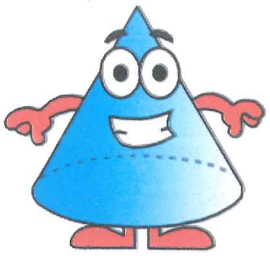


Topic 2

Perimeter, Area, and Volume

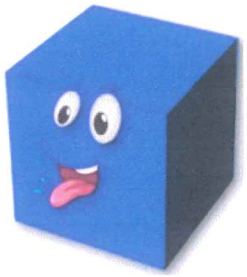


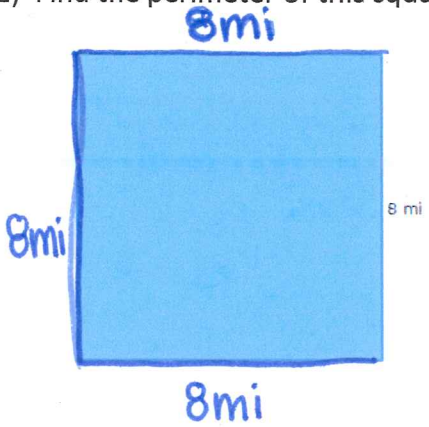
Table of Contents

Perimeter

- distance around the outside of a figure.

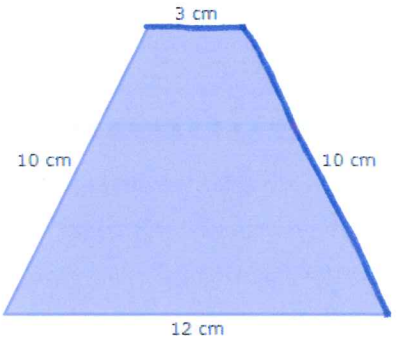
Just ADD up all of the sides!

1) Find the perimeter of this square.



$8+8+8+8=$ **32 mi**

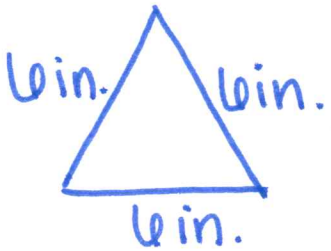
2) Find the perimeter.



$3+10+12+10=$ **35 cm**

3) An equilateral triangle has a side with a length of 6 in. Find the perimeter of the triangle.

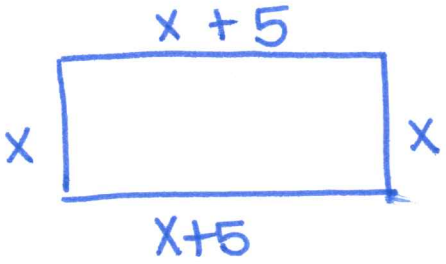
all sides =



$6+6+6=$ **18 in.**

4) The length of a rectangle is 5 more than the width. What are the dimensions of the rectangle if the perimeter is 34?

5 + x



$x+5+x+x+5+x=34$

$4x+10=34$

$-10 \quad -10$

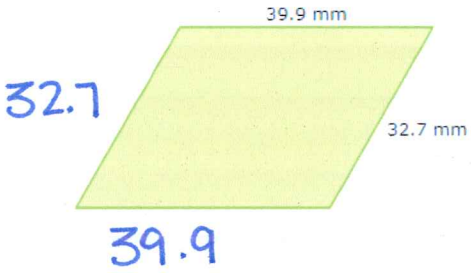
$\frac{4x}{4}=\frac{24}{4}$

$x=6$

width = **6**

length = $6+5=$ **11**

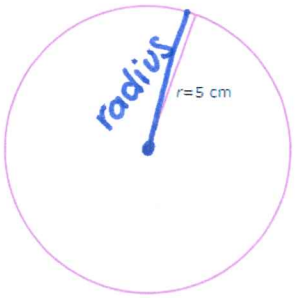
5) Find the perimeter.



$39.9 + 32.7 + 39.9 + 32.7 =$ **145.2 mm**

6) Find the perimeter to the nearest tenth.

Circumference



Note: $\pi = 3.14\ldots$

$C = 2\pi r$

$C = 2\pi(5)$

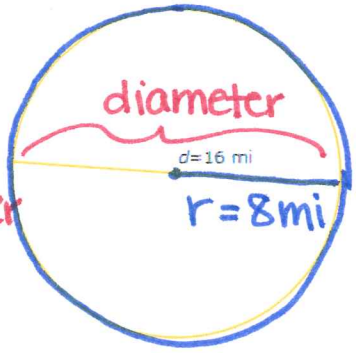
$C = 31.4$ cm

How do you find the perimeter of a circle?

$C = 2\pi r$

7) Find the circumference in terms of π.

Note: radius = $\frac{1}{2}$ diameter



$C = 2\pi(8) =$ **16 mi**

8) The circumference of a circle is 16π, find the length of the radius.

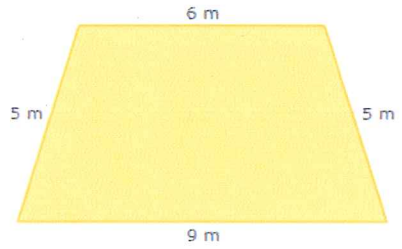
$C = 2\pi r$

$\frac{16\pi}{2\pi} = \frac{2\pi r}{2\pi}$

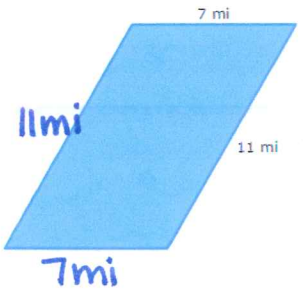
$8 = r$

You try!

