NCERT QUESTIONS WITH SOLUTIONS

EXERCISE : 12.1

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. The equilateral triangle each side = a

Its semi perimeter = $\frac{a+a+a}{2} = \frac{3}{2}a$

By Heron's formula,

the area of the triangle

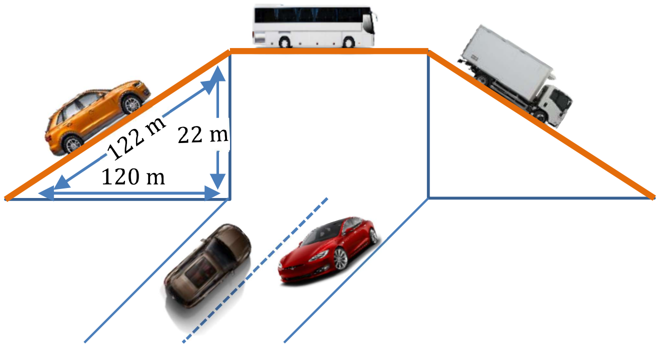
$$= \sqrt{\frac{3}{2}a \times \left(\frac{3}{2}a - a\right) \times \left(\frac{3}{2}a - a\right) \times \left(\frac{3}{2}a - a\right)}$$

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

When perimeter of the triangle is 180 cm, we have 3a = 180 cm i.e., a = 60 cm. Then the area of the triangle

$$= \frac{\sqrt{3}}{4}(60)^2 \text{ cm}^2 = 900\sqrt{3} \text{ cm}^2$$

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^2 per year. A company hired one of its walls for 3 months. How much rent did it pay ?



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

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

Area of one triangular wall

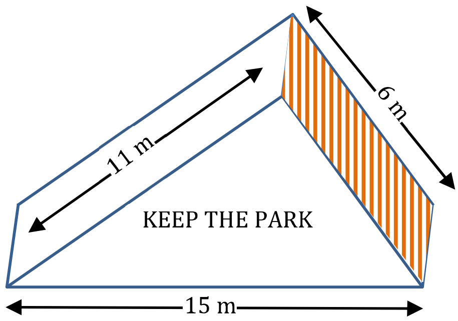
$$= \sqrt{132 \times (132-122) \times (132-22) \times (132-120)} \text{ m}^2$$

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

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.

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

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. The sides of the triangular wall be 15m, 11m and 6m.

$s = \frac{15m+11m+6m}{2} = 16m$

Area of the wall

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

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

$= 20\sqrt{2}\ m^2$

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

Sol. a = 18 cm,

b = 10 cm,

Perimeter = 42 cm

we have a + b + c = 42

$\Rightarrow$ c = 14 cm

$s = \frac{a+b+c}{2} = \frac{42}{2} = 21$ cm

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

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

$= \sqrt{21(3)(11)(7)} = 3\times7\times\sqrt{11}$

$= 21\sqrt{11}\ cm^2$

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 triangle be 12k, 17k, 25k

Perimeter = 12k + 17k + 25k = 54k.

$\Rightarrow$ 54k = 540

k = 10

$\Rightarrow$ a = 12 × k = 12 × 10 = 120

b = 17 × k = 17 × 10 = 170

c = 25 × k = 25 × 10 = 250

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

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

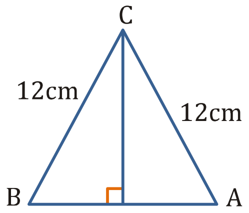
$= \sqrt{270(270-120)(270-170)(270-250)}$

$= = \sqrt{5\times3\times3\times2\times2\times7}$

= 3 × 30 × 5 × 20 cm² = 9000 cm²

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

Sol.



a = 12 cm

b = 12 cm

Perimeter = 30 cm

$\Rightarrow$ c = 30 – 24 = 6 cm

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

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

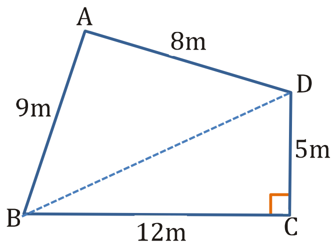
$= \sqrt{15(15-12)(15-12)(15-6)}$

$= \sqrt{15.3.3.9} = 9\sqrt{15}\ cm^2$

EXERCISE : 12.2

1. A park, in the shape of a quadrilateral ABCD, has ∠C = 90°, AB = 9 m, BC = 12 m, CD = 5 m and AD = 8 m. How much area does it occupy ?

