Heron's Formula

CHAPTER 12

NCERT FOCUS

SOLUTIONS

EXERCISE - 12.1

1. Let each side of the equilateral triangle be a.

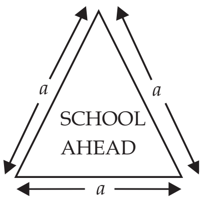
Semi-perimeter of the triangle, $s = \frac{a+a+a}{2} = \frac{3a}{2}$

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

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

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

$= \sqrt{\frac{3a^4}{16}} = \frac{\sqrt{3}}{4}a^2$ sq. units.



Now, its perimeter is 180 cm.

$\therefore$ $a + a + a = 180$ cm

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

Thus, area of the triangle $= \frac{\sqrt{3}}{4}a^2 = \frac{\sqrt{3}}{4}(60)^2 = 900\sqrt{3}\text{ cm}^2$

2. The sides of the triangular wall are

Let $a = 122$ m, $b = 120$ m, $c = 22$ m

Semi-perimeter,

$s = \frac{a+b+c}{2} = \frac{122+120+22}{2} = \frac{264}{2} = 132$ m

The area of triangular side wall

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

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

$= \sqrt{132\times10\times12\times110}$

$= \sqrt{12\times11\times10\times12\times11\times10} = 1320\text{ m}^2$

Rent for 1 year (*i.e.*, 12 months) per m^2 = ₹ 5000

$\therefore$ Rent for 3 months per m^2 = ₹ $5000\times\frac{3}{12}$

$\Rightarrow$ Rent for 3 months for 1320 m^2

$= 5000\times\frac{3}{12}\times1320 = 5000 \times 3 \times 110 =$ ₹ 16,50,000.

3. Sides of the wall are 15 m, 11 m and 6 m.

Let $a = 15$ m, $b = 11$ m, $c = 6$ m

Semi-perimeter, $s = \frac{a+b+c}{2} = \frac{15+11+6}{2} = \frac{32}{2} = 16$ m

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

$= \sqrt{16(16-15)(16-11)(16-6)}$

$= \sqrt{16\times1\times5\times10} = \sqrt{2\times400} = 20\sqrt{2}\text{ m}^2$

Thus, the required area painted in colour is $20\sqrt{2}\text{ m}^2$.

4. Let the sides of the triangle be $a = 18$ cm, $b = 10$ cm and c.

Perimeter $= a + b + c = 42$ cm

$\Rightarrow$ $c = 42 - (18 + 10) = 14$ cm

Now, semi-perimeter, $s = \frac{42}{2} = 21$ cm

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

$= \sqrt{21(21-18)(21-10)(21-14)}$

$= \sqrt{21\times3\times11\times7}$

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

Thus, the required area of the triangle is $21\sqrt{11}\text{ cm}^2$.

5. Perimeter of the triangle = 540 cm

$\therefore$ Semi-perimeter, $s = \frac{540}{2} = 270$ cm

The sides of the triangle are in the ratio of 12 : 17 : 25.

Let $a = 12x$ cm, $b = 17x$ cm, $c = 25x$ cm

$\therefore$ $12x + 17x + 25x = 540$

$\Rightarrow$ $54x = 540 \Rightarrow x = 10$

$\therefore$ $a = 12 \times 10 = 120$ cm, $b = 17 \times 10 = 170$ cm and $c = 25 \times 10 = 250$ cm

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

$= \sqrt{270(270-120)(270-170)(270-250)}$

$= \sqrt{270\times150\times100\times20}$

$= \sqrt{3\times3\times3\times10\times3\times5\times10\times10\times10\times2\times2\times5}$

$= \sqrt{10^2\times10^2\times3^2\times3^2\times5^2\times2^2}$

$= 10 \times 10 \times 3 \times 3 \times 5 \times 2 = 9000\text{ cm}^2$

6. Equal sides of the triangle are 12 cm each.

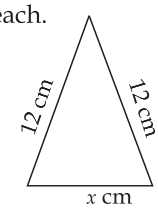
Let the third side be x cm.

Now, perimeter = 30 cm

$\Rightarrow$ $12 + 12 + x = 30$

$\Rightarrow$ $x = 6$

$\therefore$ Semi-perimeter, $s = \frac{30}{2} = 15$ cm



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

$= \sqrt{15(15-12)(15-12)(15-6)}$

$= \sqrt{15\times3\times3\times9} = \sqrt{5\times3\times3\times3\times3\times3}$

$= 3\times3\times\sqrt{5\times3} = 9\sqrt{15}\text{ cm}^2$

Thus, the required area of the triangle is $9\sqrt{15}\text{ cm}^2$.