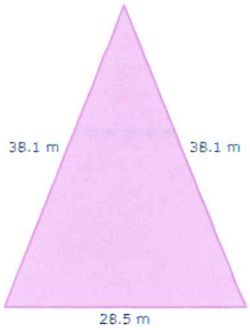
1) Find the perimeter of each of the following figures:



$5+6+5+9 = \boxed{25\text{ m}}$



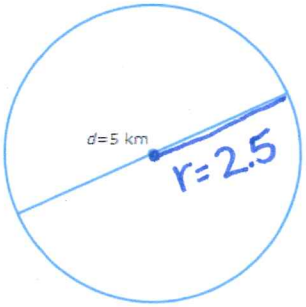
$7+11+7+11 = \boxed{36\text{ mi}}$



$38.1+28.5+38.1 = \boxed{104.7\text{ m}}$

2) Find the circumference of the following circle in terms of π.

don't type π in calc.



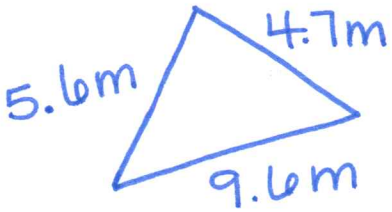
$C = 2\pi r$

$C = 2\pi(2.5)$

$\boxed{C = 5\pi\text{ km}}$

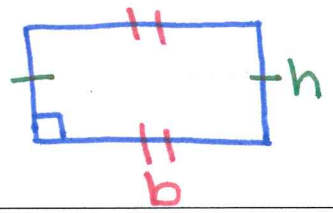
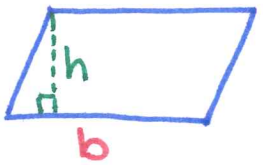
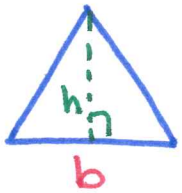
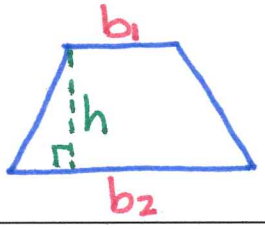
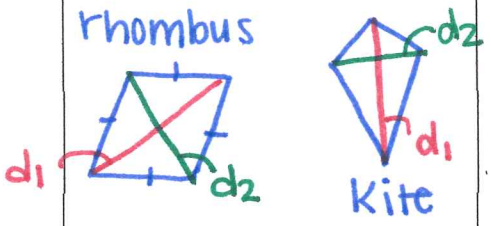
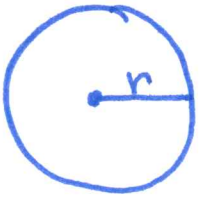
3) A triangle's sides are 5.6 m, 9.6 m, and 4.7 m. If a farmer wants to enclose the field with fencing, and fencing costs $7.40 per meter, how much will it cost the farmer?

around



$5.6+4.7+9.6 = \boxed{19.9\text{ m}}$ ← perimeter

$7.40(19.9) = \boxed{\$147.26}$

Area	Shape	Area Formula
Rectangle		$A = bh$ $(A = LW)$
Parallelogram		$A = bh$
Triangle		$A = \frac{1}{2}bh$
Trapezoid		$A = \frac{1}{2}(b_1 + b_2)h$
Rhombus/Kite		$A = \frac{1}{2}d_1d_2$
Circle		$A = \pi r^2$

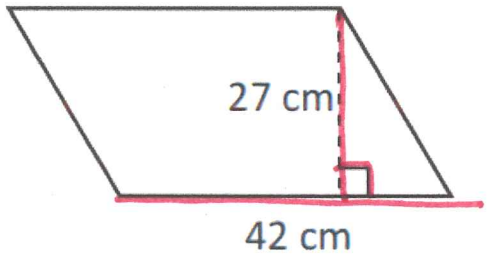
* height must be perpendicular to base !

* height (h) is always perpendicular to base (b) *
↓
forms rt. angles

height ⊥ base

Examples

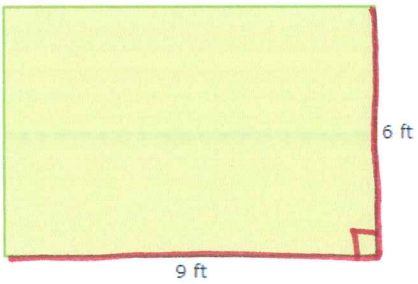
Find the area of each of the following figures below. If necessary, round your answers to the nearest tenth.



