NCERT Solutions for Class 9 Maths Chapter

12. (Heron's Formula Ex 12.1)

... **Question** 1.

A ***traffic signal board, indicating 'SCHOOL AHEAD', is an equilateral triangle with side a. Find the area of the signal board, using Heron's formula.If its perimeter is 180 cm, what will be the area of the signal board?***

Solution:

Let each side of the equilateral triangle be a.

Semi-perimeter of the triangle,

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

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

$= \sqrt{s(s-a)(s-a)(s-a)} = \sqrt{s(s-a)^3}$

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

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

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

Now, its perimeter is 180 cm.

$\therefore \quad a+a+a = 180 \text{ cm}$

$\Rightarrow \quad 3a = 180 \text{ cm}$

$\Rightarrow a = \frac{180}{3} \text{ cm} = 60 \text{ cm}$

Thus, area of the triangle $= \frac{\sqrt{3}}{4}a^2$

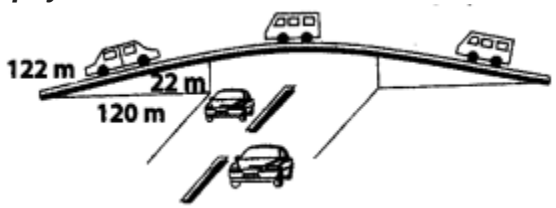
$= \frac{\sqrt{3}}{4}(60)^2 \text{ cm}^2$

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

Question 2.

The triangular side walls of a flyover have been used for advertisements. The sides of the

walls are 122 m, 22 m and 120 m (see figure). The advertisements yield an earning of ₹5000 per m² per year. A company hired one of its walls for 3 months. How much rent did it pay?



Solution:
Let the sides of the triangular will be
a = 122m, b = 12cm, c = 22m
, s = $(a+b+c)/2$
$(122+120+224)$m = 2642 m = 132m
The area of the triangular side wall

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

$$= \sqrt{132(132-122)(132-120)(132-22)}\ \text{m}^2$$

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

$$= \sqrt{12\times 11\times 10\times 12\times 11\times 10}\ \text{m}^2 = 1320\ \text{m}^2$$

Rent for 1 year (i.e. 12 months) per m² = Rs. 5000
∴ Rent for 3 months per m² = Rs. 5000 x 312
= Rent for 3 months for 1320 m² = Rs. 5000 x 312 x 1320 = Rs. 16,50,000.

. ***Question*** 3.
There is a slide in a park. One of its side Company hired one of its walls for 3 months.walls has been painted in some colour with a message "KEEP THE PARK GREEN AND CLEAN" (see figure). If the sides of the wall are 15 m, 11 m and 6m, find the area painted in colour.

Solution:
Let the sides of the wall be
a = 15m, b = 11m, c = 6m

$$s = \frac{a+b+c}{2} = \left(\frac{15+11+6}{2}\right)\text{m} = \frac{32}{2}\text{m} = 16\,\text{m}$$

Now, area of the triangular surface of the wall

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

$$= \sqrt{16(16-15)(16-11)(16-6)}\ \text{m}^2$$

$$= \sqrt{16\times1\times5\times10}\ \text{m}^2$$

$$= \sqrt{2\times400}\ \text{m}^2 = 20\sqrt{2}\,\text{m}^2$$

Thus, the required area painted in colour
= 20√2 m^2

. ***Question*** 4.
Find the area of a triangle two sides of which are 18 cm and 10 cm and the perimeter is 42 cm.
Solution:
Let the sides of the triangle be a =18 cm, b = 10 cm and c = x cm
Since, perimeter of the triangle = 42 cm
∴ 18cm + 10 cm + xcm = 42
x = [42 – (18 + 10)cm = 14cm
, s = 422cm = 21 cm

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

$$= \sqrt{21(21-18)(21-10)(21-14)}\,\text{cm}^2$$

$$= \sqrt{21\times3\times11\times7}\,\text{cm}^2$$

$$= \sqrt{3\times7\times3\times11\times7}\,\text{cm}^2 = 21\sqrt{11}\ \text{cm}^2$$

Thus, the required area of the triangle = 21√ 11cm^2
. **Question** 5.
Sides of a triangle are in the ratio of 12 : 17 : 25 and its perimeter is 540 cm. Find its area.
Solution:
Let the sides of the triangle be
a = 12x cm, b = 17x cm, c = 25x cm
Perimeter of the triangle = 540 cm
Now, 12x + 17x + 25x = 540
⇒ 54x = 54 ⇒ x = 10
∴ a = (12 x10)cm = 120cm,
b = (17 x 10) cm = 170 cm
and c = (25 x 10)cm = 250 cm

Now, semi-perimeter, s = $\frac{540}{2}$cm = 270 cm

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

$= \sqrt{270(270-120)(270-170)(270-250)}\ \text{cm}^2$

$= \sqrt{270 \times 150 \times 100 \times 20}\ \text{cm}^2$

$= \sqrt{10^2 \times 10^2 \times 3^2 \times 3^2 \times 5^2 \times 2^2}\ \text{cm}^2$

$= (10 \times 10 \times 3 \times 3 \times 5 \times 2)\ \text{cm}^2 = 9{,}000\ \text{cm}^2$

. **Question** 6.

An isosceles triangle has perimeter 30 cm and each of the equal sides is 12 cm. Find the area of the triangle.

Solution:

Let the sides of an isosceles triangle be

a = 12cm, b = 12cm,c = x cm

Since, perimeter of the triangle = 30 cm

∴ 12cm + 12cm + x cm = 30 cm

⇒ x = (30 − 24) = 6

s = $\frac{30}{2}$cm =15 cm

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

$= \sqrt{15(15-12)(15-12)(15-6)}\ \text{cm}^2$

$= \sqrt{15 \times 3 \times 3 \times 9}\ \text{cm}^2$

$= \sqrt{5 \times 3 \times 3 \times 3 \times 3 \times 3}\ \text{cm}^2$

$= \sqrt{3^2 \times 3^2 \times 3 \times 5}\ \text{cm}^2$

$= 3 \times 3 \times \sqrt{3 \times 5}\ \text{cm}^2 = 9\sqrt{15}\ \text{cm}^2$