
Term	Definition
Linear measurement.	
Dimension	
Length	
Width	
Height	
Radius	
Diameter	
Perimeter	
Linear foot	
Conversion factor	
Base of triangle	
Height of a triangle (altitude)	
2-dimensional	
Area	
Surface Area	
Square foot.	
Geometric net	
3-dimensional	
Base (or base area) of a figure	

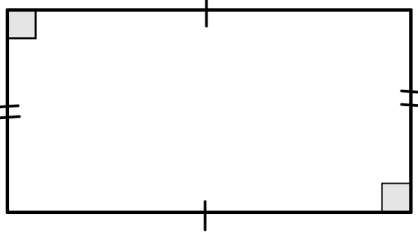
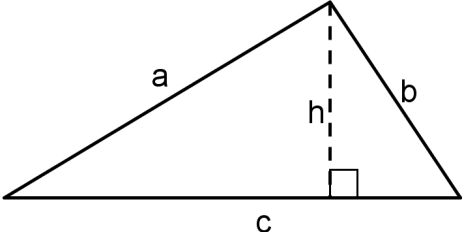
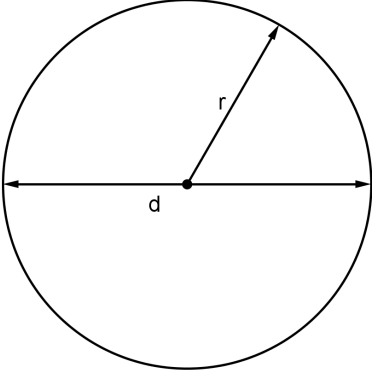
Term	Definition
Volume	
Cubic centimetres (cc or $\text{cm}^3$ )	
Millilitre	
Litre	
Gallon	
Rectangle	
Square	
Parallelogram	
Trapezoid	
Circle	
Rectangular Prism (& Cube)	
Right Triangular Prism	
Pyramid (triangular, rectangular, square)	
Right Cone	
Right Cylinder	
Sphere	
Hemisphere	

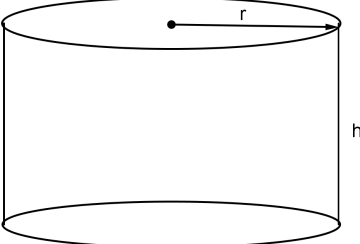
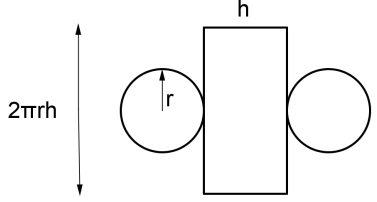
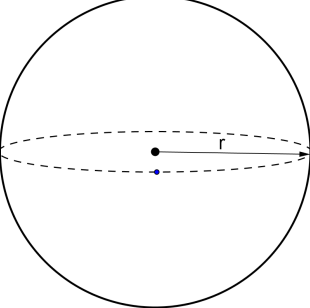
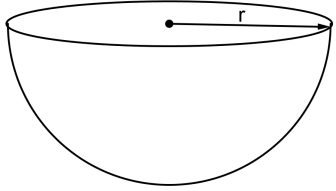
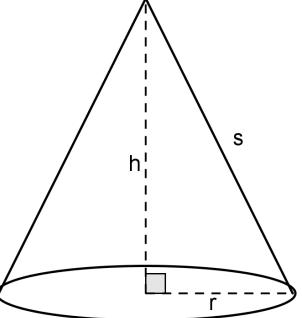
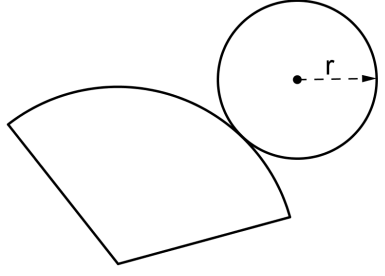
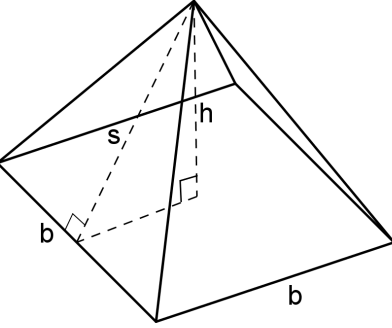
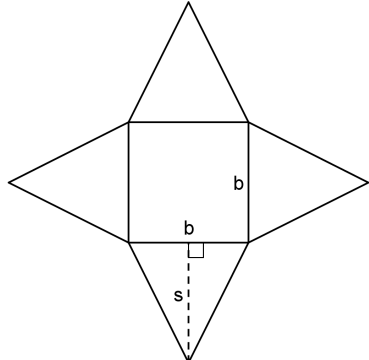
**Unit Conversions** (as they may appear on an exam formula sheet)

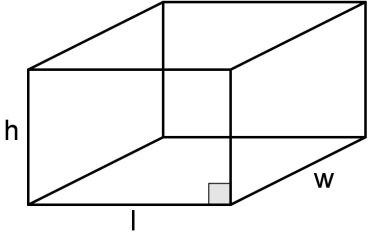
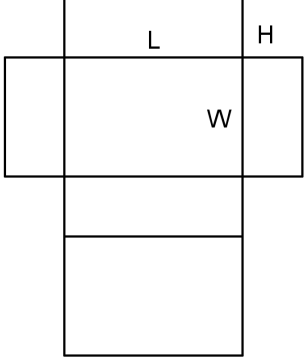
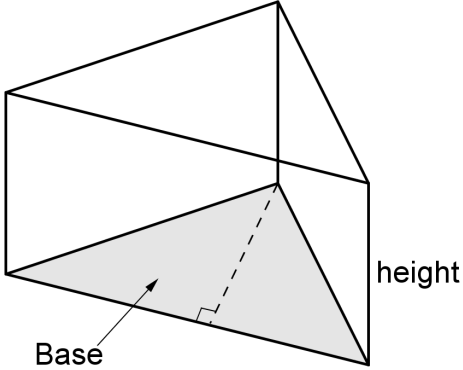
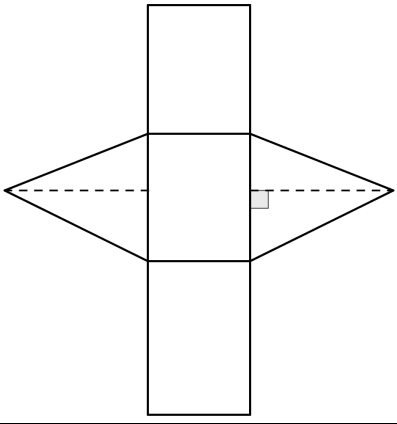
	Common Imperial	Imperial and Metric	Metric
Length	1 mile = 1760 yards 1 mile = 5280 feet 1 yard = 3 feet 1 yard = 36 inches 1 foot = 12 inches	1 mile $\approx$ 1.609 km 1 yard $\approx$ 0.9144 m 1 foot $\approx$ 0.3048 m 1 foot $\approx$ 30.48 cm 1 inch $\approx$ 2.54 cm	1 km = 1000 m 1 m = 100 cm 1 cm = 10 mm
Mass (Weight)	1 ton = 2000 pounds 1 pound = 16 ounces	1 pound $\approx$ 0.454 kg 1 ounce $\approx$ 28.35 g	1 t = 1000 kg 1 kg = 1000 g
Common Abbreviations	mile = mi yard = yd ton = ton feet = ft or ' inch = in or " pound = lb ounce = oz		kilometre = km metre = m centimetre = cm millimetre = mm tonne (metric ton) = t gram = g

