AREA is measured by the number of units it takes to cover a surface exactly.

Since we are dealing with measurements, units play a factor in our final answer.

Area has a square unit.

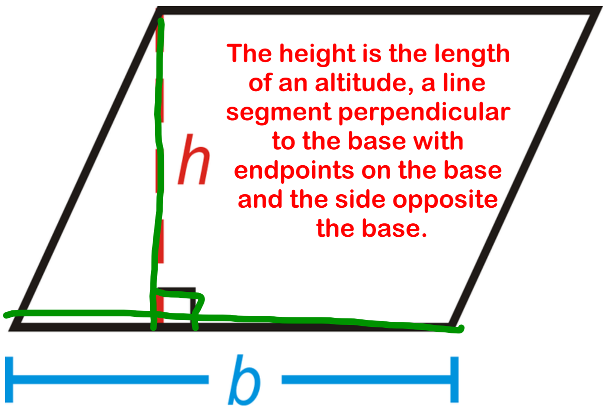
For example:
square centimeter (cm^2)
square inch (in^2)
square feet (ft^2)
square mile (mi^2)

13.1 AREA OF A PARALLELOGRAM

A parallelogram is a four-sided rectangular figure. Since it has the appearance of a rectangle, we can find the area of a parallelogram in the same fashion that we find the area of a rectangle.

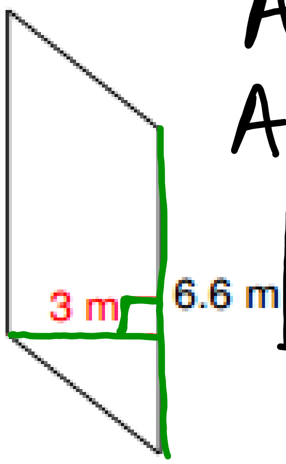
If a parallelogram has a base of b units and a height of h units, then the area (A) is b times h square units.

$A = bh$



The base can be any side of the parallelogram.

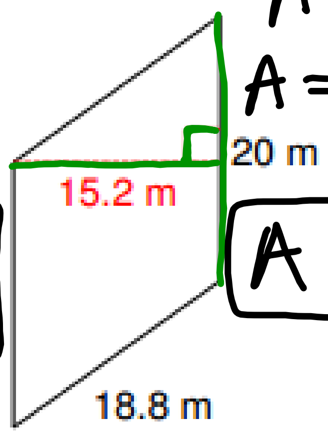
Examples: Find the area of the parallelograms.



$A = b \cdot h$

$A = 6.6 \cdot 3$

$\boxed{A = 19.8 m^2}$

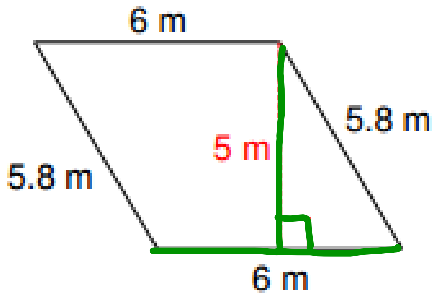


$A = b \cdot h$

$A = 20 \cdot 15.2$

$\boxed{A = 304 m^2}$

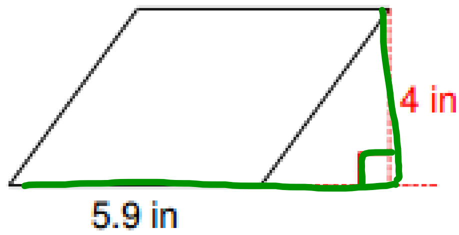
Examples: Find the area of the parallelograms.



$A = b \cdot h$

$A = 6 \cdot 5$

$\boxed{A = 30 m^2}$



$A = b \cdot h$

$A = 5.9 \cdot 4$

$\boxed{A = 23.6 in^2}$

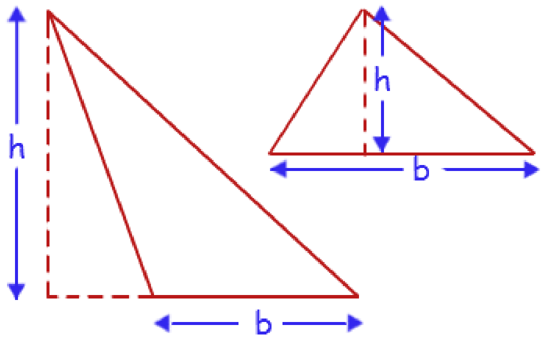
13.1 AREA OF A TRIANGLE

If a triangle has a base of b units and a height of h units, then the area (A) is one half times b times h square units.

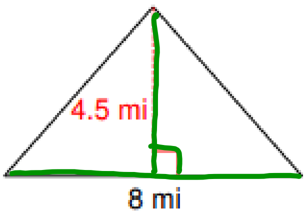
$$A = \frac{1}{2}bh = \frac{bh}{2}$$

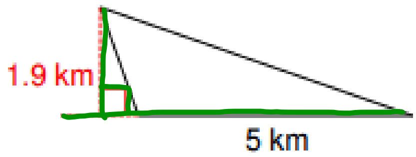
Any one of the sides of a triangle can be used as a base.

