

Exercise 12.2

1. A park, in the shape of a quadrilateral ABCD, has $\angle C = 90^\circ$, $AB = 9\text{ m}$, $BC = 12\text{ m}$, $CD = 5\text{ m}$ and $AD = 8\text{ m}$. How much area does it occupy?

→ Join BD.

Area of right triangle BCD

$$= \frac{1}{2} \times b \times h = \frac{1}{2} \times 5 \times 12 = 30\text{ m}^2$$

In right triangle BCD

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

$$= (12)^2 + (5)^2 = 144 + 25 = 169$$

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

For $\triangle ABD$

$$a = 13\text{ m}, b = 8\text{ m}, c = 9\text{ m}$$

$$s = \frac{a+b+c}{2} = \frac{13+8+9}{2} = \frac{30}{2} = 15\text{ m}$$

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

$$= \sqrt{15(15-13)(15-8)(15-9)}$$

$$= \sqrt{15(2)(7)(6)}$$

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

$$= 3 \times 2\sqrt{35} = 6\sqrt{35}\text{ m}^2$$

$$= 6 \times 5.916 = 35.5\text{ m}^2$$

$$\begin{aligned}
 \therefore \text{Area of quadrilateral ABCD} \\
 &= \text{Area of } \triangle BCD + \text{Area of } \triangle ABD \\
 &= 30\text{m}^2 + 35.5\text{m}^2 = 65.5\text{m}^2
 \end{aligned}$$

2. Find the area of a quadrilateral ABCD in which $AB=3\text{cm}$, $BC=4\text{cm}$, $CD=4\text{cm}$, $DA=5\text{cm}$ and $AC=5\text{cm}$.
- For $\triangle ABC$

$$\begin{aligned}
 a &= 4\text{cm}, b = 5\text{cm}, c = 3\text{cm} \\
 \therefore \text{Area} &= \frac{1}{2} \times b \times h = \frac{1}{2} \times 3 \times 4 = 6\text{cm}^2
 \end{aligned}$$

For $\triangle ACD$

$$\begin{aligned}
 a &= 4\text{cm}, b = 5\text{cm}, c = 5\text{cm} \\
 \therefore s &= \frac{a+b+c}{2} = \frac{4+5+5}{2} = \frac{14}{2} = 7\text{cm}
 \end{aligned}$$

$$\begin{aligned}
 \therefore \text{Area of the } \triangle ACD \\
 &= \sqrt{s(s-a)(s-b)(s-c)} \\
 &= \sqrt{7(7-4)(7-5)(7-5)} \\
 &= \sqrt{7(3)(2)(2)} = 2\sqrt{21}\text{cm}^2 \\
 &= 2 \times 4.6\text{cm}^2 = 9.2\text{cm}^2
 \end{aligned}$$

$$\begin{aligned}
 \therefore \text{Area of quadrilateral ABCD} \\
 &= \text{Area of } \triangle ABC + \text{Area of } \triangle ACD \\
 &= 6\text{cm}^2 + 9.2\text{cm}^2 = 15.2\text{cm}^2
 \end{aligned}$$

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

→ For Triangular Area I

$$a = 5 \text{ cm}, b = 5 \text{ cm}, c = 1 \text{ cm}$$

$$\therefore s = \frac{a+b+c}{2} = \frac{5+5+1}{2} = \frac{11}{2} = 5.5 \text{ cm}$$

$$\begin{aligned} \therefore \text{Area} &= \sqrt{s(s-a)(s-b)(s-c)} \\ &= \sqrt{5.5(5.5-5)(5.5-5)(5.5-1)} \\ &= \sqrt{5.5(0.5)(0.5)(4.5)} \\ &= (0.5) \sqrt{5.5(4.5)} \\ &= (0.5) \sqrt{(0.5)(11)(0.5)(9)} \\ &= (0.5)(0.5)(3)\sqrt{11} \\ &= 0.75\sqrt{11} = 0.75(3.3) \\ &= 2.5 \text{ cm}^2 \end{aligned}$$