**Formula**

Triangles	Lines
<p>Trigonometry:</p> $\sin A = \frac{\textit{opposite}}{\textit{hypotenuse}}$ $\cos A = \frac{\textit{adjacent}}{\textit{hypotenuse}}$ $\tan A = \frac{\textit{opposite}}{\textit{adjacent}}$ <p>Pythagorean Theorem:</p> $a^2 + b^2 = c^2$ 	<p>The equation of a line:</p> <p>Slope-intercept form: <math display="block">y = mx + b</math></p> <p>Standard Form: <math display="block">Ax + By + C = 0</math></p> <p>Point-slope form: <math display="block">y - y_1 = m(x - x_1)</math></p> <p>Slope formula: <math display="block">m = \frac{y_2 - y_1}{x_2 - x_1}</math></p>

2-Dimensional Figure	Perimeter	Area
<p>Rectangle</p> 	<p>or</p> $P = 2l + 2w$ $P = 2(l + w)$	$A = lw$
<p>Triangle</p> 	$P = a + b + c$	<p>or</p> $A = \frac{bh}{2}$ $A = \frac{1}{2}bh$
<p>Circle</p> 	<p>or</p> $C = 2\pi r$ $C = \pi d$	$A = \pi r^2$

3-Dimensional figures:		
<p>Right Cylinder:</p> 	$A_{top} = \pi r^2$ $A_{bottom} = \pi r^2$ $A_{side} = 2\pi r h$ $SA_{total} = 2\pi r^2 + 2\pi r h$ $V = (\text{Base Area})h$	<p>Net:</p> 
<p>Sphere:</p> 	<p>Sphere:</p> $SA = 4\pi r^2$ $V = \frac{4}{3}\pi r^3$ <p>Hemisphere:</p> $SA = 3\pi r^2$ $V = \frac{2}{3}\pi r^3$	<p>Hemisphere:</p> 
<p>Cone:</p> 	<p>Side: <math>A = \pi r s</math>            Base: <math>A = \pi r^2</math></p> $SA = \pi r^2 + \pi r s$ $V = \frac{1}{3}(\pi r^2)h$	<p>Net:</p> 
<p>Square-Based Pyramid:</p> 	$A_{triangle} = \frac{1}{2}bs$ $A_{base} = b^2$ $SA = 2bs + b^2$ $V = \frac{1}{3}(\text{base area})h$	<p>Net:</p> 

<p>Rectangular (Right) Prism:</p> 	$SA = 2(hl + lw + hw)$ <p>Or</p> $V = lwh$ $V = (\text{base area})h$	<p>Net:</p> 
<p>Triangular Prism</p> 	$SA = \text{sum of all faces}$ $V = (\text{base area})h$	<p>Net:</p> 



## Measurement in Two Systems.

### The International System of Units (SI) (Metric System) Système International d'unités

#### History:

Formally called *System Internationale* but more commonly called THE METRIC SYSTEM.

Based on the **metre**. One meter is defined as the distance light travels in  $1/299792458$  of a second.

#### Prefixes:

Prefixes are added to the base units to be used with smaller or larger measurements.

tera  
giga  
mega  
kilo  
hecto  
deca  
**BASE UNIT (metre/gram/litre)**  
deci  
centi  
milli  
micro  
nano  
pico

### The Imperial System of Units

#### History:

The system used by the British Empire and therefore many Commonwealth countries for many years.

To this day much daily work in trades is still done using the imperial system. Most technical work, however, uses the metric system.

#### Some useful conversions:

1 inch = 2.54 cm  
1 foot = 30.5 cm (30.48)  
1 yard = 3 feet  
1 yard = 0.915 m  
1 mile = 1760 yards  
1 mile = 1.6 km  
1 kg = 2.2 lbs  
1 litre = 1.06 quarts (US)  
1 gallon (US) = 3.79 litres  
[1 gallon (UK) = 4.55 litres]

## The Imperial System of Units

UNIT	QUANTITY MEASURED (circle one)	REPRESENTATIVE EXAMPLE or REFERENT (a comparison you could use)	3 EXAMPLES OF OBJECTS YOU WOULD MEASURE USING THIS UNIT
INCH	MASS?  VOLUME?  DISTANCE?		1.  2.  3.
FOOT	MASS?  VOLUME?  DISTANCE?		1.  2.  3.
YARD	MASS?  VOLUME?  DISTANCE?		1.  2.  3.
MILE	MASS?  VOLUME?  DISTANCE?		1.  2.  3.
GALLON	MASS?  VOLUME?  DISTANCE?	The large plastic jug of milk at the grocery store.	1.  2.  3.

## Converting Between Units Within the Imperial System

Conversion Factor: Multiplying or dividing by this number allows us to convert from one unit to another.

Eg. Convert 57 inches to feet.

$$57 \text{ inches} \times \frac{1 \text{ foot}}{12 \text{ inches}} = \frac{57}{12} \text{ feet}$$

$$4 \frac{9}{12} = 4 \frac{3}{4} \text{ feet}$$

Use the numbers in the table on page 5.

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

The unit on top is the one you are converting to!

### One Unit Conversions

Convert the following. Answer in exact form (fraction or non-rounded decimal).

1. 3 yd. = _____ feet.  $3 \text{ yd} \times \frac{3 \text{ ft}}{1 \text{ yd}} = 9 \text{ ft}$	2. 15 yd. = _____ feet.	3. 12.5 yd. = _____ feet.
4. 12 ft. = _____ yards.	5. 2.25 ft. = _____ inches.  $2.25 \text{ ft.} \times \frac{12 \text{ in}}{1 \text{ ft}} = 27 \text{ in}$	6. 136 ft. = _____ yards.
7. 8 ft. = _____ inches.	8. 2.75 ft. = _____ inches.	9. 4.8 ft = _____ inches.
10. 36 in. = _____ feet.	11. 140 in. = _____ feet.	12. 2016 in = _____ feet.
13. 2 mi. = _____ yards.	14. 4.2 mi. = _____ feet.	15. 1500 yd. = _____ miles.
16. 5250 yd. = _____ inches.	17. 160 oz. = _____ pounds.	18. 220oz. = _____ pounds.
19. 4 lb. = _____ ounces.	20. 2.25 lb. = _____ ounces.	21. 6000 lb. = _____ tons.
22. Mr.S placed 32 yard sticks end to end across his front yard. Find the width of his yard in feet.	23. Maisy can fit 8 blocks of butter in her backpack. Butter is sold in 1 pound blocks. How many ounces does Maisy carry?	

24. Auntie Dee is making a frame for a photograph. The outer dimensions are 3 ft. by 5 ft. How many inches of frame must she purchase?
25. Mr. J wants to update his living room with crown moulding. The room is rectangular and measures 180 in. by 260 in. Moulding is sold by the foot and costs \$2.19 per linear foot. What is the cost of moulding required (not including any taxes)?

Convert each of the following measurements to the indicated units.

26. 140 feet to yards and feet.

Recall:  $3 \text{ yd} = 1 \text{ ft}$

$$\begin{aligned} 140 \text{ ft} &\times \frac{1 \text{ yd}}{3 \text{ ft}} \\ &= \frac{140}{3} \text{ yd} \\ &= 46\frac{2}{3} \text{ yd} \end{aligned}$$

140 ft = 46yd and 2 ft.

27. 256 feet to yards and feet.

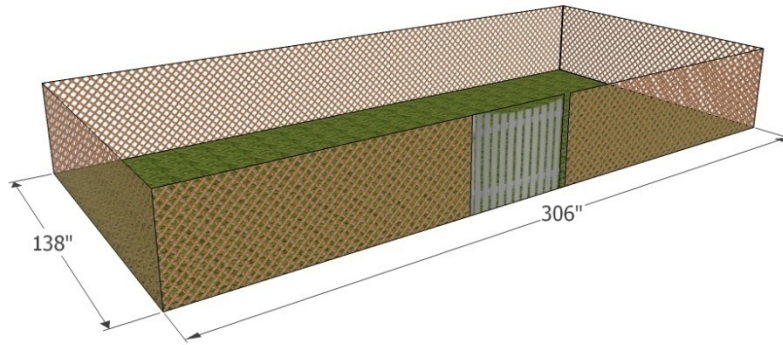
28. 356 inches to yards, feet and inches

29. 142 inches to feet and inches.