Shape: parallelogram

Area: $A = bh$

$A = (42)(27) = 1134\ cm^2$

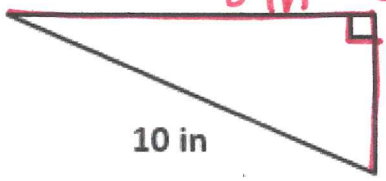


Shape: rectangle

Area: $A = bh$

$A = (9)(6) = 54\ ft^2$

Challenge



to find: $a^2 + b^2 = c^2$

$6^2 + x^2 = 10^2$

$36 + x^2 = 100$

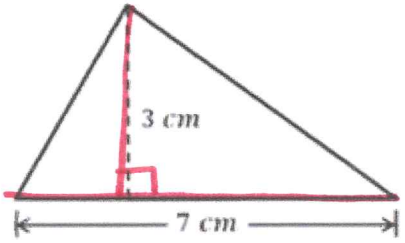
$\sqrt{x^2} = \sqrt{64}$

$x = 8$

Shape: triangle

Area: $A = \frac{1}{2}bh$

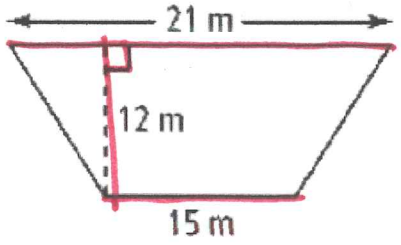
$A = \frac{1}{2}(6)(8) = 24\ in^2$



Shape: triangle

Area: $A = \frac{1}{2}bh$

$A = \frac{1}{2}(7)(3) = 10.5\ cm^2$



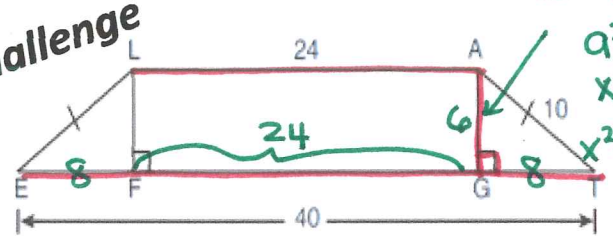
Shape: trapezoid

Area: $A=\frac{1}{2}(b_1+b_2)h$

$A=\frac{1}{2}(15+21)(12)$

$A=$ 216 m^2

Challenge



to find height:

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

$x^2+8^2=10^2$

$x^2+64=100$

$-64 \quad -64$

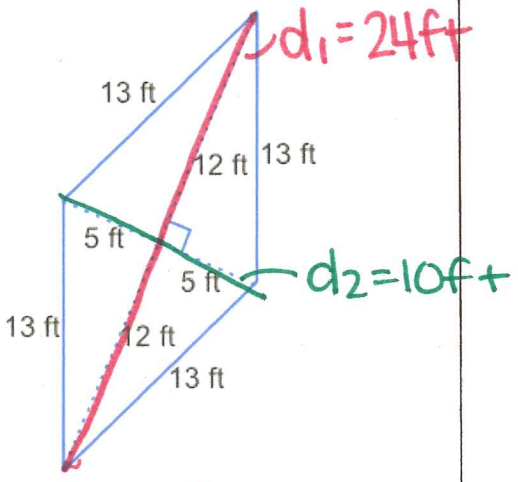
$\sqrt{x^2}=\sqrt{36}$

$x=6$

Shape: trapezoid

Area: $A=\frac{1}{2}(b_1+b_2)h$

$A=\frac{1}{2}(24+40)(6)=$ 192 units^2



$d_1=24$ft

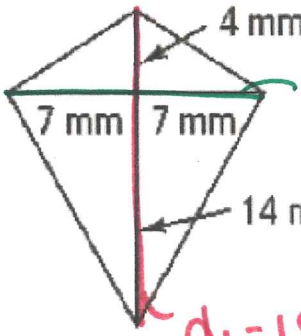
$d_2=10$ft

Shape: rhombus

Area: $A=\frac{1}{2}d_1d_2$

$A=\frac{1}{2}(24)(10)$

$A=120$ft^2



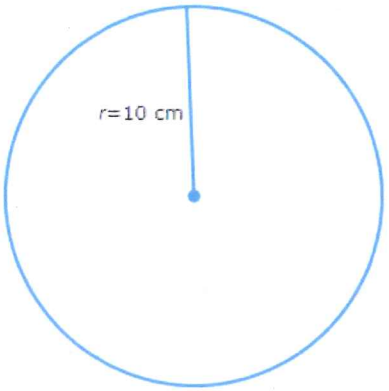
$d_2=14$mm

$d_1=18$mm

Shape: kite

Area: $A=\frac{1}{2}d_1d_2$

$A=\frac{1}{2}(18)(14)=$ 126 mm^2

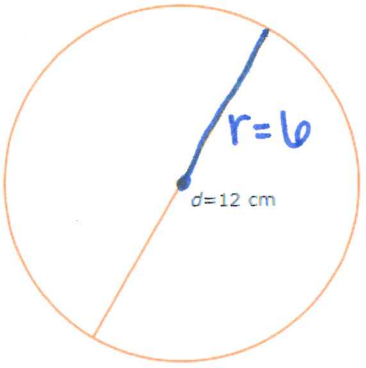


Shape: circle

Area: $A = \pi r^2$

$A = \pi (10)^2$

$A = 100\pi \text{ cm}^2$ (in terms of π)



* radius = $\frac{1}{2}$ diameter

Shape: circle

Area: $A = \pi r^2$

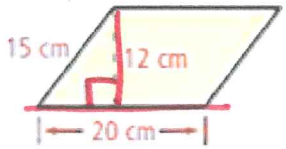
$A = \pi (6)^2$

$A = 113.1 \text{ cm}^2$ (to nearest tenth)

You try!

Find the area of each parallelogram.

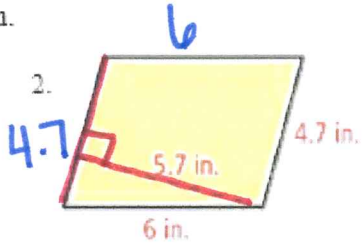
1.



$A = bh$

$A = 12(20) = 240 \text{ cm}^2$

2.

