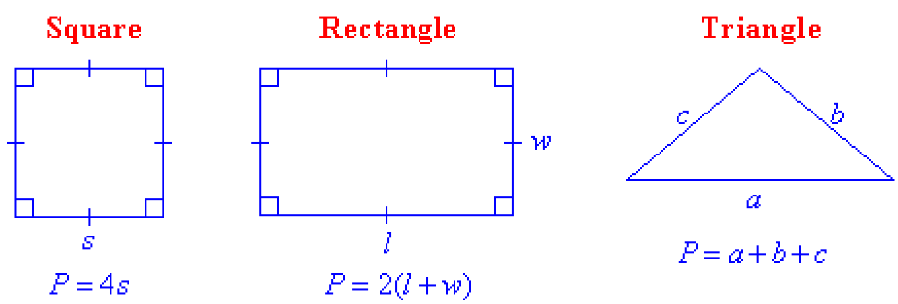
Chapter 8 Geometry 1 (Perimeter and Area)

1. Perimeters of Polygons

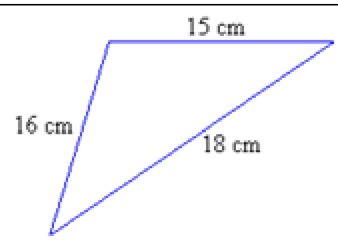
1) Perimeter

The perimeter, *P*, of a closed plane shape (or figure) is the distance around its outside boundary.

Perimeters of the following figures are often required to solve real world problems.



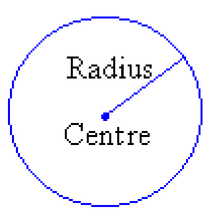
Example: Find the perimeter, *P*, of the triangle shown below.

	Solution: $P = 18 + 16 + 15$ $= 49$ So, the perimeter is 49 cm.

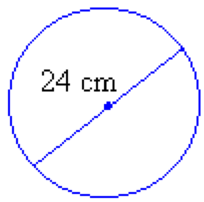
2) The Circle

The parts of a circle are given special names as described below:
The radius, *r*, of a circle is the distance from its centre to a point on the edge of the circle.

The diameter, *d*, of a circle is the distance across the circle through its centre.

	Diameter = 2× radius In symbolic form: $d = 2r\ ,\ r = \frac{1}{2}d$ So, the radius is half of the diameter.

Example: Find the radius of the following circle:

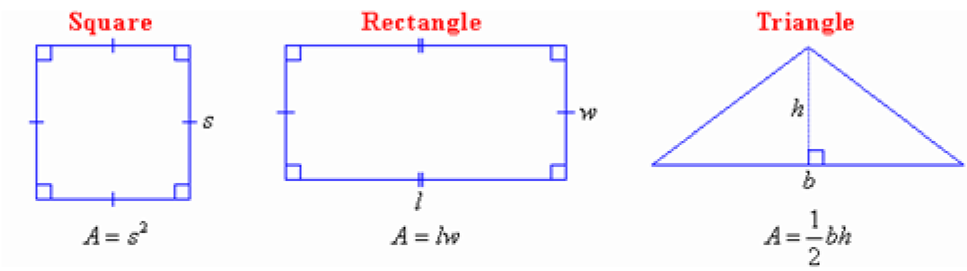
	Solution: d =24cm, $r = \frac{1}{2}d = \frac{1}{2} \times 24 = 12$ So, the radius of the circle is 12 cm.

2. Area

Area is the measurement of the amount of space occupied by a closed flat surface and is measured in square units. The most widely used units of area are mm^2, cm^2 and m^2. Land areas are often given in hectares (ha).
1 ha = 10 000 m^2

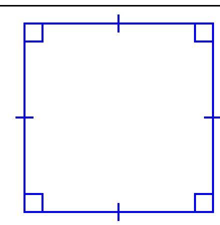
1) Calculating the Area

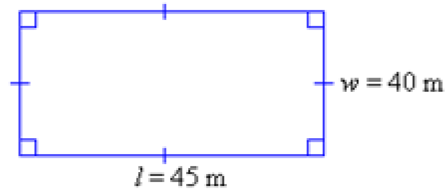
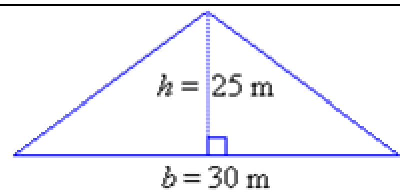
The following formulas for calculating the area of plane figures such as squares, rectangles and triangles.