30. 204 inches to yards and feet.

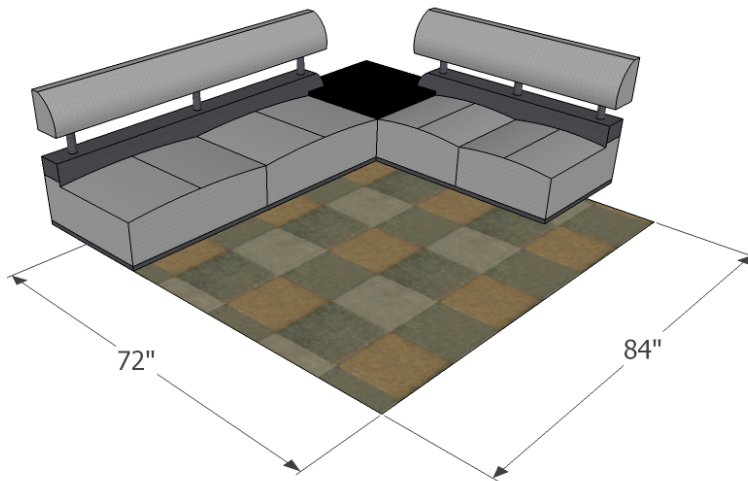
31. 84260 ounces to tons, pounds and ounces.

32. Shelby the French Bull Dog needs an outdoor area to run. Ben plans on building her the pen below. The fencing material is sold by the linear foot but his measuring tape only shows inches. How many feet will he need to purchase?



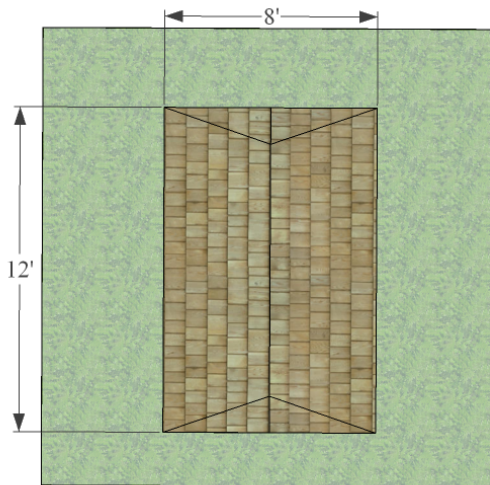
33. Convert your answer above to yards, feet and inches.

34. What are the dimensions of the rectangular carpet below in feet?



35. If the carpet is sold for \$4.25 per square foot, what is the cost of carpet required? Include 12% tax.

36. What is the perimeter of the garden shed in yards and feet?



37. The shed covers one-third of the area of the yard. How many square feet of sod (grass) are shown in the yard above?
38. Sod-Warehouse sells sod by the roll. Each roll is 1 foot wide and 4 feet long. Each roll sells for \$2.75. what is the cost (including 12% tax) to buy sod for the yard?

**Two Unit Conversions {Be comfortable working in fraction form and always reduce.}**

You will need to use TWO conversion factors. Simply follow the steps for one unit conversions, then repeat.

Eg. Convert 58 inches to yards.

$$\begin{aligned} \textcircled{1} \quad 58 \text{ inches} &\times \frac{1 \text{ foot}}{12 \text{ inches}} = \frac{58}{12} \text{ feet} \\ \textcircled{2} \quad \frac{58}{12} \text{ feet} &\times \frac{1 \text{ yard}}{3 \text{ feet}} = \frac{58}{36} \text{ yards} \\ &= 1 \frac{22}{36} \text{ yards} = 1 \frac{11}{18} \text{ yards} \end{aligned}$$

Conversion Factors:

$$\text{Step } \textcircled{1} \quad \frac{1 \text{ foot}}{12 \text{ inches}} \qquad \text{Step } \textcircled{2} \quad \frac{1 \text{ yard}}{3 \text{ feet}}$$

The unit on top is the one you are converting to!

39. 6025 feet = \_\_\_\_\_ miles

$$6025 \text{ feet} \times \frac{1 \text{ yard}}{3 \text{ feet}} = \frac{6025}{3} \text{ yards}$$

$$\frac{6025}{3} \text{ yards} \times \frac{1 \text{ mile}}{1760 \text{ yards}} = \frac{6025}{5280} \text{ miles}$$

$$1 \frac{745}{5280} = 1 \frac{149}{1056} \text{ miles}$$

40. 123450 feet = \_\_\_\_\_ miles

41.  $2\frac{1}{2}$  miles = \_\_\_\_\_ inches.

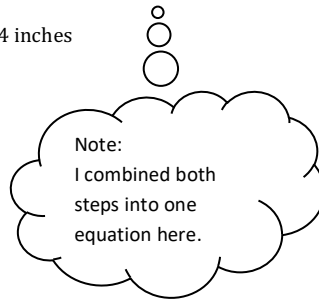
42. 3.25 yards = \_\_\_\_\_ inches

43.  $15\frac{2}{3}$  yards = \_\_\_\_\_ inches

44.  $24\frac{1}{3}$  yards = \_\_\_\_\_ inches

$$\frac{47}{3} \text{ yd} \times \frac{3 \text{ ft}}{1 \text{ yd}} \times \frac{12 \text{ in}}{1 \text{ ft}} = \frac{(47)(3)(12)}{3} \text{ inches}$$

$$= 564 \text{ inches}$$



45. A cabinet maker is using 1"x3" edge grain fir to make some cabinet doors. He purchased  $42\frac{2}{3}$  yards on Craig's list. How many inches did he buy?

46. Gary is building picture frames to sell in a market. He has 75 yards of material and will make square frames with side lengths of 14 inches. How many frames can he make?

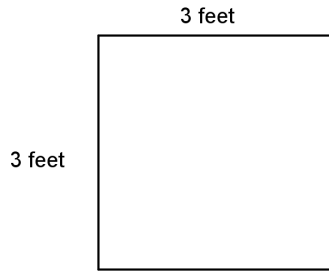
Mr.J's measuring wheel clicks once for every yard it travels. On a walk to school, the wheel clicks 35200 times.

47. How many inches does he walk?

48. How many miles?

49. \*\*A piece of paper is folded in half repeatedly. The paper has a thickness of  $\frac{1}{250}$ ". How many yards thick will the paper be after 20 folds?

Conversions with Non-linear Measurements.



50. How do you calculate the area of a square?

51. What is the area of the square to the left in square-feet?

52. What is the side length of the square in inches?

53. What is the area in square inches?

54. To convert the area of a figure from square feet to square inches, what calculations must you perform?

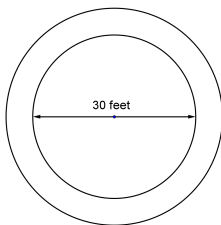
55. A rectangular plot of land has dimensions of 0.5 miles by 0.4 miles. What is the area in  $\text{ft}^2$ ?

56. To convert the area of a figure from square miles to square feet, what calculations must you perform?

57. A pizza has an area of  $1.5 \text{ ft}^2$ . If the pizza is to be sliced into six equal slices, how many square inches is each slice?

58. A circular carpet has an area of  $100\pi \text{ ft}^2$  (approximately  $314 \text{ ft}^2$ ). What is the length of the radius in inches?

59. The cross-section of a concrete underground pipe is shown below. Calculate the area of the inner (open) part of the pipe to the nearest  $\text{in}^2$ .



