## **12** HERON'S FORMULA

## EXERCISE 12.1

- **Q.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? ∧
- **Sol.** Each side of the triangle = aPerimeter of the triangle = 3a

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



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

$$= \sqrt{s(s-a)(s-a)(s-a)} \qquad [\because a = b = c]$$
  
=  $(s-a)\sqrt{s(s-a)} = \left(\frac{3a}{2} - a\right)\sqrt{\frac{3a}{2}\left(\frac{3a}{2} - a\right)}$   
=  $\frac{a}{2} \cdot \sqrt{\frac{3a^2}{4}} = \frac{a}{2} \cdot \frac{a}{2} \sqrt{3} = \frac{a^2}{4} \sqrt{3}$ 

Hence, area of the signal board =  $\frac{a^2}{4}\sqrt{3}$  sq units Ans. Now, perimeter = 180 cm

Each side of the triangle =  $\frac{180}{3}$  cm = 60 cm

Area of the triangle =  $\frac{(60)^2}{4} \times \sqrt{3}$  cm<sup>2</sup> = 900  $\sqrt{3}$  cm<sup>2</sup> Ans.

Q.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 Fig.). The advertisements yield an earning of Rs 5000 per m<sup>2</sup> per year. A company hired one of its walls for 3 months. How much rent did it pay?



Sol. Here, we first find the area of the triangular side walls. a = 122 m, b = 120 m and c = 22 m

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

<u>www.tiwariacademy.com</u> Focus on free education Area of the triangular side wall =  $\sqrt{s(s-a)(s-b)(s-c)}$ 

$$= \sqrt{132 (132 - 122) (132 - 120) (132 - 22)} m^{2}$$
$$= \sqrt{132 \times 10 \times 12 \times 110} m^{2} = 1320 m^{2}$$

Rent of  $1 \text{ m}^2$  of the wall for 1 year = Rs 5000

- $\therefore$  Rent of 1 m<sup>2</sup> of the wall for 1 month = Rs  $\frac{5000}{12}$
- $\therefore$  Rent of the complete wall (1320 m<sup>2</sup>) for 3 months

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

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



Sol. Here 
$$a = 15$$
 m,  $b = 11$  m,  $c = 6$  m  
 $\therefore s = \frac{a+b+c}{2} = \frac{15+11+6}{2}$  m = 16 m  
Area of the triangle =  $\sqrt{s(s-a)(s-b)(s-c)}$   
 $= \sqrt{16(16-15)(16-11)(16-6)}$  m<sup>2</sup>  
 $= \sqrt{16 \times 1 \times 5 \times 10}$  m<sup>2</sup> =  $20\sqrt{2}$  m<sup>2</sup>

Hence, the area painted in colour =  $20\sqrt{2}$  m<sup>2</sup> Ans.

**Q.4.** Find the area of a triangle two sides of which are 18 cm and 10 cm and the perimeter is 42 cm.

Sol. Here 
$$a = 18 \text{ cm}$$
,  $b = 10 \text{ cm}$ ,  $c = ?$   
Perimeter of the triangle = 42 cm  
 $\Rightarrow a + b + c = 42$   
 $\Rightarrow 18 + 10 + c = 42$   
 $\Rightarrow c = 42 - 28 = 14$   
Now,  $s = \frac{a + b + c}{2} = \frac{42}{2} \text{ cm} = 21 \text{ cm}$   
Area of the triangle =  $\sqrt{s(s - a)(s - b)(s - c)}$   
 $= \sqrt{21(21 - 18)(21 - 10)(21 - 14)} \text{ cm}^2$   
 $= \sqrt{21 \times 3 \times 11 \times 7} \text{ cm}^2 = \sqrt{7 \times 3 \times 3 \times 11 \times 7} \text{ cm}^2$   
 $= 7 \times 3 \sqrt{11} \text{ cm}^2 = 21\sqrt{11} \text{ cm}^2$  Ans.

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- **Q.5.** Sides of a triangle are in the ratio of 12 : 17 : 25 and its perimeter is 540 cm. Find its area.
- **Sol.** Let the sides of the triangle be 12x cm 17x cm and 25x cm. Perimeter of the triangle = 540 cm
  - $\therefore 12x + 17x + 25x = 540$  $\Rightarrow 54 \ x = 540$

$$\Rightarrow \qquad x = \frac{540}{54} = 10$$

:. Sides of the triangle are  $(12 \times 10)$  cm,  $(17 \times 10)$  cm and  $(25 \times 10)$  cm i.e., 120 cm, 170 cm and 250 cm.

Now, suppose a = 120 cm, b = 170 cm, c = 250 cm,

:. 
$$s = \frac{a+b+c}{2} = \frac{540}{2}$$
 cm = 270 cm

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

$$= \sqrt{270 (270 - 120) (270 - 170) (270 - 250)} \text{ cm}^2$$
$$= \sqrt{270 \times 150 \times 100 \times 20} \text{ cm}^2 = 9000 \text{ cm}^2 \text{ Ans}$$

**Q.6.** An isosceles triangle has perimeter 30 cm and each of the equal sides is 12 cm. Find the area of the tirangle.

Sol. Here, 
$$a = b = 12$$
 cm,  
Also,  $a + b + c = 30 \implies 12 + 12 + c = 30 \implies c = 30 - 24 = 6$   
 $\therefore \quad s = \frac{a + b + c}{2} = \frac{30}{2}$  cm = 15 cm  
 $\therefore$  Area of the triangle  $= \sqrt{s(s - a)(s - b)(s - c)}$   
 $= \sqrt{15(15 - 12)(15 - 12)(15 - 6)}$  cm<sup>2</sup>

= 
$$\sqrt{15 \times 3 \times 3 \times 9}$$
 cm<sup>2</sup> =  $9\sqrt{15}$  cm<sup>2</sup> Ans.

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