The height is the length of the corresponding altitude, a line segment perpendicular to the chosen base from the opposite angle.



Example: Find the area of the triangles.





$$A = \frac{b \cdot h}{2} = \frac{8 \cdot 4.5}{2}$$

$$A = \frac{b \cdot h}{2} = \frac{5 \cdot 1.9}{2}$$

$$\frac{8 \cdot 4.5}{2}$$

$$\frac{8 \cdot 4.5}{2}$$

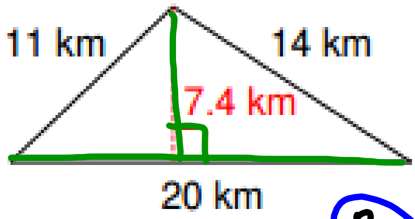
$$A = \frac{9.5}{2}$$

$$\frac{36}{2} = 18 \qquad 4 \cdot 4.5 = 18$$

$$\boxed{A = 4.75\,km^2}$$

$$\boxed{A = 18\,mi^2}$$

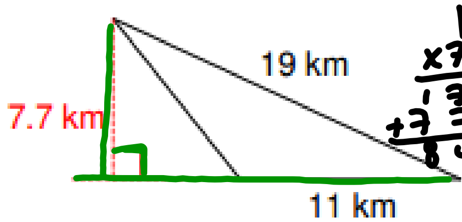
Example: Find the area of the triangles.



$$A = \frac{bh}{2} = \frac{20 \cdot 7.4}{2}$$

$$= 10 \cdot 7.4$$

$$\boxed{A = 74 \text{ km}^2}$$



$$\begin{array}{r} 11 \\ \times 7.7 \\ \hline 77 \\ +770 \\ \hline 84.7 \end{array}$$

$$A = \frac{bh}{2} = \frac{11 \cdot 7.7}{2}$$

$$= \frac{84.7}{2}$$

$$\boxed{A = 42.35 \text{ km}^2}$$

13.2 AREA OF TRAPEZOIDS

A quadrilateral is any four sided object. Squares, rectangles, and parallelograms are examples of quadrilaterals.

A quadrilateral with exactly two parallel sides is known as a **TRAPEZOID**.

Those parallel sides are called bases.

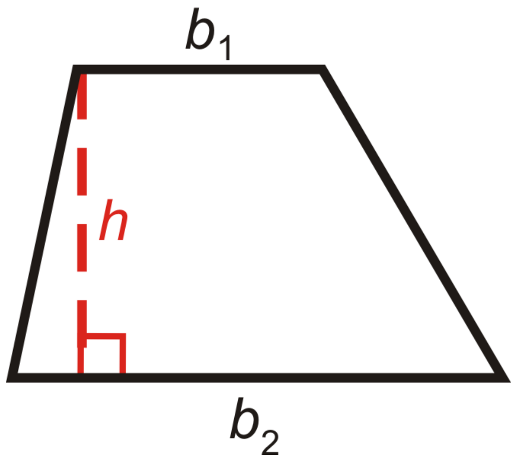
The height of a trapezoid is the distance between the two bases. Like a parallelogram, an altitude is a segment perpendicular to both bases. The length of the altitude is called the height.

Area of a Trapezoid

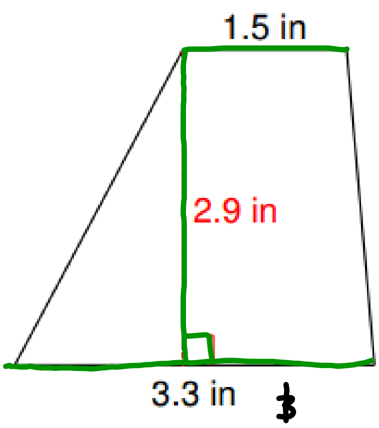
If a trapezoid has bases of b_1 and b_2 units and a height of h units, then the area (A) of the trapezoid is one half times the height times the sum of the bases square units.

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

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



Example: Find the area of each trapezoid.



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

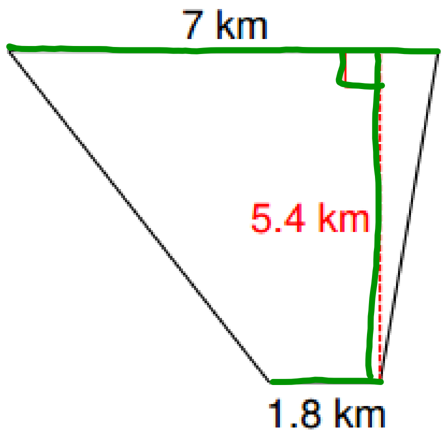
$$A = \frac{2.9(1.5+3.3)}{2}$$

$$A = \frac{2.9(4.8)}{2} = 2.9 \cdot 2.4$$

$$\boxed{A = 6.96 \text{ in}^2}$$

$$\begin{array}{r} 2.9 \\ \times\, 2.4 \\ \hline 116 \\ +\,580 \\ \hline 6.96 \end{array}$$

Example: Find the area of each trapezoid.