60. The pipe in the previous question has concrete walls that are 5 feet thick. Calculate the cross-sectional area of concrete to the nearest  $\text{in}^2$ .



## The International System of Units (SI)

UNIT	QUANTITY MEASURED	REPRESENTATIVE EXAMPLE	3 EXAMPLES OF OBJECTS YOU WOULD MEASURE USING THIS UNIT
Milligram	MASS? VOLUME? DISTANCE?	ONE GRAIN OF SALT	1. 2. 3.
Gram	MASS? VOLUME? DISTANCE?	ONE PAPER CLIP	1. 2. 3.
Kilogram	MASS? VOLUME? DISTANCE?	ONE PINEAPPLE	1. 2. 3.
Millilitre	MASS? VOLUME? DISTANCE?		1. 2. 3.
Litre	MASS? VOLUME? DISTANCE?		1. 2. 3.
Millimetre	MASS? VOLUME? DISTANCE?		1. 2. 3.
Centimetre	MASS? VOLUME? DISTANCE?		1. 2. 3.
Metre	MASS? VOLUME? DISTANCE?		1. 2. 3.
Kilometre	MASS? VOLUME? DISTANCE?		1. 2. 3.

## Converting Between Units in the Metric System (SI)

Conversion Factor: Multiplying or dividing by this number allows us to convert from one unit to another.

Eg. Convert 230 mm to cm.

$$230 \text{ mm} \times \frac{1 \text{ cm}}{10 \text{ mm}} = 23 \text{ cm}$$

Use the numbers in the table on page 5.

$$\frac{1 \text{ cm}}{10 \text{ mm}}$$

The unit on top is the one you are converting to!

Metric conversions can be made by moving the decimal left or right. Imperial conversions cannot

### One Unit Conversions

Convert the following. Answer to the nearest tenth when necessary.

61.  $1250 \text{ mm} = \underline{\hspace{2cm}} \text{ cm}$

$$1250 \text{ mm} \times \frac{1 \text{ cm}}{10 \text{ mm}} = 125 \text{ cm}$$

Or...simply move the decimal one place to the left.

62.  $37.25 \text{ m} = \underline{\hspace{2cm}} \text{ cm}$

63.  $0.8 \text{ cm} = \underline{\hspace{2cm}} \text{ mm.}$

64.  $138 \text{ m} = \underline{\hspace{2cm}} \text{ mm}$

65.  $1508 \text{ cm} = \underline{\hspace{2cm}} \text{ m}$

66.  $3.28 \text{ cm} = \underline{\hspace{2cm}} \text{ mm}$

67. A circle has a radius of 10 cm. Find the circumference of the circle in millimetres.

68. A farmer builds a fence around a rectangular sheep pen. The pen is 5 metres long and 7 metres wide. What is the perimeter of the pen in centimetres?

69. Find the height of a triangle with a base of 12 cm and an area of  $75 \text{ cm}^2$ . Answer in millimetres.

## Two (or three) Unit Conversions

Use two conversion factors to make necessary conversions. Round to the nearest tenth of a unit if necessary.

70. Convert 3.45 m to mm.

71. Convert 12.357 km to m.

72. Convert 176 mm to m.

73. Convert 1.365 km to mm.

74. Convert  $17\frac{1}{5}$  m to mm.

75. Convert  $\frac{3}{4}$  km to cm.

76. The poliovirus is about 30 **nanometers** in diameter. That is 0.000 000 030 m. How many millimetres in diameter is the virus.

77. The Great Wall of Ming Dynasty in China has been measured to be 8851.8 km long. Approximately how many centimetres is this?

78. A standard volleyball court is 18 m long and 9 m wide. Find the area in square millimetres.

79.  $2\text{ m} + 30\text{ cm} + 4\text{ mm}$

= \_\_\_\_\_ mm

80.  $1.35\text{ km} + 125\text{ m} + 40\text{ cm}$

= \_\_\_\_\_ m

81.  $1.35\text{ km} + 125\text{ m} + 120\text{ mm}$

= \_\_\_\_\_ cm

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**Unit Conversion *between* Systems**


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**One-Step Conversions:**

Use the table on page 5. Write the conversion factors as a ratio (watch the units!).

Convert each of the following. Round to the nearest tenth.

82.  $50 \text{ mi} = \underline{\hspace{2cm}} \text{ km}$

83.  $185 \text{ lb} = \underline{\hspace{2cm}} \text{ kg}$

84.  $150 \text{ m} = \underline{\hspace{2cm}} \text{ yd}$

Use :  $\frac{1.609 \text{ km}}{1 \text{ mi}}$  (from reference page)

$$50 \text{ mi} \times \frac{1.609 \text{ km}}{1 \text{ mi}} = 80.45 \text{ km}$$

$$\cong 80.5 \text{ km}$$

85.  $72 \text{ in} = \underline{\hspace{2cm}} \text{ cm}$

86.  $42 \text{ oz} = \underline{\hspace{2cm}} \text{ g}$

87.  $1245 \text{ km} = \underline{\hspace{2cm}} \text{ mi}$

**Two-Step or Three-Step Conversions:**

Convert each of the following. Round to the nearest tenth.

88.  $42 \text{ km} = \underline{\hspace{2cm}} \text{ ft}$

89.  $54 \text{ m} = \underline{\hspace{2cm}} \text{ in}$

90.  $1250 \text{ g} = \underline{\hspace{2cm}} \text{ lb}$

① Convert from km  $\rightarrow$  mi

② Convert from mi  $\rightarrow$  ft

$$42 \text{ km} \times \frac{1 \text{ mi}}{1.609 \text{ km}} \times \frac{5280 \text{ ft}}{1 \text{ mi}}$$

$$\cong 137824.7 \text{ ft}$$

91. Answer the question above using a different conversion strategy.

92.  $4.25 \text{ km} = \underline{\hspace{2cm}} \text{ in}$

93.  $1.3 \text{ tons} = \underline{\hspace{2cm}} \text{ kg}$

Convert the following. Exact answers or round to the nearest hundredth when necessary.

<p>94. <math>12\text{ lbs } 3\text{ oz} = \underline{\hspace{2cm}}\text{ kg}</math></p> <p>① Convert 3 oz to lbs.  <math>3\text{ oz} \times \frac{1\text{ lb}}{16\text{ oz}} = 0.1875\text{ lb}</math></p> <p>② Add: <math>12 + 0.1875 = 12.1875\text{ lb}</math></p> <p>③ <math>12.1875\text{ lb} \times \frac{0.454\text{ kg}}{1\text{ lb}} = 5.53\text{ kg}</math></p>	<p>95. <math>2\text{ lbs } 14\text{ oz} = \underline{\hspace{2cm}}\text{ kg}</math></p>	<p>96. <math>7\text{ lbs } 8\text{ oz} = \underline{\hspace{2cm}}\text{ g}</math></p>
<p>97. <math>12'6'' = \underline{\hspace{2cm}}\text{ m}</math></p>	<p>98. <math>8\text{ yd } 3' = \underline{\hspace{2cm}}\text{ m}</math></p>	<p>99. <math>14\text{m } 28\text{ cm} = \underline{\hspace{2cm}}\text{ yd}</math></p>
<p>100. Answer the question above using a different conversion strategy.</p>	<p>101. Answer the question above using a different conversion strategy.</p>	<p>102. Answer the question above using a different conversion strategy.</p>
<p>103. A pizza has a circumference of 5 feet 3 inches. Find the diameter in centimetres.</p>	<p>104. A volleyball has a diameter of 2 feet 2 inches. Find the circumference of the ball at its widest point. Answer to the nearest inch.</p>	<p>105. Mr. J needs 2m, 41 cm and 3 mm of edge grain fir to make each of his cabinet doors. How many linear feet does he need to make his 8 doors?</p>

## Geometry of 3-D figures.

Familiarize yourself with the shapes, names and formulas at the beginning of this booklet.