Example: Find the area of:
a. a square flower-bed of side 17 m
b. a rectangular field 45 m long and 40 m wide
c. a triangle of base length 30 m and height 25 m

Solution:

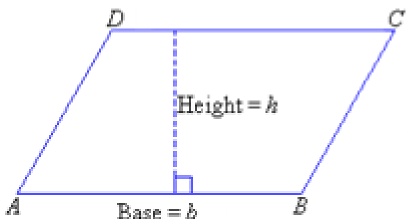
a. $A = s^2$ $= 17^2$ $= 289$ So, the area of the flower-bed is 289 m^2.	 $s = 17$ m

b. $A = lw = 45 \times 40 = 1800$ So, the area of the rectangular field is 1800 m^2.	
c. $A = \frac{1}{2}bh = \frac{1}{2} \times 30 \times 25 = 375$ So, the area of the triangle is 375 m^2.	

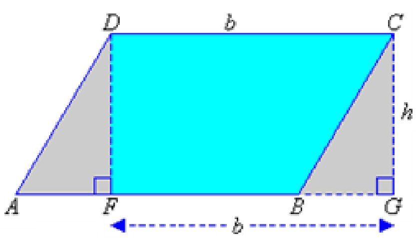
2) Area of a Parallelogram

A **parallelogram** is a quadrilateral that has two pairs of parallel sides of equal length.

Consider the area of the following parallelogram.



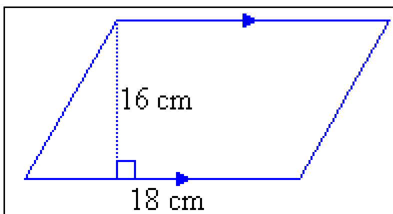
To calculate the area of a parallelogram divide it into two parts that can form a rectangle. This is possible if we cut off one end of the parallelogram (i.e. triangle *AFD*) and add it to the other end to form the rectangle *FGCD*, as shown below.



It is clear from the diagram that the area of the shape has not changed.

$\therefore$ Area of the parallelogram = Area of the rectangle = length $\times$ width = bh

Example: Find the area of the following parallelogram.

 	Solution: $A = bh = 18 \times 16 = 288$ So, the area of the parallelogram is 288 cm^2.

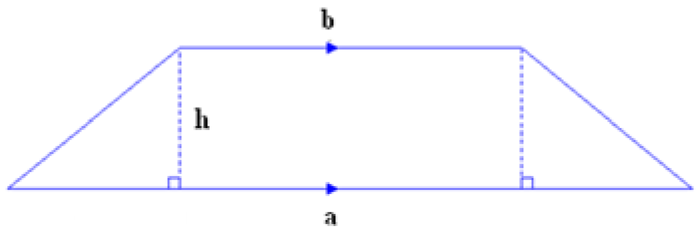
3) Area of A trapezium

A **trapezium** is a quadrilateral that has only one pair of parallel sides.

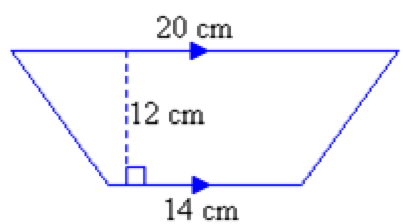
The area of the trapezium is given by the following formula where *a* and *b* are the lengths of the parallel sides and *h* is the perpendicular distance between the parallel sides.

$$A = \frac{1}{2}(a+b)h$$

To calculate the area of a trapezium, divide it into a rectangle and two triangles as shown below.



Example: Find the area of the following trapezium.

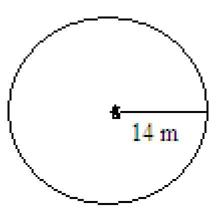
	Solution: $a = 20$ cm, $b = 14$ cm, $h = 12$ cm $A = \frac{1}{2}(a+b)h = \frac{1}{2}(20+14)\times 12$ $= \frac{1}{2}\times 34\times 12 = 204$ So, the area of the trapezium is 204 m^2.