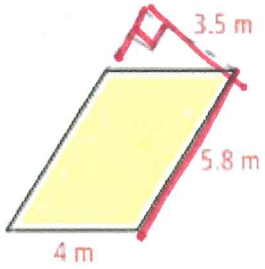


$A = bh$

$A = (5.7)(4.7)$

$A = 26.79 \text{ in}^2$

3.



$A = bh$

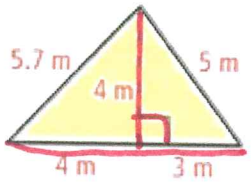
$A = (5.8)(3.5)$

$A = 20.3 \text{ m}^2$

Remember: The base must be perpendicular to the height!

Find the area of each triangle.

4.

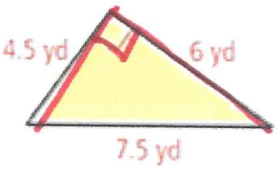


$A = \frac{1}{2}bh$

$= \frac{1}{2}(7)(4)$

$= \boxed{14\,m^2}$

5.

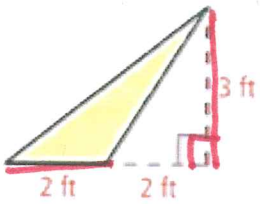


$A = \frac{1}{2}bh$

$= \frac{1}{2}(4.5)(6)$

$= \boxed{13.5\,yd^2}$

6.



$A = \frac{1}{2}bh$

$= \frac{1}{2}(2)(3)$

$= \boxed{3\,ft^2}$

Find the area of each trapezoid. If your answer is not an integer, leave it in simplest radical form.

7.

(h)

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

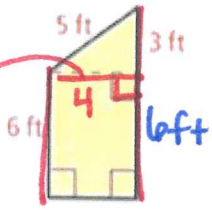
$3^2+x^2=5^2$

$9+x^2=25$

$-9 \quad -9$

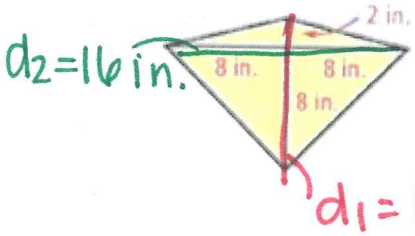
$\sqrt{x^2}=\sqrt{16}$

$x=4$



$A = \frac{1}{2}(6+9)(4) = \boxed{30\,ft^2}$

8. Find the area of the kite.



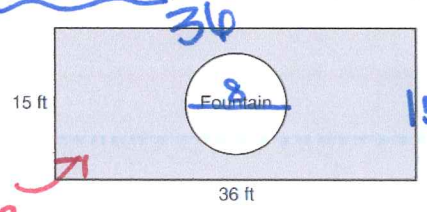
$d_2 = 16$ in.

$d_1 = 10$ in

$A = \frac{1}{2}d_1d_2 = \frac{1}{2}(10)(16) = \boxed{80\,in^2}$

Compound Area

1. *The Rock Solid Concrete Company has been asked to pave a rectangular area surrounding a* circular fountain with a diameter of 8 feet, as shown in the diagram.



36

radius = 4 ft.

Shaded part is the part that needs to be paved.

a) Find the area, to the *nearest square foot,* that must be paved.

$A_{\square} = bh = (15)(36) = 540 ft^2$

$A_{\circ} = \pi r^2 = \pi(4)^2 = 16\pi ft^2$

$540 - 16\pi = 489.7345175 =$ **490 ft²**

b) Find the cost, *in dollars,* of paving the area if the Rock Solid Concrete Company charges $8.95 per square foot.

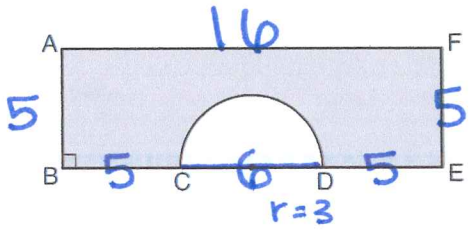
$490(8.95) =$ **$4385.50**

c) If it is decided that fencing should be placed around the newly paved area, how much fencing will be needed?

perimeter

$15 + 36 + 15 + 36 =$ **102 ft**

2. In the diagram below of rectangle *AFEB* and a semicircle with diameter $\overline{CD}$, $AB = 5$ inches, $AB = BC = DE = FE$, and $CD = 6$ inches. Find the area of the shaded region, to the *nearest hundredth of a square inch*.

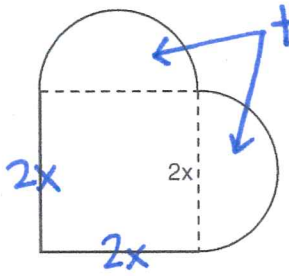


$A_{\square} = bh = (16)(5) = \boxed{80 \text{ in}^2}$

$A_{\frown} = \frac{1}{2}\pi r^2 = \frac{1}{2}\pi(3)^2 = \boxed{4.5\pi \text{ in}^2} =$
(half a circle)

$80 - 4.5\pi = \boxed{65.86 \text{ in}^2}$

3. A patio consisting of two semicircles and a square is shown in the diagram below. The length of each side of the square region is represented by $2x$.



together makes whole circle
diameter = 2x
radius = x

Write an expression for the area of the entire patio, in terms of x and π.