Using the **reference page** at the beginning of this unit.

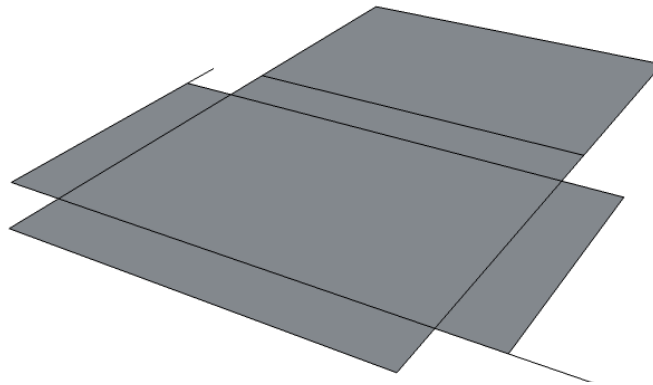
- Choose the right formula.
- Fill in all known values into the formula.
- Calculate (remember BEDMAS).

### Surface Area

Area is the **two-dimensional** size of a surface. Consider the area that this booklet is covering on the surface below it (unless you are on a computer of course).

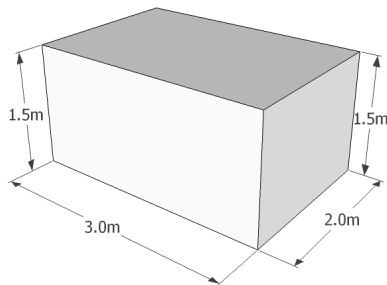
The **surface area** of a solid is the total area of its exposed surfaces.

Consider a common cereal box. If you unfolded the sides, top, bottom, front and back...how much area on your desk would it cover? That would be the surface area of the box.



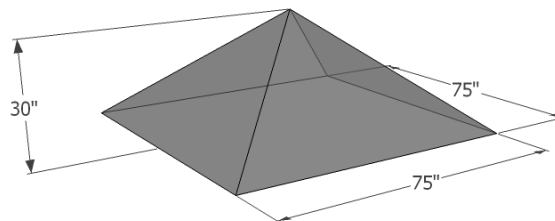
127. Refer to page 5 to answer the following question.

Find the surface area of the rectangular prism below to the nearest square metre.

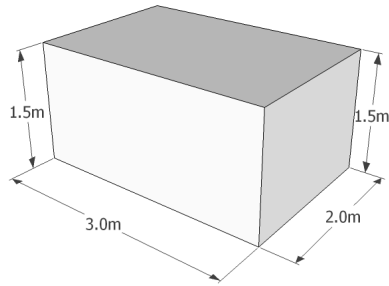


128. Refer to page 5 to answer the following question.

Find the surface area of the square pyramid below to the nearest ten square inches..



Find the surface area of the rectangular prism below to the nearest square metre.



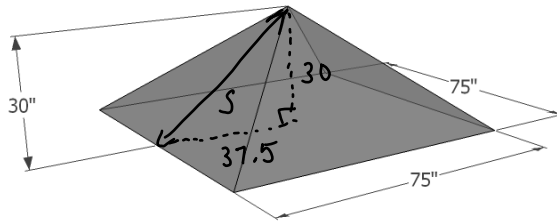
$$SA = 2(hl + lw + hw)$$

$$SA = 2[(1.5 \times 3) + (3 \times 2) + (1.5 \times 2)]$$

$$SA = 2[4.5 + 6 + 3]$$

$$SA = 27 \text{ m}^2$$

Find the surface area of the square pyramid below to the nearest ten square inches..



$$A = 2bs + b^2$$

$$A = 2(75)(s) + (75)^2$$

$$A = 2(75)(48.0) + (75)^2$$

$$A \approx 12830 \text{ sq in}$$

Need 's'

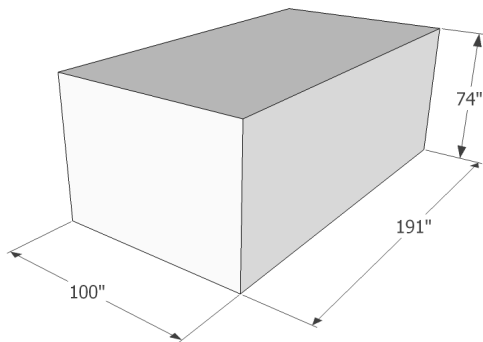
Use  $a^2 + b^2 = c^2$

$$37.5^2 + 30^2 = s^2$$

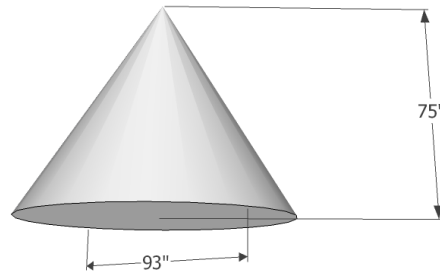
$$s = 48.0$$

Calculate the surface area of the following figures. Answers should be given as indicated.

129. Nearest square inch.

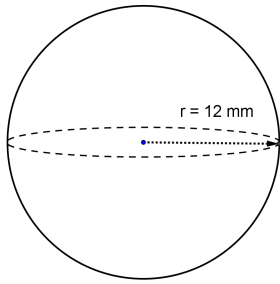


130. Nearest square inch.

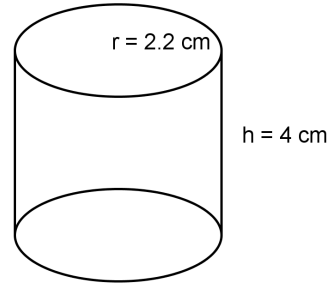


Calculate the surface area of the following figures. Answers should be given as indicated.

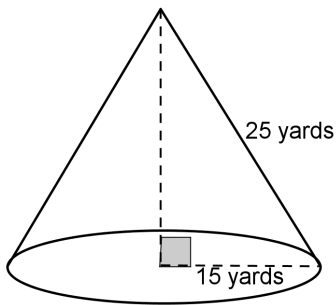
131. Nearest square millimetre.



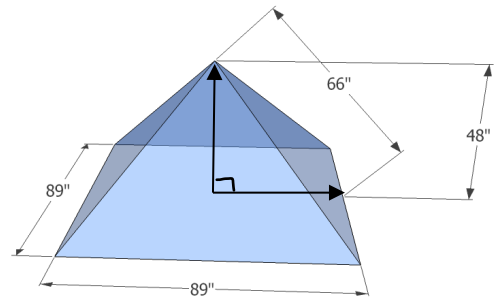
132. Nearest square centimetre.



133. Nearest square foot.



134. Nearest square foot.

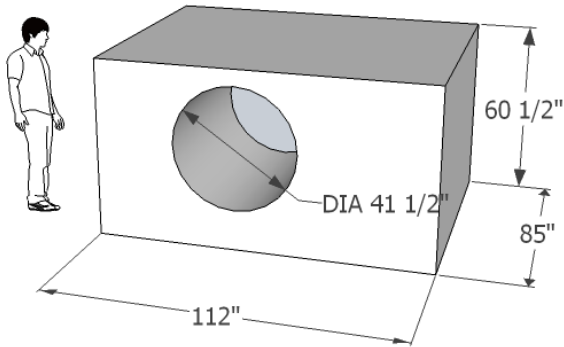


135. Calculate the surface area of a cone with a height of 10 cm and a base diameter of 12 cm. Answer to the nearest square centimetre.

136. A cone has a base radius of 15 inches and a surface area of 1650 square inches. Find the slant height of the cone to the nearest inch.