$$\text{Area II} = 6.5 \times 1 = 6.5 \text{ cm}^2$$

$$\text{Area III} = a+b+c$$

$$= \frac{1}{2} \times \left[\frac{\sqrt{3}}{2} \times \frac{1}{2} \right] + \left[\frac{\sqrt{3}}{2} \times 1 \right] +$$

$$\frac{1}{2} \left[\frac{\sqrt{3}}{2} \times \frac{1}{2} \right]$$

$$= \frac{\sqrt{3}}{2} \left[\frac{1}{2} \times \frac{1}{2} + 1 + \frac{1}{2} \times \frac{1}{2} \right]$$

$$= \frac{\sqrt{3}}{2} \left[\frac{1}{4} + 1 + \frac{1}{4} \right]$$

$$= \frac{\sqrt{3}}{2} \left[\frac{6}{4} \right] = \frac{3}{4} \times \sqrt{3} = 1.3 \text{ cm}^2$$

$$\text{Area IV} = \frac{3}{8} \times 1.5 = 4.5 \text{ cm}^2$$

$$\text{Area V} = \frac{3}{8} \times 1.5 = 4.5 \text{ cm}^2$$

∴ Total area of paper used

$$= \text{Area I} + \text{Area II} + \text{Area III} + \text{Area IV} + \text{Area V}$$

$$= 2.5 \text{ cm}^2 + 6.5 \text{ cm}^2 + 1.3 \text{ cm}^2 + 4.5 \text{ cm}^2 + 4.5 \text{ cm}^2$$

$$= 19.3 \text{ cm}^2$$

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 base 28 cm, find the height of the parallelogram.

→ For triangle.

$$a=26\text{ cm}, b=28\text{ cm}, c=30\text{ cm}$$

$$\therefore s = \frac{a+b+c}{2} = \frac{26+28+30}{2} = \frac{84}{2} = 42\text{ cm}$$

$$\begin{aligned}\therefore \text{Area} &= \sqrt{s(s-a)(s-b)(s-c)} \\ &= \sqrt{42(42-26)(42-28)(42-30)} \\ &= \sqrt{42(16)(14)(12)} \\ &= \sqrt{(6 \times 7)(16)(7 \times 2)(6 \times 2)} \\ &= 6 \times 4 \times 7 \times 2 = 336\text{ cm}^2\end{aligned}$$

Let the height of parallelogram be h cm.

Then, area of parallelogram = $b \times h = 28 \times h\text{ cm}^2$

$$\text{Then, } 28h = 336$$

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

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

→ For $\triangle ABC$

$$a=30\text{ m}, b=48\text{ m}, c=30\text{ m}$$

$$\therefore s = \frac{a+b+c}{2} = \frac{30+48+30}{2} = \frac{108}{2} = 54 \text{ m}$$

$\therefore$ Area of $\triangle ABC$

$$\begin{aligned} &= \sqrt{s(s-a)(s-b)(s-c)} \\ &= \sqrt{54(54-30)(54-48)(54-30)} \\ &= \sqrt{54 \times 24 \times 6 \times 24} \\ &= 3 \times 6 \times 24 = 432 \text{ m}^2 \end{aligned}$$

$$\begin{aligned} \therefore \text{Area of rhombus} &= 2 \times \text{area of } \triangle ABC \\ &= 2 \times 432 = 864 \text{ m}^2 \end{aligned}$$

$$\therefore \text{Area of grass for 18 cows} = 864 \text{ m}^2$$

$$\therefore \text{Area of grass for 1 cow} = \frac{864}{18} = 48 \text{ m}^2$$

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

→ For one triangular piece

$$a = 20 \text{ cm}, b = 50 \text{ cm}, c = 50 \text{ cm}$$

$$\therefore s = \frac{a+b+c}{2} = \frac{20+50+50}{2} = \frac{120}{2} = 60 \text{ cm}$$

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∴ Area of one triangle

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

$$= \sqrt{60(60-20)(60-50)(60-50)}$$

$$= \sqrt{60(40)(10)(10)} = 200\sqrt{6} \text{ cm}^2$$

∴ Area of 5 triangles of one colour

$$= 5 \times 200\sqrt{6} = 1000\sqrt{6} \text{ cm}^2$$