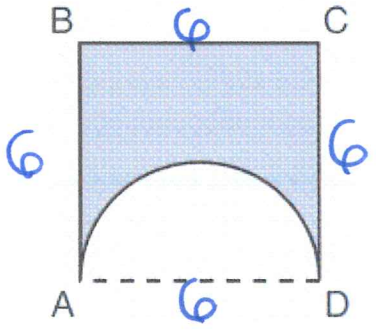
$A_{\square} = bh = (2x)(2x) = 4x^2$
$A_{\frown} = \pi r^2 = \pi(x)^2 = \pi x^2$
$\boxed{4x^2 + \pi x^2}$

Write an expression for the perimeter of the entire patio, in terms of x and π

$C_{\frown} = 2\pi r = 2\pi(x) = 2x\pi$

$2x\pi + 2x + 2x = \boxed{4x + 2x\pi}$

4. A figure consists of a square and a semicircle, as shown in the diagram below. If the length of a side of the square is 6, what is the area of the shaded region, to the nearest hundredth.

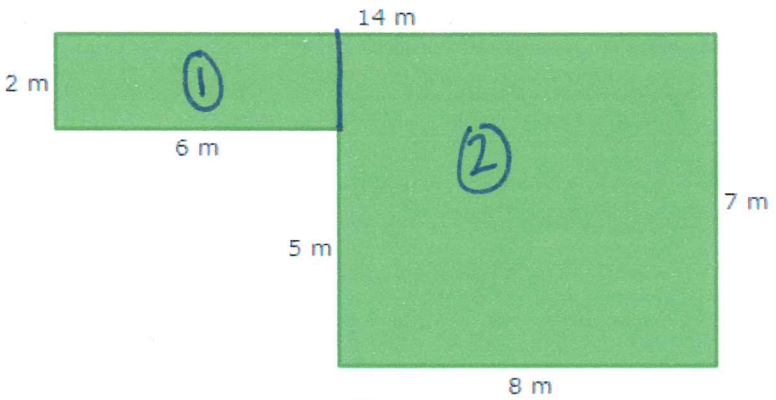


$A_{\square} = bh = (6)(6) = 36$

$A_{\cap} = \frac{1}{2}\pi r^2 = \frac{1}{2}\pi (3)^2 = 4.5\pi$

$36 - 4.5\pi = \boxed{21.86 \text{ units}^2}$

5. Find the area and perimeter of the following figure:



Perimeter:

$2+14+7+8+5+6 = \boxed{42 \text{ m}}$

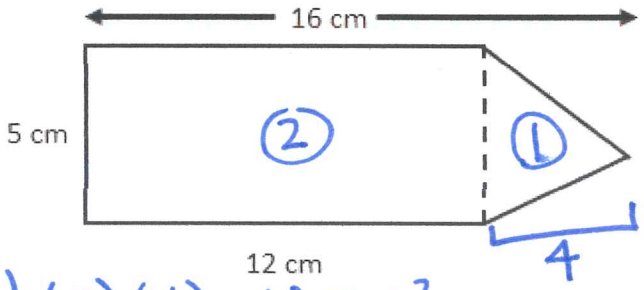
$A_1 = bh = (2)(6) = 12 \text{ m}^2$

$A_2 = bh = (7)(8) = 56 \text{ m}^2$

$\boxed{68 \text{ m}^2}$

You try!

1. Find the area of the irregular figure shown below.



$A_1 = \frac{1}{2}bh = \frac{1}{2}(5)(4) = 10\ cm^2$

$A_2 = bh = (5)(12) = 60\ cm^2$

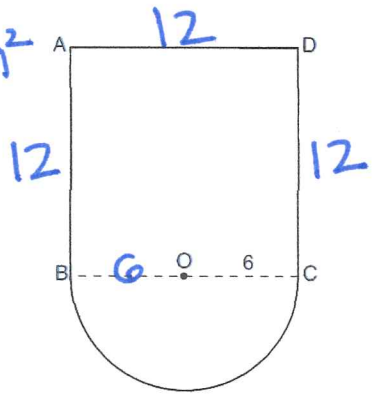
$10 + 60 = \boxed{70\ cm^2}$

2. In the figure below, *ABCD* is a square and semicircle *O* has a radius of 6 meters.

   a) What is the area of the figure, in terms of π?

$A_{\square} = (12)(12) = 144\ m^2$

$A_{\triangle} = \frac{1}{2}\pi(6)^2 = 18\pi$



$\boxed{144 + 18\pi\ m^2}$

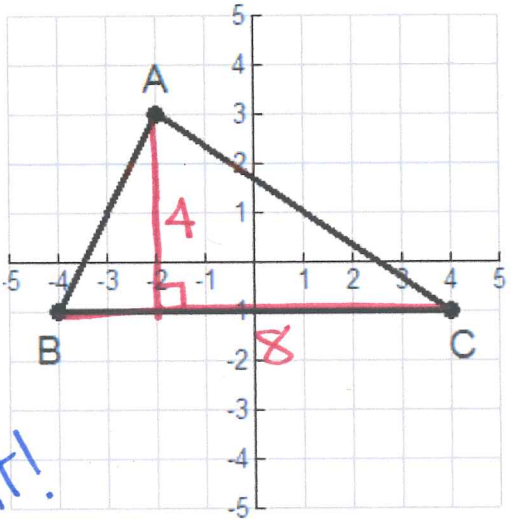
   b) If the figure above represents the layout of a basketball court that needs to be repaved at a cost of $14.98 per square meter, what is the cost to repave this area?