137. Frank needs to find the surface area of the playground equipment below so he can estimate how much paint to buy. Explain the process he should use (he will not paint the bottom).

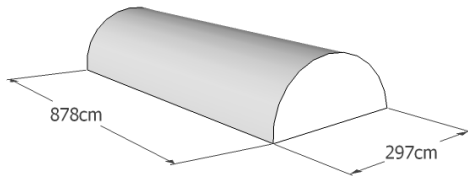


Explain \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

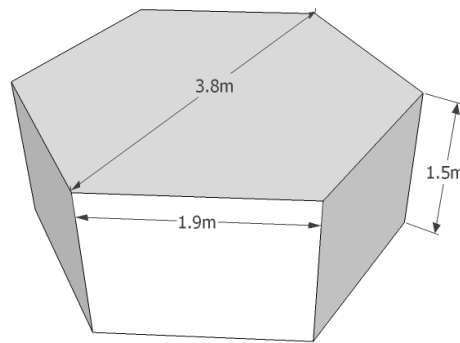
138. Find the surface area of the figure to the left to the nearest square inch.

139. One quart of paint (a small can) covers 87.5 sq ft. How many quarts will Frank need to buy?

140. Find the surface area of the concrete curb below (all surfaces). Answer to the nearest square centimetre.



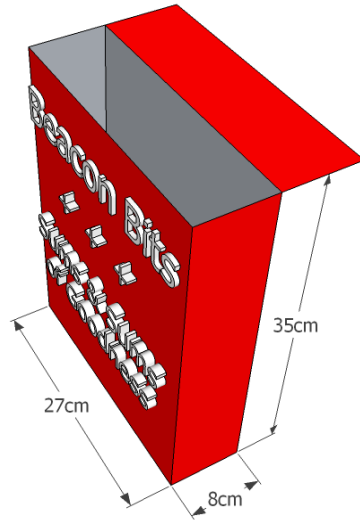
141. Calculate the surface area of the hexagonal prism (regular) to the nearest square metre.



**Volume**

Volume is the amount of 3-dimensional space that a figure occupies or contains.

Consider the cereal box. The “amount” of Beacon Bits that fit inside the box is its volume. This is often referred to as the **capacity** of a container.

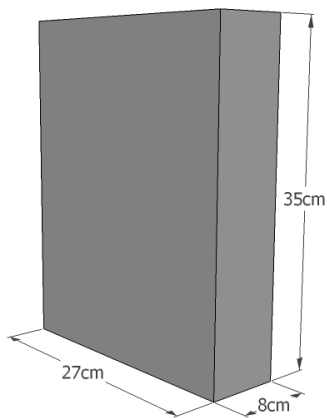


**142. Challenge:**

If each Beacon Bit is a cube 1 cm by 1 cm by 1cm, how many Bits would fit in the box? Start by finding out how many would fit in the bottom layer.

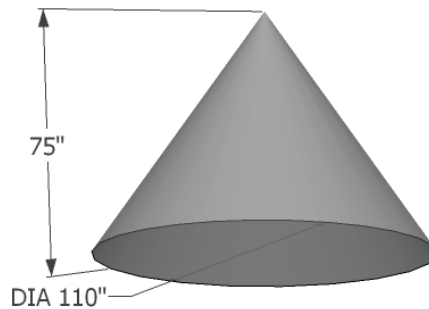
143. Refer to page 5 to answer the following question.

Find the volume of the box to the nearest  $\text{cm}^3$ .

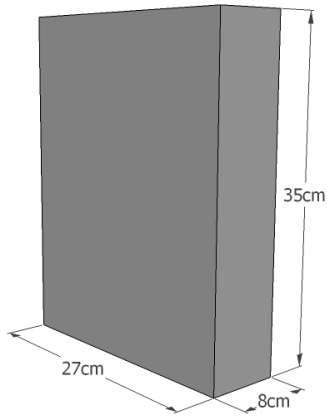


144. Refer to page 5 to answer the following question.

Find the volume of the cone to the nearest cubic inch.



Find the volume of the box to the nearest  $\text{cm}^3$ .

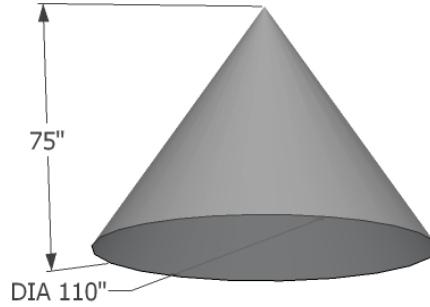


$$V = lwh$$

$$V = (27)(8)(35)$$

$$V = 7560 \text{ cm}^3$$

Find the volume of the cone to the nearest cubic inch.



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

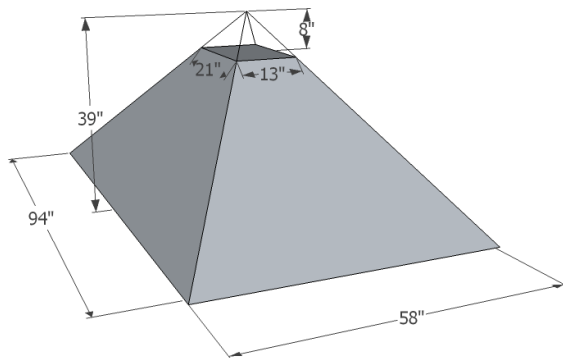
$$V = \frac{\pi(55)^2(75)}{3}$$

$$V = \frac{226875\pi}{3} = 75625\pi \approx 237583 \text{ sq in}$$

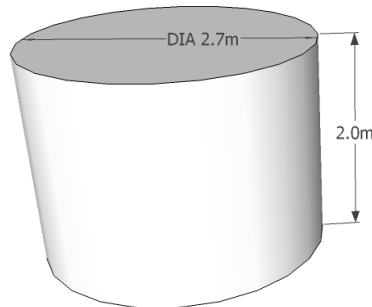
145. Using the formula for the volume of a rectangular prism,  $V = lwh$ , explain why the units for volume are “cubed”.

146. Refer to page 5. Compare the formulas to calculate volume of right prisms, right cylinders, and triangular prisms. What do they all have in common?

147. Timothy is building a garden water fountain in the shape of a “truncated” square pyramid. Describe **how** you would find the volume of concrete required to build this fountain.

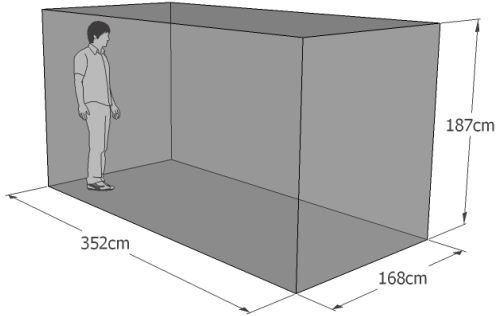


148. Find the volume to the nearest tenth of metre.

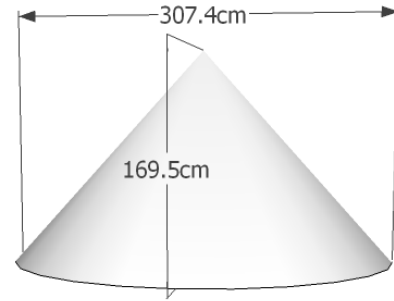


Calculate the volume of the following figures. Answers should be given as indicated.

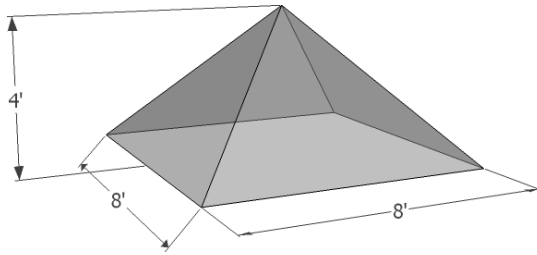
149. Cubic centimetres.