Sol. Join the diagonal AD of the quadrilateral ABCD.



$BD^2 = BC^2 + CD^2$

$= (12)^2 + (5)^2 = 169$

$\Rightarrow$ BD $= \sqrt{169} = 13$ m

Area of right angle ΔBCD

$= \frac{1}{2} \times BC \times CD = \frac{1}{2} \times 12 \times 5m^2 = 30\ m^2$

Now, the sides of the ΔABD are 9m, 13 m and 8 m.

semi-perimeter of ΔABD

$s = \frac{9m + 13m + 8m}{2} = 15$ m.

The area of the ΔABD

$= \sqrt{15 \times (15-9) \times (15-13) \times (15-8)}\ m^2$

$= \sqrt{15 \times 6 \times 2 \times 7}\ m^2$

$= \sqrt{5 \times 3 \times 3 \times 2 \times 2 \times 7}$

$= 6 \times 5.916\ m^2$ (approx.)

$= 35.496\ m^2$ (approx.)

$= 35.5\ m^2$ (approx.)

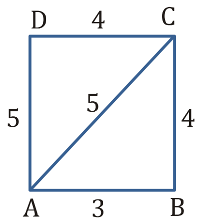
Thus area of the quadrilateral ABCD

$= ar(\Delta BCD) + ar(\Delta ABD)$

$= 30\ m^2 + 35.5\ m^2$ (approx.)

$= 65.5\ m^2$ (approx.)

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



Sol. a = 4

b = 5

c = 3

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

$\Rightarrow$ $\angle B = 90°$

Area of $\Delta ABC = \frac{1}{2} \times$ Base $\times$ Height

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

For ΔACD a = 4, b = 5 and c = 5

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

$\therefore$ Area of ΔACD

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

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

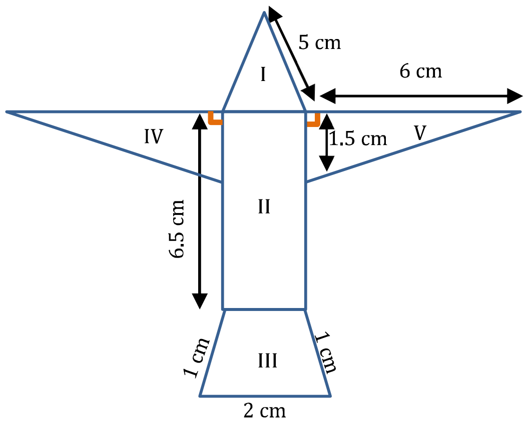
$= \sqrt{7 \times 3 \times 2 \times 2}$

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

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

$\approx 15.2\ cm^2$

3. Radha made a picture of an aeroplane with coloured paper as shown in figure. Find the total area of the paper used.



Sol. It is triangular part and its sides are 5 cm, 5 cm, 1 cm. Here, semi perimeter of the triangle

$s = \frac{5cm + 5cm + 1cm}{2} = \frac{11}{2}$ cm

Area of part I in figure

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

$= \sqrt{\frac{11}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{9}{2}}$ cm^2

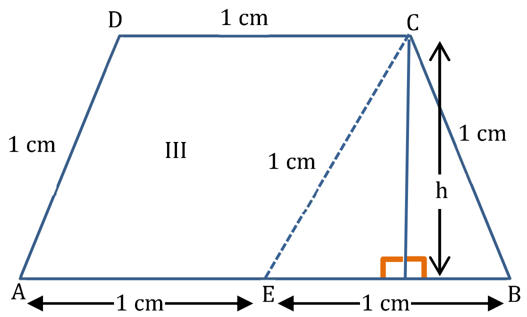
$= \frac{3}{4}\sqrt{11}$ cm^2 $= \frac{3}{4} \times 3.31$ cm^2

= 2.482 (approx.)

Area of part II in figure

= 6.5 × 1 cm^2 = 6.5 cm^2

Area of part III in figure



Area of ΔBEC $= \frac{\sqrt{3}}{4}$ $(1)^2$ cm^2 $= \frac{\sqrt{3}}{4}$ cm^2

Let h be the height of the ΔBEC i.e., height of the trapezium.