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

$$A = \frac{5.4(7.0+1.8)}{2}$$

$$A = \frac{5.4(8.8)}{2} = 5.4 \cdot 4.4$$

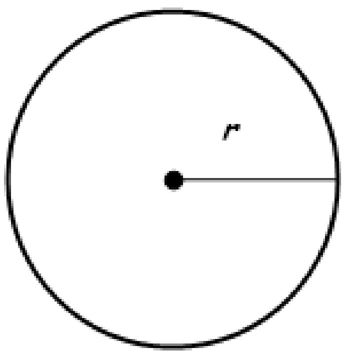
$$\begin{array}{r} 5.4 \\ \times\ 4.4 \\ \hline 216 \\ +\,2160 \\ \hline 23.76 \end{array}$$

$$\boxed{A = 23.76\ km^2}$$

13.3 AREA OF CIRCLES

If a circle has a radius of r units, then the area (A) is $\pi \cdot r \cdot r$ or $\pi \cdot r^2$ square units.

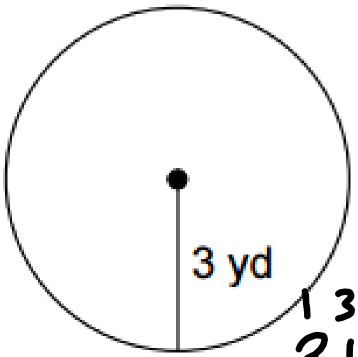
Remember: The radius is half of the diameter. So, if you are given the diameter, divide that by 2 to get the radius.



$$A = \pi \cdot r^2$$

Use 3.14 for π

Example: Find the area of each circle.



$A = \pi r^2$

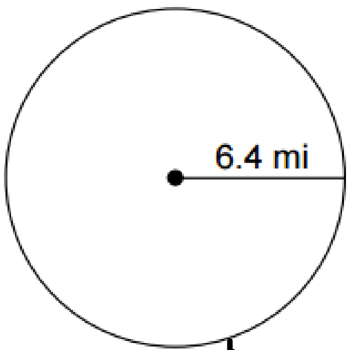
$A = (3.14)(3)^2$ $3 \cdot 3$

$A = (3.14)(9)$

$\boxed{A = 28.26 \text{ yd}^2}$

$$\begin{array}{r} 3.14 \\ \times\ 9 \\ \hline 28.26 \end{array}$$

Example: Find the area of each circle.



$A = \pi r^2$

$A = (3.14)(6.4)^2$

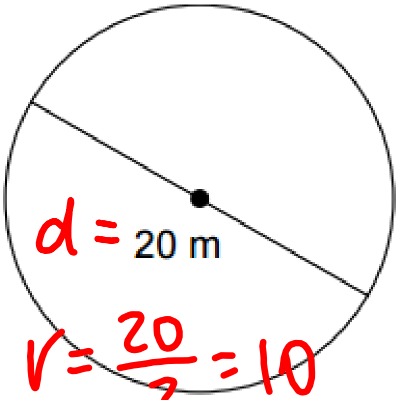
$A = (3.14)(40.96)$

$\boxed{A = 128.6144 \text{ mi}^2}$

$$\begin{array}{r} 6.4 \\ \times\ 6.4 \\ \hline 256 \\ +3840 \\ \hline 40.96 \end{array}$$

$$\begin{array}{r} 40.96 \\ \times\ 3.14 \\ \hline 16384 \\ 40960 \\ +1228800 \\ \hline 128.6144 \end{array}$$

Example: Find the area of each circle.



$d = 20$ m

$r = \frac{20}{2} = 10$

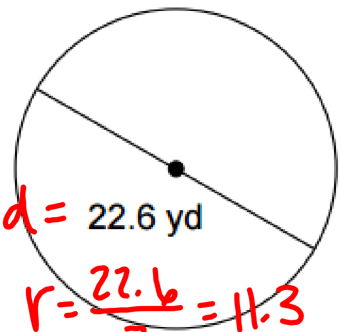
$A = \pi r^2$

$A = (3.14)(10)^2$

$A = 3.14 \cdot 100$

$\boxed{A = 314\text{ m}^2}$

Example: Find the area of each circle.



$d = 22.6$ yd

$r = \frac{22.6}{2} = 11.3$

$A = \pi r^2$

$A = (3.14)(11.3)^2$

$A = (3.14)(127.69)$

$\boxed{A = 400.9466\text{ yd}^2}$

$$\begin{array}{r} 11.3 \\ \times\ 11.3 \\ \hline 339 \\ 1130 \\ +11300 \\ \hline 127.69 \end{array}$$

$$\begin{array}{r} 127.69 \\ \times\ 3.14 \\ \hline 51076 \\ 127690 \\ +3830700 \\ \hline 400.9466 \end{array}$$

13.2 Area of Trapezoids.notebook

13.3 Area of Circle.notebook