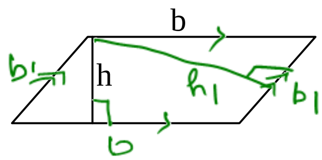
Math 1312
Section 8.1 - 8.2
Perimeter and Area of Polygons

Area and Perimeter formulas

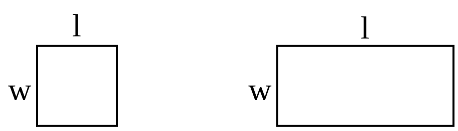
l = length	w = width
P = perimeter	b = base
h = height	d = diagonal
r = radius	m = median
a = apothem	

1. Parallelogram: $A = bh$



$A = b_1 h_1$

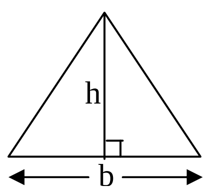
2. Rectangle/square: $A = lw$

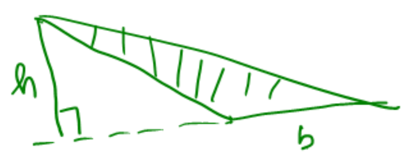


$w = l$ (in square)

$A = l^2$

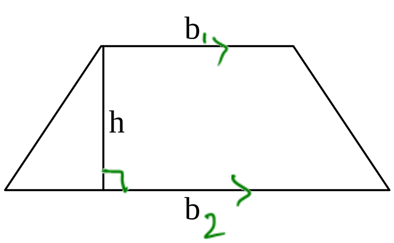
3. Triangle: $A = \frac{1}{2}bh$

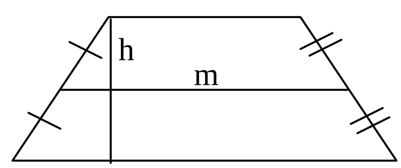




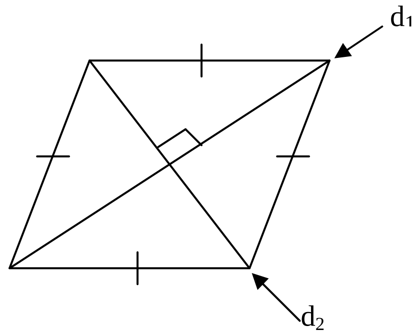
4. Trapezoid: $A = \frac{1}{2}h(b_1 + b_2)$ OR $A = mh$

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





5. Rhombus and kite: $A = \frac{1}{2} d_1 d_2$



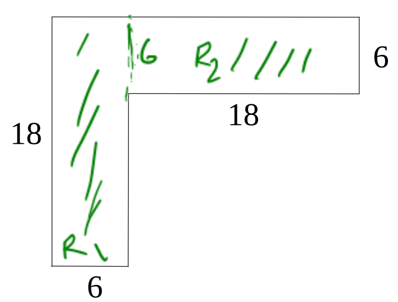
Heron's Formula: For any triangle with sides of lengths a, b and c, the area is found by $A = \sqrt{s(s-a)(s-b)(s-c)}$ where s is the *semi*perimeter of ΔABC ($s = \frac{1}{2}(a+b+c)$)

Brahmagupta's Formula: For a quadrilateral with sides a, b, c, and d the area is
$A = \sqrt{(s-a)(s-b)(s-c)(s-d)}$ ($s = \frac{1}{2}(a+b+c+d)$)

Theorem: The ratio of the areas of two similar triangles (or any similar polygons) equals the squares of the ratios of the lengths of any two corresponding sides.

$$\frac{A_1}{A_2} = \left(\frac{s_1}{s_2}\right)^2$$

Example 1: What is the total area of the figure below:



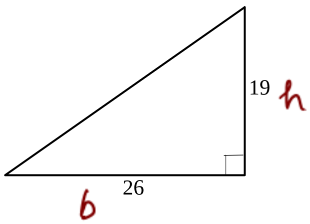
Area of R_1 = $18 \cdot 6$ = 108 sq units

Area of R_2 = $18 \cdot 6$ = 108 sq units

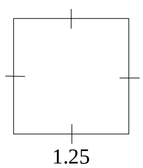
∴ Total Area = 108 + 108

= 216 sq units

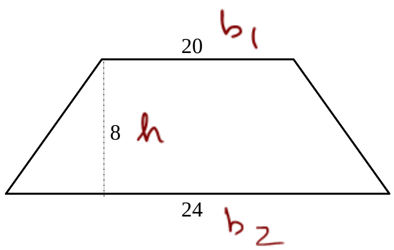
Example 2: Find the area of each figure below:



$A = \frac{1}{2}bh = \frac{1}{\cancel{2}}\overset{13}{\cancel{26}}\cdot 19 = 247$ sq units

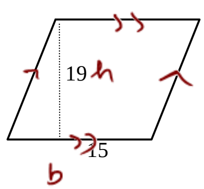


$A = (1.25)^2 = 1.5625$ sq units

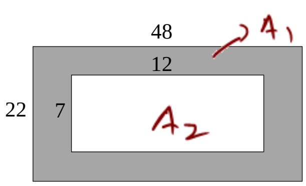


$A = \frac{1}{2}h(b_1+b_2) = \frac{1}{2}\cdot 8(20+24)$

$= \frac{1}{\cancel{2}}\cdot 8\cdot \overset{22}{\cancel{44}} = 176$ sq units



$A = b\cdot h = 15\cdot 19 = 285$ sq units



$A_1 = 48\cdot 22 = 1056$ sq units

$A_2 = 12\cdot 7 = 84$ sq units

$\therefore$ Area of shaded region

$= A_1 - A_2$

$= 1056 - 84 = 972$ sq units

Example 3: The area of a triangle is 216 square-units. If the height is 18 units, what is the length of the base?

$$A = \frac{1}{2} b h$$

$$216 = \frac{1}{\cancel{2}} b \cdot \cancel{18}^{9}$$

$$216 = 9 \cdot b$$

$$\frac{216}{9} = b$$

$$24 = b$$

Example 4: The diagonals of a rhombus are 21 and 16 centimeters long. Find the area of the rhombus.

$$A = \frac{1}{2} d_1 \cdot d_2$$

$$= \frac{1}{\cancel{2}} 21 \cdot \cancel{16}^{8}$$

$$= 168 \text{ sq units}$$

Example 5: Compare the areas of two similar triangles in which each side of the first triangle 3 times as long as each side of the second.

$T_1 \rightarrow A_1$ $\qquad$ $T_1 \rightarrow s_1 = 3x$

$T_2 \rightarrow A_2$ $\qquad$ $T_2 \rightarrow s_2 = x$

$$\frac{A_1}{A_2} = \left(\frac{s_1}{s_2}\right)^2 = \left(\frac{3x}{x}\right)^2 = 9$$

$$\frac{A_1}{A_2} = 9 \Rightarrow A_1 = 9A_2$$

Example 6: Find the area of a triangle with sides 4, 13, 15.

$a = 4 \quad b = 13 \quad c = 15$

$$s = \frac{a+b+c}{2} = \frac{4+13+15}{2} = \frac{32}{2} = 16$$

$$A = \sqrt{s(s-a)(s-b)(s-c)}$$

$$= \sqrt{16(16-4)(16-13)(16-15)}$$

$$= \sqrt{16 \cdot 12 \cdot 3 \cdot 1}$$

$$= \sqrt{4^2 \cdot 4 \cdot 3 \cdot 3} = \sqrt{4^2 \cdot 2^2 \cdot 3^2} = 4 \cdot 2 \cdot 3 = 24 \text{ sq units}$$