4) Area of a Circle

The area, *A*, of a circle is given by the following formula where *r* is the radius of the circle: $A = \pi \cdot r^2$.

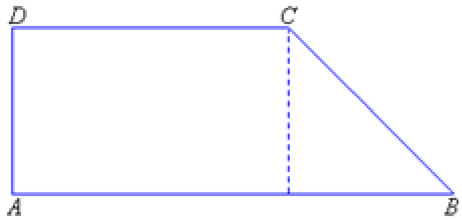
Example: Find the area of a circle whose radius is 14 m using an approximate value for π of $\frac{22}{7}$.

Solution:

	$r = 14$ m $A = \pi r^2 = \frac{22}{7}\times 14^2 = \frac{22}{7}\times 196 = 616$ So, the area is 616 m^2.

5) Composite Figures

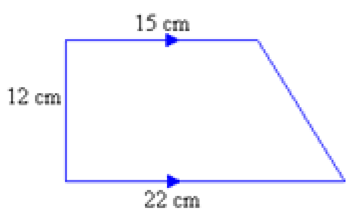
A figure (or shape) that can be divided into more than one of the basic figures is said to be a composite figure (or shape).



For example, figure *ABCD* is a composite figure as it consists of two basic figures. That is, a figure is formed by a rectangle and triangle as shown below.

The area of a composite figure is calculated by dividing the composite figure into basic figures and then using the relevant area formula for each basic figure.

Example 1: Find the area of the following composite figure:



Solution:
The figure can be divided into a rectangle and triangle as shown below.

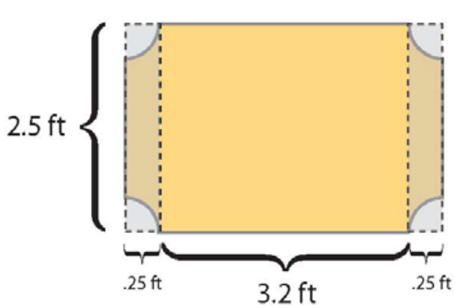
$$\text{Area of the triangle} = \frac{1}{2}bh = \frac{1}{2}\times 7\times 12 = 42\text{ cm}^2$$

$$\text{Area of the rectangle} = lw = 15\times 12 = 180\text{ cm}^2$$

$$\therefore \text{Total area} = \text{Area of the rectangle} + \text{Area of the triangle} = 18$$

So, the area of the composite figure is 222 cm^2.

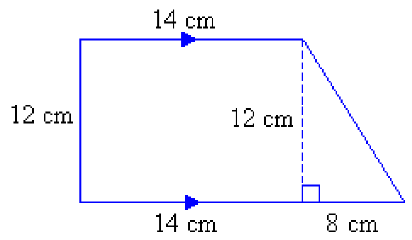
Example 2: The figure is a rectangle with four decorative cutouts that are each 1/4 of a circle. Find the area of the rectangular table and then subtract the cutout sections (4 × 1/4 of a circle or one whole circle).

	Center table section: A = 2.5 ft 3.2 ft = 8 ft^2 Two decorative ends: A=2(2.5 × 0.25 -1/2(0.2)) = 1.05 ft^2 Approximate area of the table: 8 ft^2 + 1.05 ft^2 = **9.05 ft^2**

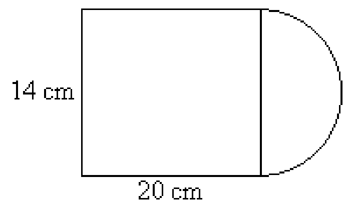
Practice in Class

Find the perimeter and area for the following figures.

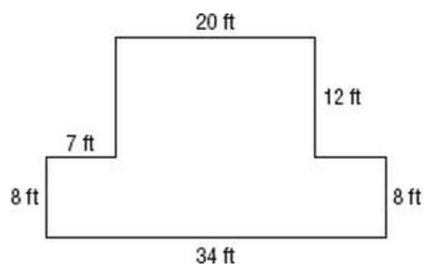
1.



2.



3.



4.