$(14.98)(144 + 18\pi)$

$(14.98)(200.54866778) = \$3004.22$

Area on the Coordinate Plane

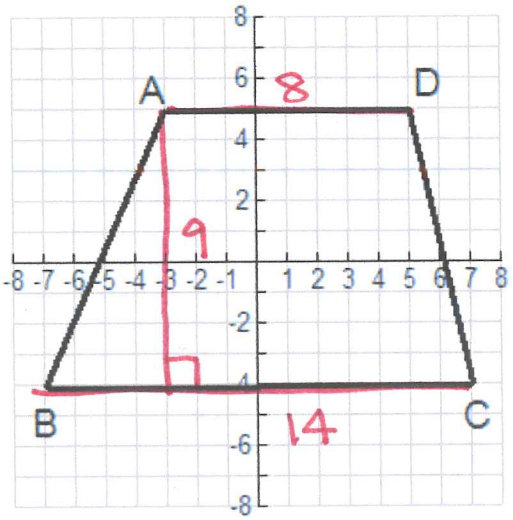
Find the area of each of the following figures.



we can count!

$A = \frac{1}{2}bh$

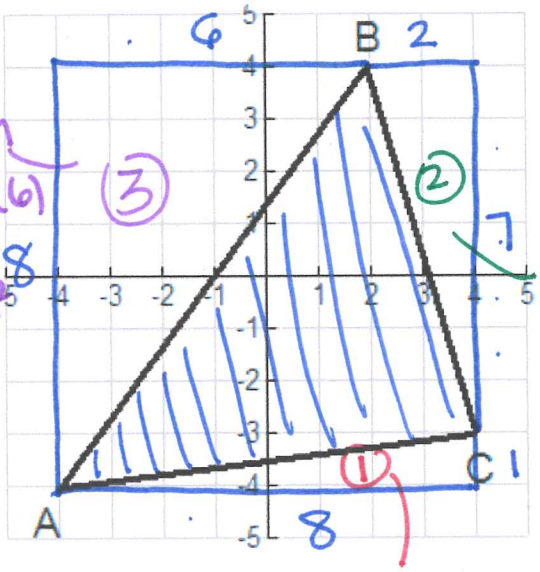
$A = \frac{1}{2}(8)(4) = 16 \text{ units}^2$



$A = \frac{1}{2}(b_1 + b_2)h$

$= \frac{1}{2}(8+14)(9)$

$= 99 \text{ units}^2$



$A = \frac{1}{2}bh$

$= \frac{1}{2}(8)(6)$

$= 24 \text{ units}^2$

$A_{\square} = (8)(8) = 64 \text{ units}^2$ (whole square)

$A = \frac{1}{2}(2)(7)$

$= 7 \text{ units}^2$

$A = \frac{1}{2}(8)(1) = 4 \text{ units}^2$

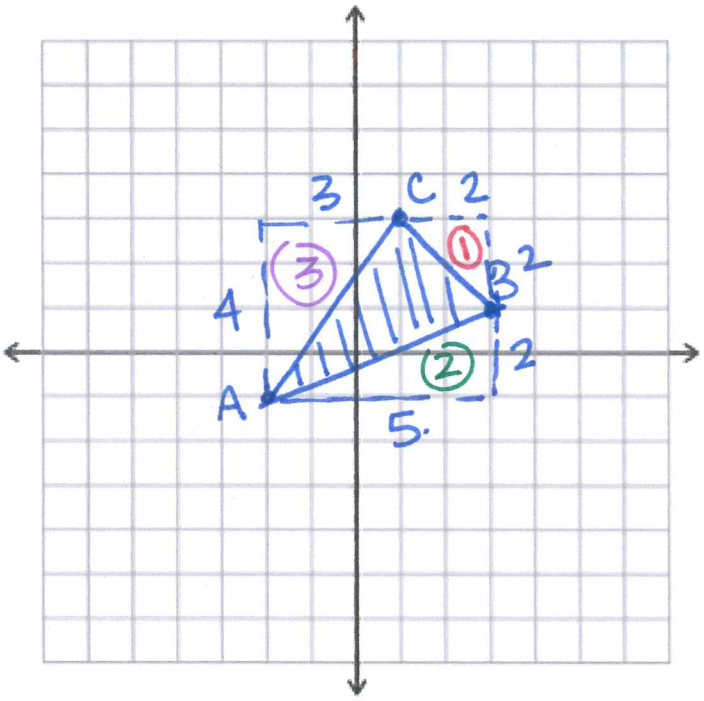
Sides aren't horizontal or vertical... can't count!

Area of shaded region:

$64 - 24 - 7 - 4 = 29 \text{ units}^2$

You try!

Find the area of ΔABC whose vertices are A$(-2,-1)$, B$(3,1)$ and C$(1,3)$



$A_{\square} = (4)(5) = 20$

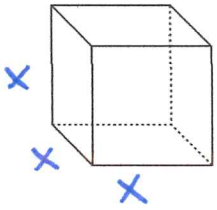
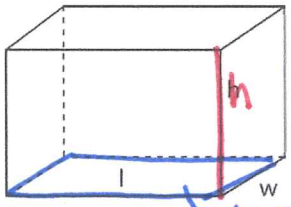
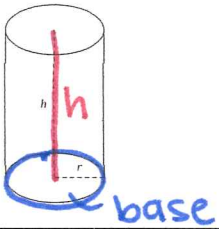
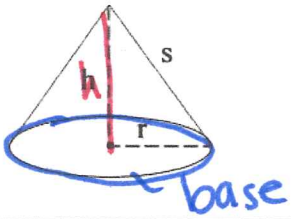
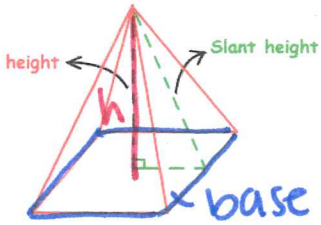
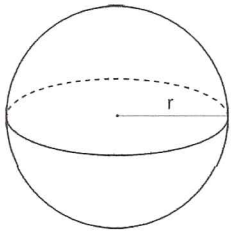
$A_{\triangle 1} = \frac{1}{2}(2)(2) = 2$

