Q. A traffic signal board, indicating 'School Ahead', is an equilateral triangle with side 'a'. Find the area of signal board, using Heron's formula. If the perimeter is 180cm, what will the area of the school board?

$$s = \frac{a+b+c}{2} = \frac{a+a+a}{2} = \frac{3a}{2}$$

$$\text{Area of } \Delta = \sqrt{s(s-a)(s-b)(s-c)}$$

$$= \sqrt{\frac{3}{2}\left(\frac{3a}{2}-a\right)\left(\frac{3a}{2}-a\right)\left(\frac{3a}{2}-a\right)}$$

$$= \sqrt{3 \cdot \frac{a}{2} \cdot \frac{a}{2} \cdot \frac{a}{2} \cdot \frac{a}{2}}$$

$$= \sqrt{3} \cdot \frac{a}{2} \cdot \frac{a}{2} = \frac{\sqrt{3}}{4} a^2$$

(ii) 180cm (perimeter)

$3 \text{ side} = 180$

$$\text{side} = \frac{180}{3} = 60\text{cm}$$

$$\text{Area of } \Delta = \frac{\sqrt{3}}{4} \times a^2 = \frac{\sqrt{3}}{4} \times 60 \times 60 \text{ cm}^2$$

$$= \frac{\sqrt{3}}{4}(60)^2 \text{ cm}^2$$

$$= 900\sqrt{3} \text{ cm}^2$$

Heron's formula

Exercise: 12.1

Q2. The triangular side walls of a flyover have been used for advertisements. The sides of the walls are 122m, 22m and 120m. The advertisements yield earning of Rs. 5000 per m^2 per year. A company hired one of its walls for 3 months. How much rent did it pay?

→) Sides of the two triangular walls below the bridge are 122m, 22m and 120m.

$$s = \frac{122m + 22m + 120m}{2} = 132m$$

Area of one triangular wall

$$= \sqrt{132 \times (132-122)(132-22)(132-120)}$$

$$= \sqrt{132 \times 10 \times 110 \times 12}\ m^2 = 1320\ m^2$$

Company hired only one wall for 3 months. Thus, earning from advertisements for 3 months at the rate of Rs. 5000 per m^2 per year.

$$\Rightarrow Rs.\ 5000 \times \frac{3}{12} \times 1320 = Rs.\ 16,50,000$$

Hw

Heron's Formula

Exercise 12.2

Q2 Find the area of quadrilateral ABCD in which AB = 3cm, BC = 4cm, CD = 4cm, DA = 5cm and AC = 5cm.

Ans. $a = 4$

$b = 5$

$c = 3$

$\therefore a^2 + B^2 = b^2$

$\Rightarrow \angle B = 90^\circ$

Area of $\triangle ABC = \frac{1}{2} \times$ base $\times$ height

$= \frac{1}{2} \times 3 \times 4 = 6 cm^2$

For $\triangle ACD$, $a = 4$; $b = 5$ and $c = 5$

$$S = \frac{a+b+c}{2} = \frac{14}{2} = 7 cm$$

$\therefore$ Area of $\triangle ACD$

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

$= \sqrt{7(7-4)(7-5)(7-5)}$

$= \sqrt{7 \times 3 \times 2 \times 2}$

$= 2\sqrt{21} cm^2$

Area of quadrilateral ABCD $= 6 + 2\sqrt{21} cm^2$

$= 15.2 cm^2$

Q4. A triangular and a parallelogram have the same base and the same area. If the sides of the triangle are 26cm, 28cm and 30cm, and the parallelogram stands on the base 28cm, find the height of the parallelogram.

Ans. Semiperimeter of ΔABC

$$s = \frac{26+28+30}{2} = 42cm$$

$$s-a = 42-26 = 16cm$$

$$s-b = 42-28 = 14cm$$

$$s-c = 42-30 = 12cm$$

Area of $\triangle ABC = \sqrt{s(s-a)(s-b)(s-c)}$

$= \sqrt{42 \times 16 \times 14 \times 12}\ cm^2$

$= \sqrt{14 \times 3 \times 4 \times 4 \times 14 \times 4 \times 3}\ cm^2$

$= 14 \times 4 \times 3 \times 2\ cm^2 = 336\ cm^2$

∴ Area of parallelogram = Area of triangle

$h \times AB = 336$

$h \times 28 = 336\ cm^2$

$h = \frac{336}{28} = 12\ cm$