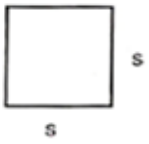
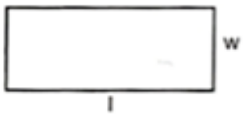
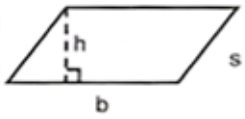
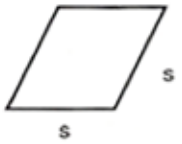
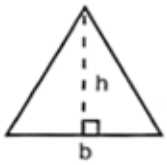
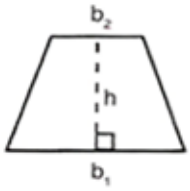
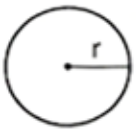
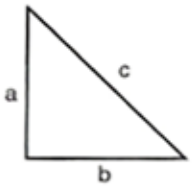
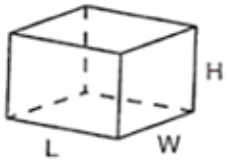
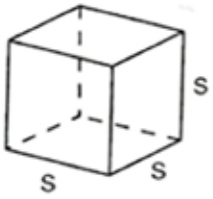
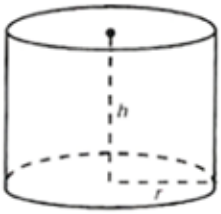
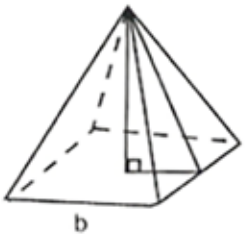
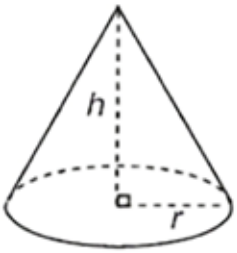
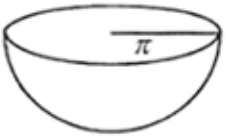
Math Help Sheet: Formulas for 2D and 3D Figures

Type of Figure		What to Find	Formula
Square		Perimeter	$4s$
Square		Area	s^2
Rectangle		Perimeter	$2l + 2w$
Rectangle		Area	lw
Parallelogram		Perimeter	$2b + 2s$
Parallelogram		Area	bh
Rhombus		Perimeter	$4s$
Triangle		Area	$\frac{1}{2}bh$
Trapezoid		Area	$\frac{1}{2}h\,(b_1 + b_2)$
Circle		Circumference	πD or $2\pi r$
Circle		Area	πr^2
Semicircle		Circumference	πr
Semicircle		Area	$\frac{1}{2}\pi r^2$
Right triangle		Length of side	$a^2 + b^2 = c^2$ (c = hypotenuse)

Type of Figure		What to Find	Formula
Rectangular Box (Open) Minus EFGH		Surface Area	LW + 2LH + 2WH
Rectangular Box (Closed)		Surface Area	2LW + 2LH + 2WH
Rectangular Box		Volume	LWH
Cube		Surface Area	$6s^2$
Cube		Volume	s^3
Cylinder (Open) minus the top		Surface Area	$\pi r^2 + 2\pi rh$
Cylinder (Closed)		Surface Area	$2\pi r^2 + 2\pi rh$
Cylinder		Volume	$\pi r^2 h$
Pyramid		Volume	$\frac{1}{3}bh$
Cone		Volume	$\frac{1}{3}\pi r^2 h$
Sphere		Surface Area	$4\pi r^2$
		Volume	$\frac{4}{3}\pi r^3$
Hemisphere		Surface Area	$2\pi r^2$
		Volume	$\frac{2}{3}\pi r^3$

EXAMPLES

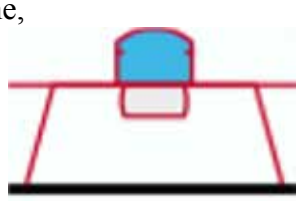
1) Find the volume and area of a cylinder with diameter and height both 30 inches to nearest whole number.