$A_{\triangle 2} = \frac{1}{2}(5)(2) = 5$

$A_{\triangle 3} = \frac{1}{2}(4)(3) = 6$

$20 - 2 - 5 - 6 = \boxed{7 \text{ units}^2}$

Volume

Shape	Volume Formula
Cube		$V = x^3$
Rectangular Prism		$V = Bh$ $V = (LW)h$ B = area of base
Cylinder		$V = Bh$ $V = (\pi r^2)h$
Cone		$V = \frac{1}{3}Bh$ $V = \frac{1}{3}(\pi r^2)h$
Pyramid		$V = \frac{1}{3}Bh$ $V = \frac{1}{3}(LW)h$
Sphere		$V = \frac{4}{3}\pi r^3$

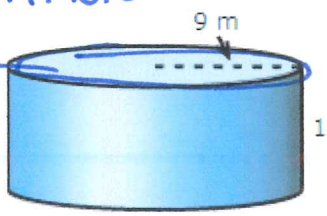
Prisms ← → Pyramids

Volume = units^3

Examples

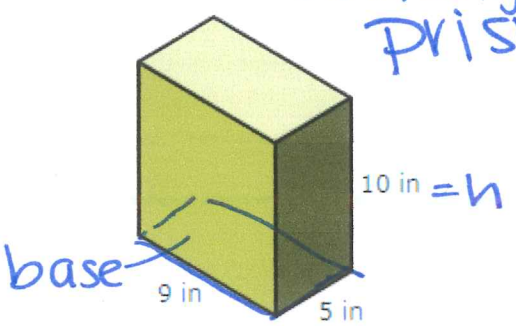
Find the volume of each of the following to the nearest hundredth.

Cylinder



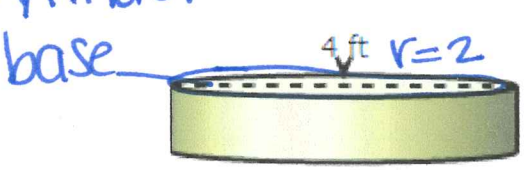
V = (area of base)(height)
$= (\pi (9)^2)(10)$
$= \boxed{2544.69\ m^3}$

rectangular prism



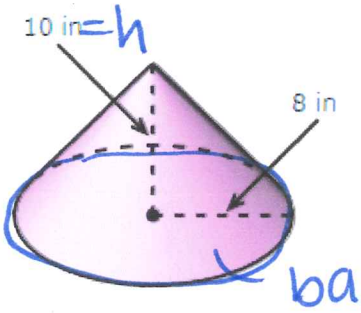
V = (area of base)(height)
$= (9 \cdot 5)(10)$
$= \boxed{450\ in^3}$

cylinder



V = (area of base)(height)
$= (\pi (2)^2)(1)$
$= \boxed{12.57 ft^3}$

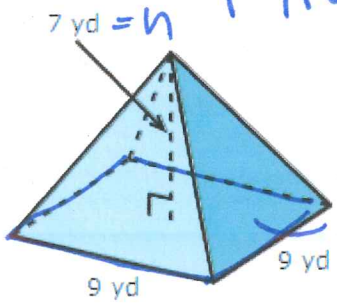
cone



$V = \frac{1}{3}$(area of base)(height
$= \frac{1}{3} (\pi (8)^2)(10)$
$= \boxed{670.21\ in^3}$

Find the volume of each of the following to the nearest tenth.