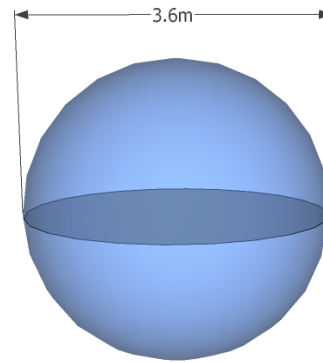
150. Cubic centimetres.



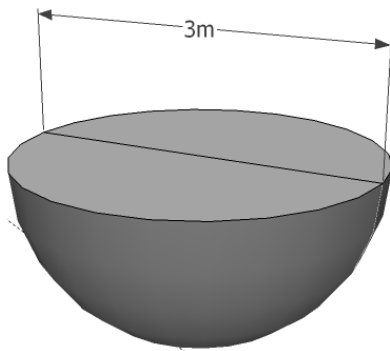
151. Cubic feet.



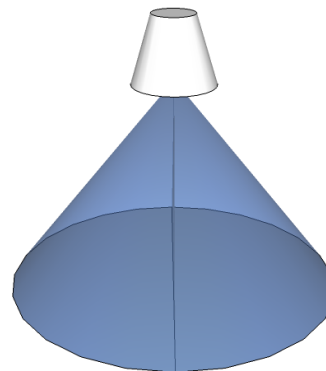
152. Cubic metres.



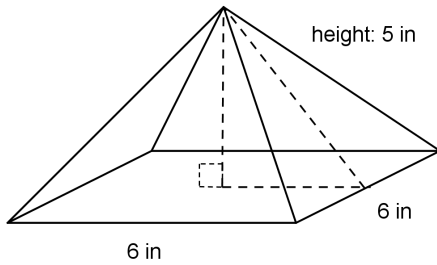
153. Nearest tenth of a cubic metre.



154. A spray nozzle produces a cone-shaped spray pattern. Find the volume of the cone if the nozzle is 12 feet above the ground and produces a circle with a diameter of 16 feet. (Nearest cubic foot)



155. Find the volume to the nearest cubic inch.



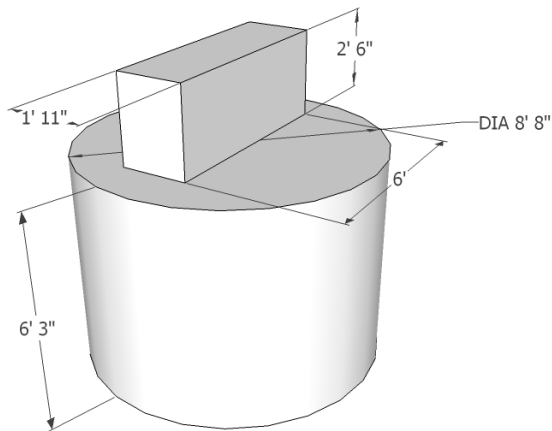
156. If the pyramid to the left is enlarged by a factor of 2, what will the new volume be?

Can you make a rule (formula) for this?

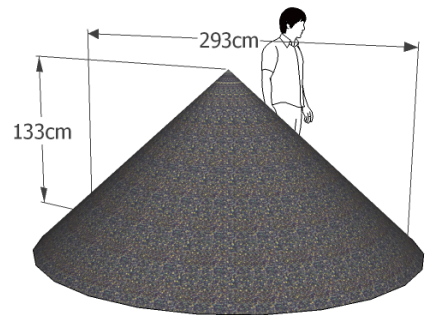
157. A square-based pyramid has a volume of 250 cubic yards and a height of 30 feet. Find the side length of the square base to the nearest foot.

158. A sphere has a volume of  $3000 \text{ m}^3$ . Find the radius of the sphere to the nearest metre.

159. Charlie needs to paint the composite shape below. Before he purchases paint he needs to calculate the surface area to the nearest square foot. The bottom does not need to be painted. How many square feet does he need to paint?

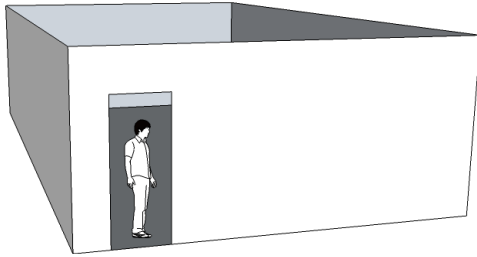


160. Find the volume of gravel in the pile to the nearest cubic yard.

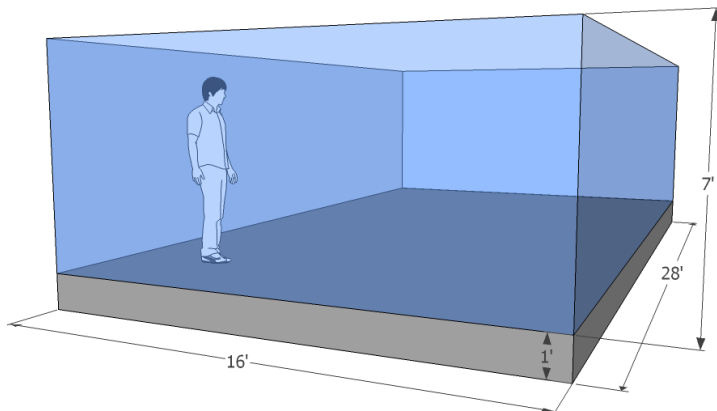


161. Find a spherical object and measure the diameter. Calculate the surface area of your object. Draw a neat and detailed diagram showing your object and measurement. Record all measurements to the nearest tenth of a centimetre. Round your answer to the nearest square centimetre.
162. Find a conical object. Make appropriate measurements to the nearest tenth of a centimetre. Draw a neat and detailed diagram showing your object and measurements. Calculate the volume of the cone to the nearest cubic centimetre.
163. One gallon of paint covers approximately 350 sq-ft. How many decorative balls can you paint with a 5-gallon bucket of paint if each ball has a radius of 12 cm.
164. A cylindrical can holds 3 tennis balls. The diameter of a tennis ball is  $2\frac{1}{2}$  inches. Calculate the volume of air in the can surrounding the 3 balls. The can is designed to hold exactly three tennis balls in terms of height and diameter. (Nearest tenth of a cubic inch).
165. A section of concrete pipe has an inside diameter of 2.2 m and an outside diameter of 2.5 m. Find the cross-sectional area of exposed concrete for one end of the pipe.
166. A sphere has a surface area of  $260\pi$  square feet. Find the exact radius of the sphere.
167. A sphere has a surface area of  $289\pi$  square inches. Find the radius of the sphere to the nearest tenth of an inch.

168. Below is a model of a standard room at a storage facility. The interior walls are to be painted. The room measures 18' by 24' and the wall height is 8'. The door is standard height and width (36" by 80"). Find the interior surface area of the walls.



Check out the huge aquarium! Mr. J wants to swim the fishes so he is building this aquarium in his home.



169. Calculate the volume of concrete in the floor of the aquarium in cubic feet.

170. Calculate the mass of the floor if concrete has a mass of 2400 kg per cubic metre.

171. Calculate the area of acrylic (aquarium wall) required to build this structure.

172. Sheets of acrylic sell for \$45 /sq ft. If he could actually find sheets this size, what would be the cost (before taxes)?