$V = \pi r^2 h$ and $SA = 2\pi rh + 2\pi r^2$ ← *Note that the radius is half the diameter, so r = 15 inches.*

$V = \pi(15)^2(30) = 6750\pi$ cubic inches or about 21,206 in^3 ← *We used the pi key on a calculator.*

$SA = 2\pi rh + 2\pi r^2 = 2\pi(15)(30) + 2\pi(15)^2 = 900\pi + 450\pi = 1350\pi$ square inches or about 4241 in^2

2) Find the area of the trapezoid behind the goalie which has a 22 ft base at the goal line, 28 ft base at the boards and a depth behind the goal line of 11 ft.



$A = (\frac{1}{2})h(b_1+b_2)$ with $b_1 = 22$ feet, $b_2 = 28$ feet, and $h = 11$ feet

$A = (\frac{1}{2})(11)(22 + 28) = 275$ square feet or 275 ft^2

3) A hemispherical dome is to be constructed with radius of 113 feet. Find the base circumference and area, and the surface area and volume of the dome.

$C = 2\pi r = 2\pi(113) = 710$ feet, Base Area $= \pi r^2 = \pi(113)^2 = 40{,}115$ square feet

$SA = 2\pi r^2 = 2\pi(113)^2 = 80{,}230$ square feet, $V = (2/3)\pi r^3 = (2/3)\pi(113)^3 = 4{,}927{,}351$ cubic feet

4) The units of measure must match when we use formulas for area or volume.
Suppose we need to order a number of cubic feet of concrete to poor a garage floor 24 ft by 30 ft at a depth of 9 inches. We need the volume in cubic yards of a rectangular box with length 24 feet, width 30 feet and height 9 inches. We have 12 inches in 1 foot, and 3 feet in 1 yard.

Method 1: Use L = 24 ft, W = 30 ft, H = 9/12 = ¾ ft, so V = LWH = (24)(30)(0.75) = 540 cubic feet

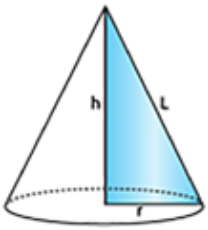
1 cubic yard = $(3 \text{ feet})^3 = 27$ cubic feet, so $V = (540/27)\ yd^3 = 20$ cubic yards.

Method 2: L = (24/3) yd, W = (30/3) yd, H = (9÷12÷3) yd, so $V = LWH = (8)(10)(0.25) = 20\ yd^2$

5) Find the volume of a cone with diameter and height both 30 inches to nearest whole number.

$V = (1/3)\ \pi r^2 h = (1/3)\pi(15)^2(30) = 2250\pi$ cubic inches or about 7069 in^3 ← *1/3 of answer 1 above.*

Extra Information: The surface area of a cone is $\pi rL + \pi r^2$, with L = lateral length.
Find the surface area of a cone with height 4 cm and radius 3 cm.



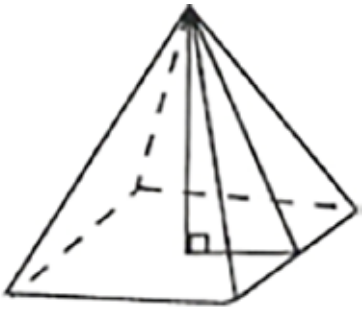
Since $3^2 + 4^2 = 5^5$ we have L = 5cm ← *We used the Pythagorean Theorem*

$SA = \pi rL + \pi r^2 = \pi(3)(5) + \pi(3)^2 = 15\pi + 9\pi = 24\pi$ cubic centimeters [about 75 cc]

6) Find the volume a square pyramid with base sides of 6 feet and height 4 feet.

$V = (1/3)bh$, where b = base area $= 6^2 = 36\ ft^2$

$V = (1/3)(36)(4) = 48$ cubic feet.



Extra Information: The surface area of a regular pyramid is $(\frac{1}{2})bL + b$, with L = lateral length = 5 feet ← *Same as for cone above.*

Find the total surface area of square pyramid.

SA = is $(\frac{1}{2})bL + b$ = is $(\frac{1}{2})(36)(5) + (36) = 126$ square feet.