Pyramid



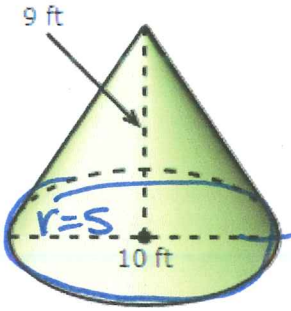
base

$V = \frac{1}{3}(\text{area of base})(\text{height})$

$= \frac{1}{3}(9 \cdot 9)(7)$

$= \boxed{189 \text{ yd}^3}$

Cone



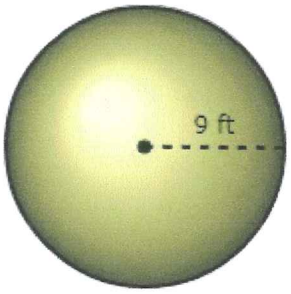
base

$V = \frac{1}{3}(\text{area of base})(\text{height})$

$= \frac{1}{3}(\pi(25))(9)$

$= \boxed{235.6 \text{ ft}^3}$

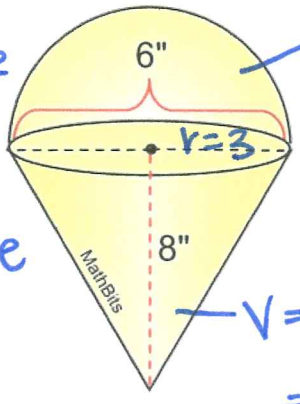
Sphere



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

$= \frac{4}{3}\pi(9)^3 = \boxed{3053.6 \text{ ft}^3}$

$\frac{1}{2}$ Sphere + cone



$V = \frac{\frac{4}{3}\pi(3)^3}{2}$

$= 56.5 \text{ in}^3$

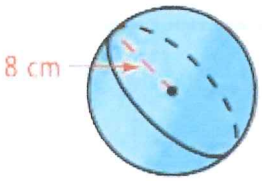
$V = \frac{1}{3}\pi(3)^2(8)$

$= 75.4 \text{ in}^3$

$56.5 + 75.4 = \boxed{131.9 \text{ in}^3}$

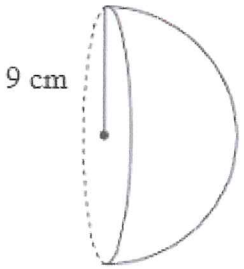
You try!

1) Find the volume of each of the following to the nearest hundredth.



Sphere

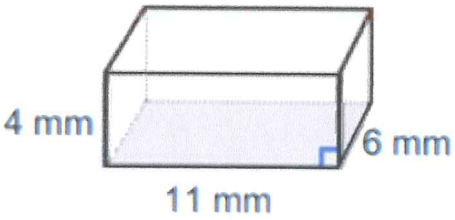
$V = \frac{4}{3}\pi(8)^3 = 2144.66\ cm^3$



Hemisphere

$V = \frac{\frac{4}{3}\pi(9)^3}{2}$

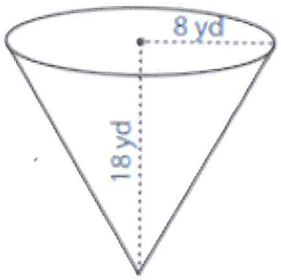
$= 1526.81\ cm^3$



rectangular prism

$V = (4)(11)(6)$

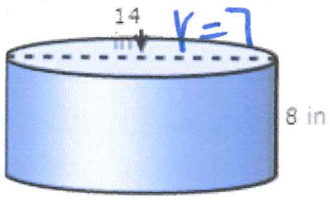
$= 264\ mm^3$



Cone

$V = \frac{1}{3}\pi(8)^2(18)$

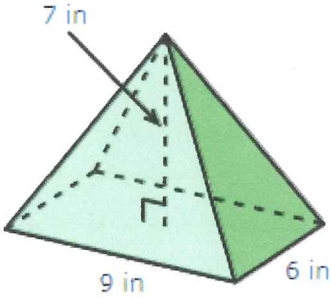
$= 1206.37\ yd^3$



cylinder

$V = \pi(7)^2(8)$

$= 1231.50\ in^3$



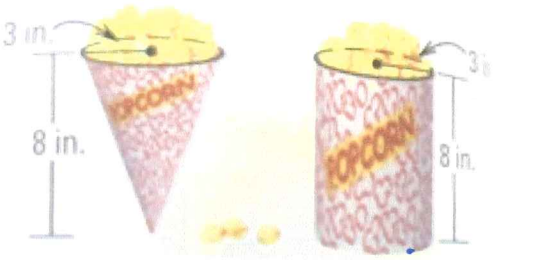
pyramid

$V = \frac{1}{3}(9)(6)(7)$

$= 126\ in^3$

2) A snack stand serves a small order of popcorn in a cone-shaped cup and a large order of popcorn in a cylindrical cup.

a. Find the volume of the small cup to the nearest tenth.



Small

$V = \frac{1}{3}(\pi(3)^2)(8)$

$= 75.4 \text{ in}^3$

Large

$V = (\pi(3)^2)(8)$

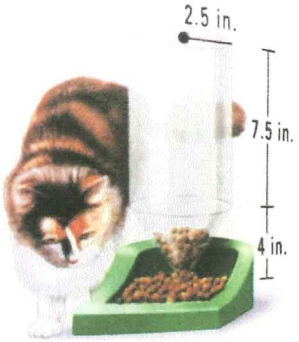
$= 226.2 \text{ in}^3$

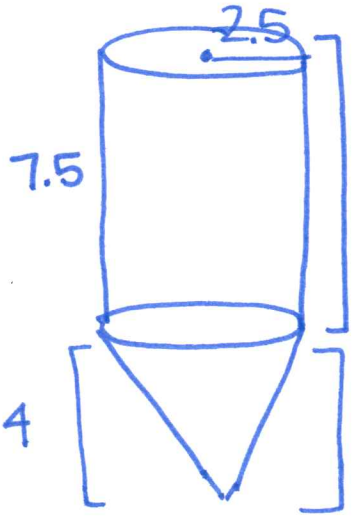
cone cylinder

b. How many small orders of popcorn are in a large order of popcorn?

$\frac{226.2}{75.4} = 3$ orders

3. The automatic pet feeder pictured at the right is a right cylinder on top of a right cone of the same radius. The radius is 2.5 in, height of cylinder is 7.5 in, and height of cone is 4 in. Calculate the number of cups that can be placed in the feeder if 1 cup = 14.4 in.^{3}.





Cylinder: $V = (\pi(2.5)^2)(7.5)$

$= 147.26$

Cone: $V = \frac{1}{3}\pi(2.5)^2(4) = 26.18$

$147.26 + 26.18 = 173.44 \text{ in}^3$

$\frac{173.44}{14.4} = 12$ cups