$\frac{1}{2} \times BE \times h = \frac{\sqrt{3}}{4}$

$\Rightarrow \quad \frac{1}{2} \times 1 \times h = \frac{\sqrt{3}}{4}$

$\Rightarrow \quad h = \frac{\sqrt{3}}{4}$ cm

Area of Trapezium ABCD

$= \frac{1}{2}$ (sum of parallel sides) (height)

$= \frac{1}{2}(1 + 2)\left(\frac{\sqrt{3}}{2}\right)$ cm^2

$= \frac{3}{4}\sqrt{3}$ cm^2 $= \frac{3}{4} = \times 1.732$ (approx.)

= 1.299 (approx.) = 1.3 cm^2 (approx.)

Area of part IV in figure

$= \frac{1}{2} \times 1.5 \times 6$ cm^2 = 4.5 cm^2

Area of part V in figure

$= \frac{1}{2} \times 1.5 \times 6$ cm^2 = 4.5 cm^2

Total area of the paper used

= part (I + II + III + IV + V)

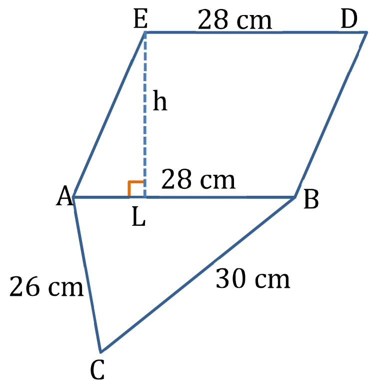
= 2.482 cm^2 + 6.5 cm^2 + 1.3 cm^2 + 4.5cm^2 + 4.5cm^2

= (10.282 + 9) cm^2 (approx.)

= 19.282 cm^2 (approx.)

= 19.3 cm^2 (approx.)

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



Sol. Semi perimeter of ΔABC

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

s – a = 42 – 26 = 16 cm

s – b = 42 – 28 = 14 cm

s – c = 42 – 30 = 12 cm

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

$= \sqrt{42 \times 16 \times 14 \times 12}$ cm²

$= \sqrt{14 \times 3 \times 4 \times 4 \times 14 \times 4 \times 3}$ cm²

$= 14 \times 4 \times 3 \times 2$ cm² = 336 cm²

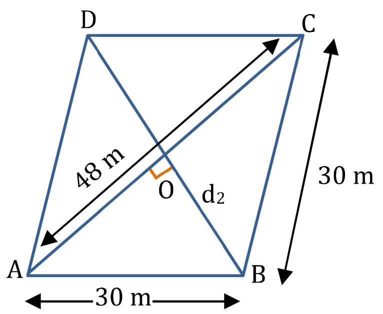
$\therefore$ Area of parallelogram = Area of triangle [Given]

h × AB = 336

h × 28 = 336 cm²

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

5. A rhombus shaped field has green grass for 18 cows to graze. If each side of the rhombus is 30 m and its longer diagonal is 48 m, how much area of grass field will each cow be getting ?



Sol. In ΔABC

Semi perimeter = $\frac{AB + BC + AC}{2}$

$= \frac{30 + 30 + 48}{2}$ = 54 m

Using Heron's formula:

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

$= \sqrt{54(54-30)(54-30)(54-48)}$

$= \sqrt{54 \times 24 \times 24 \times 6}$

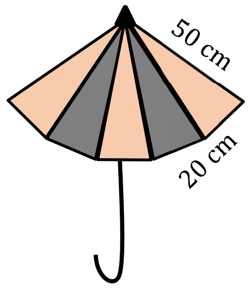
= 432 m²

$\therefore$ Area of field = 2 × area of ΔABC

= 2 × 432 = 864 m²

Thus, the area of gross field that each cow be getting = $\frac{864}{18} = 48 \text{ m}^2$

6. An umbrella is made by stitching 10 triangular pieces of cloth of two different colours (see Fig.) each piece measuring 20 cm, 50 cm and 50 cm. How much cloth of each colour is required for the umbrella?



Sol. Sides of a triangular piece of coloured cloth are 20 cm, 50 cm and 50 cm.

Its semi perimeter = $\frac{20\text{cm} + 50\text{cm} + 50\text{cm}}{2}$

= 60cm

Then, the area of one triangular piece

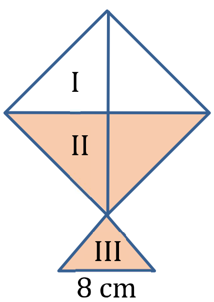
$= \sqrt{60 \times 10 \times 10 \times 40}$ cm² = $200\sqrt{6}$ cm²

There are 5 triangular pieces one colour and 5 of the other colour.