173. How many litres of water does the tank hold? How many gallons?

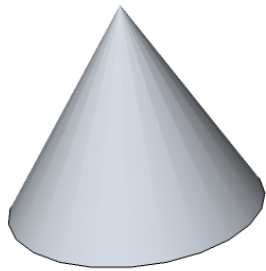
Note:  $1\text{ cm}^3 = 1\text{ ml}$ ,  $1000\text{ ml} = 1\text{ litre}$ ,  $1\text{ gallon} = 3.785\text{ litres}$

174. A sphere has a volume of  $\frac{256\pi}{3} \text{ cm}^3$ . Find the exact radius of the sphere.

175. A square-based pyramid with a height of 10 metres has a volume of  $300\text{m}^3$ . Find the exact side length of the base.

176. Find the height of a cylinder if it has a volume of  $1200 \text{ cm}^3$  and a radius of 12 cm. Answer to the nearest tenth of a centimetre.

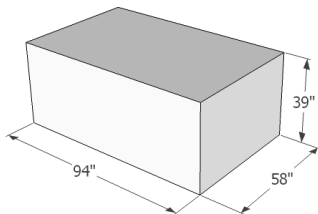
177. Find the exact volume of the right cone below. It has a height of 10 cm and a radius of 5 cm.



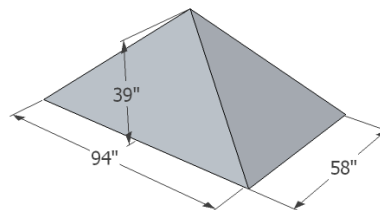
178. Find the exact volume of a cylinder with the same height and radius as the cone in the previous question.

179. What is the ratio of volumes for the two figures in the previous two questions?

180. Find the volume of the right prism below. Answer to the nearest cubic inch.



181. Below is a right pyramid with the same base and height as the prism in the previous question. Find the volume to the nearest cubic inch.



182. What is the ratio of volumes for the two previous figures?

183. In general, what is the relationship between the volumes of right pyramids and right prisms with the same dimensions?



## Answers:

1. 9 ft
2. 45 ft
3.  $37\frac{1}{2}$  or 37.5 ft
4. 4 yd
5. 27 inches
6.  $45\frac{1}{3}$  yd
7. 96 in
8. 33 in
9. 57.6 in
10. 3 ft
11.  $11\frac{2}{3}$  ft
12. 168 ft
13. 3520 yd
14. 22176 ft
15.  $\frac{75}{88}$  miles
16. 189000 in
17. 10 lbs
18.  $13\frac{3}{4}$  or 13.75 lbs
19. 64 oz
20. 36 oz
21. 3 tons
22. 96'
23. 128 oz
24. 192"
25. \$162.06 for 74'
26. 46 yd, 2 ft
27. 85 yd, 1 ft
28. 9 yd, 2 ft, 8 in
29. 11' 10"
30. 5 yd, 2 ft
31. 2 tons, 1266 lbs and 4 oz
32. 74 ft
33. 24 yd, 2 ft
34. 6' x 7'
35. \$199.92
36. 13 yd, 1 ft
37. 192 sq ft
38. \$147.84 for 48 rolls
39.  $1\frac{149}{1056}$  miles (about 1.141 miles)
40.  $23\frac{67}{176} \cong 23.4$  miles
41. 158400"
42. 117"
43. 564"
44. 876"
45. 1536"
46. 48 frames
47. 1267200"
48. 20 miles
49. 116.5 yd
50.  $A = lw$
51. 9 sq ft
52. 36 in
53. 1296 sq in
54. Multiply by the conversion factor (12) twice. That is, multiply by 12<sup>2</sup>
55. 5 575 680 sq ft
56. Multiply by (5280)<sup>2</sup>
57. 36 sq in
58. 120"
59. 101788 sq in
60. 79168 sq in
61. 125 cm
62. 3725 cm
63. 8 mm
64. 138 000 mm
65. 15.1 m
66. 32.8 mm
67. 628 mm
68. 2400 cm
69. 125 mm
70. 3450 mm
71. 12357 m
72. 0.2 m
73. 1 365 000 mm
74. 17200 mm
75. 75 000 cm
76. 0.000 03 mm
77. 885 180 000 cm
78. 162 000 000 mm<sup>2</sup>
79. 2304 mm
80. 1475.4 m
81. 147512 cm
82. 80.5 km
83. 84.0 kg
84. 164.0 yd
85. 182.9 cm
86. 1190.7 g
87. 773.8 miles
88. 137824.7 ft
89. 2126.0 in
90. 2.8 lbs
91. 137795.3 ft
92. 167322.8 in
93. 1180.4 kg
94. 5.53 kg
95. 1.31 kg
96. 3402 g
97. 3.81 m
98. 8.23 m
99. 15.62 yd
100. 3.81 m
101. Try yards  
→feet→metres
102. Try m→cm  
→inches→yards
103. 50.94 cm
104. 82"
105.  $66\frac{1}{3} = 66.33$  linear ft.
106. Your answers here.
107. Your answers here.
108. Your answers here.
109. Your answers here.
110. Trundle wheel.
111. Vernier calipers.
112. Micrometer.
113. Inches, cm, mm.
114. Eg. Measuring tape. Cm, inches (and fractions thereof)
115. Eg. Measuring cup. Cups, ounces, ml, l
116. Eg. Volumetric cylinder. ml
117. Eg. 2-pan balance scale. g, kg
118. Eg. Electronic scale.  $\mu$ g, mg, g
119. Diameter, distance.
120. Volume. ml
121. Diameter, distance.
122. One set of claws is for measuring inside diameters such as inside a tube. The other is for measuring outside diameter.
123. 1.97 mm
124. 3.15 cm
125. 3.68 cm
126. 0.40 mm
127. 27 m<sup>2</sup>
128. 12 830 sq in
129. 81 268 sq in
130. 19 684 sq in
131. 1810 mm<sup>2</sup>
132. 86 cm<sup>2</sup>
133. 16 965 sq ft
134. 137 sq ft
135. 333 cm<sup>2</sup>
136. 20"
137. Find the surface area of the rectangular prism, add the area of the curved cylindrical surface, subtract the bottom of the prism and the two circles.
138. 41 734 sq in
139. Frank should buy 4 quarts.
140. 739 655 cm<sup>2</sup> (with bottom) 478889 cm<sup>2</sup> (without bottom)
141. 36m<sup>2</sup>
142. 7560 Beacon Bits

143.  $7560 \text{ cm}^3$
144. 237 583 cubic inches
145. The three dimensions have units such as centimetres. If we multiply  $cm \times cm \times cm$  we get  $cm^3$ .
146. Bottom (base area) multiplied by the height.
147. Find the volume of the large pyramid and subtract the volume of the small (removed) pyramid.
148.  $11.5 \text{ m}^3$
149.  $11\,058\,432 \text{ cm}^3$
150.  $4\,193\,205 \text{ cm}^3$
151. 85 cubic feet
152.  $24.4 \text{ m}^3$
153.  $7.1 \text{ m}^3$
154. 804 cubic feet
155. 60 cubic inches
156. 480 cubic inches
157. 26 ft
158. 9 m
159. 269 sq ft
160.  $4 \text{ yd}^3$
161. Your answer here.
162. Your answer here.
163. 897 balls
164. 12.3 cubic inches
165.  $1.1 \text{ m}^2$
166. Radius is  $\sqrt{65}$  ft
167. 8.5 in
168. 652 sq ft
169. 448 cubic feet or  $12.69 \text{ m}^3$
170. 30 446 kg
171. 616 sq ft
172. \$27720
173. 76 116 l, 20 108 gal
174. 4 cm
175.  $3\sqrt{10}$  m (approx 9.49 m)
176. 2.7 cm
177.  $\frac{250}{3}\pi \text{ cm}^3$
178.  $250\pi \text{ cm}^3$
179. 1: 3 or  $\frac{1}{3}$
180. 212628 cubic inches
181. 70876 cubic inches
182. 1: 3 or  $\frac{1}{3}$
183. Pyramids and cones will have volumes equal to one-third of their corresponding prism.