Then total area of cloth of each colour (two colours) = $5 \times 200\sqrt{6}$ cm²

$= 1000\sqrt{6}$ cm²

7. A kite in the shape of a square with a diagonal 32 cm and an isosceles triangle of base 8 cm and sides 6 cm each is to be made of three different shades as shown in figure. How much paper of each shade has been used in it ?



Sol. Area of paper shade I = $\frac{1}{2}\left[\frac{1}{2}\times 32\times 32\right]$

= 256 cm^2

Area of paper shade II = 256 cm^2

Area of paper of shade III

a = 8 cm; b = 6 cm; c = 6 cm

s = $\frac{a+b+c}{2} = \frac{8+6+6}{2}$ = 10cm

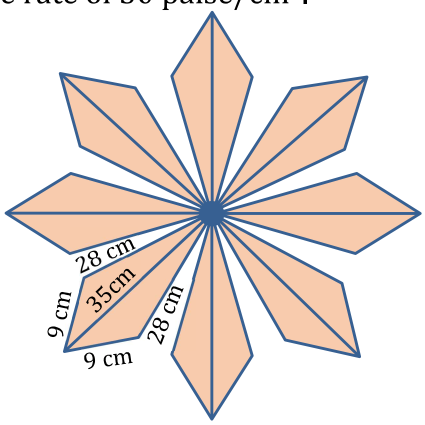
$\therefore$ Area of paper of shade III

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

= $\sqrt{10(10-8)(10-6)(10-6)}$

= $\sqrt{10.2.4.4} = 8\sqrt{5}$ = 17.89 cm^2

8. A floral design on a floor is made up of 16 tiles which are triangular, the sides of the triangle being 9 cm, 28 cm and 35 cm (See Fig.). Find the cost of polishing the tiles at the rate of 50 paise/cm^2.



Sol. Sides of a triangular tile are 9 cm, 28 cm and 35 cm.

Its semi perimeter will be

s = $\frac{9\text{cm}+28\text{cm}+35\text{cm}}{2}$ = 36 cm

Area of one tile = $\sqrt{36\times 27\times 8\times 1}$ cm^2

= 36$\sqrt{6}$ cm^2

Total area of 16 tiles = 16 × $36\sqrt{6}\,\text{cm}^2$

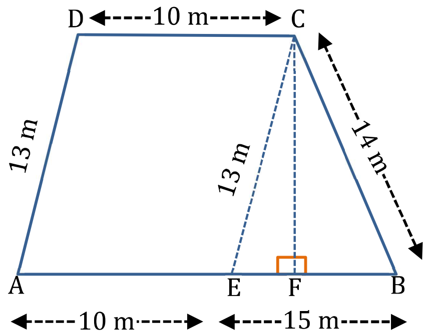
= 576$\sqrt{6}$ cm^2 = 576 × 2.45 cm^2 (approx.)

= 1411.20 cm^2 (approx.)

Total cost of polishing at the rate of 50p per cm^2

= Rs.1411.20 × $\frac{1}{2}$ cm^2 = Rs. 705.60

9. A field is in the shape of a trapezium whose parallel sides are 25 m and 10 m. The non-parallel sides are 14 m and 13 m. Find the area of the field.



Sol. Through C draw CE $\parallel$ DA

Draw CF $\perp$ AB

In ΔBCE, we have

s = $\frac{15+14+13}{2}$ = 21 m

s – a = 21 – 15 = 6 m

s – b = 21 – 14 = 7 m

s – c = 21 – 13 = 8 m

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

= $\sqrt{21\times 6\times 7\times 8}$ m^2

= 7 × 4 × 3 = 84 m^2

Now, area of ΔBCE = 84 m^2

$\Rightarrow$ $\frac{1}{2}$ × base × height = 84 m^2

$\Rightarrow$ $\frac{1}{2}$ × 15 × h = 84

$\Rightarrow$ h = $\frac{84\times 2}{15}$ m

$\Rightarrow$ h = distance between parallel sides of trapezium = $\frac{168}{15}$ m

Area of parallelogram,

AECD = base × height

= 10 × $\frac{168}{15}$ = 56 × 2 = 112 m^2

$\therefore$ Area of trapezium ABCD

= Area of parallelogram AECD + Area of ΔBCE = 112 + 84 = 196 m^2