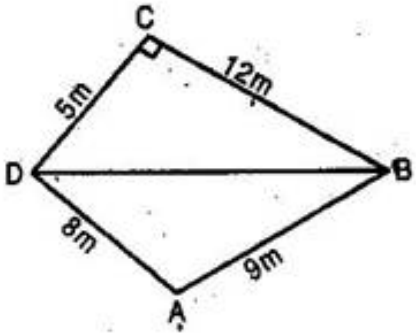
NCERT solutions for class 9 maths Heron's Formula Ex 12.2

Q1. A park, in the shape of a quadrilateral ABCD has $\angle C = 90^{\circ}$, AB = 9 m, BC = 12 m, CD = 5 m and AD = 8 m. How much area does it occupy?

Ans. Since BD divides quadrilateral ABCD in two triangles:



(i) Right triangle BCD and (ii) ΔABD.

In right triangle BCD, right angled at C,

therefore, Base = CD = 5 m and Altitude = BC = 12 m

$\therefore$ Area of $\Delta BCD = \frac{1}{2} \times CD \times BC =$

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

In ΔABD, AB = 9 m, AD = 8 m

And BD = $\sqrt{CD^2 + BC^2}$ [Using Pythagoras theorem]

$\Rightarrow BD = \sqrt{(5)^2 + (12)^2} = \sqrt{25+144} = \sqrt{169} = 13$ m

Now, Semi=perimeter of $\Delta ABD = \frac{9+8+13}{2} = 15$ m

Using Heron's formula,

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

$= \sqrt{15(15-9)(15-8)(15-13)} = \sqrt{15\times6\times7\times2}$

$= 6\sqrt{35} = 6\times5.91\,m^2 = 35.4\,m^2$ (approx.)

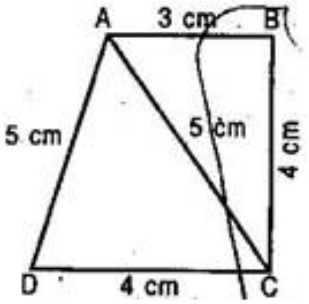
$\therefore$ Area of quadrilateral ABCD = Area of Δ BCD + Area of ΔABD

$= 30 + 35.4$

$= 65.4\,m^2$

Q2. Find the area of a quadrilateral ABCD in which AB = 3 cm, BC = 4 cm, CD = 4 cm, DA = 5 cm and AC = 5 cm.

Ans. In quadrilateral ABCE, diagonal AC divides it in two triangles, ΔABC and ΔADC.



In ΔABC, Semi-perimeter of $\Delta ABC = \frac{3+4+5}{2} =$ 6 cm

Using Heron's formula,

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

$= \sqrt{6(6-3)(6-4)(6-5)} = \sqrt{6\times3\times2\times1} = 6\ cm^2$

Again, In ΔADC, Semi-perimeter of ΔADC = $\frac{4+5+5}{2} = 7\,cm$

Using Heron's formula, Area of ΔABC = $\sqrt{s(s-a)(s-b)(s-c)}$

$= \sqrt{7(7-4)(7-5)(7-5)} = \sqrt{7\times3\times2\times2} = 2\sqrt{21}$

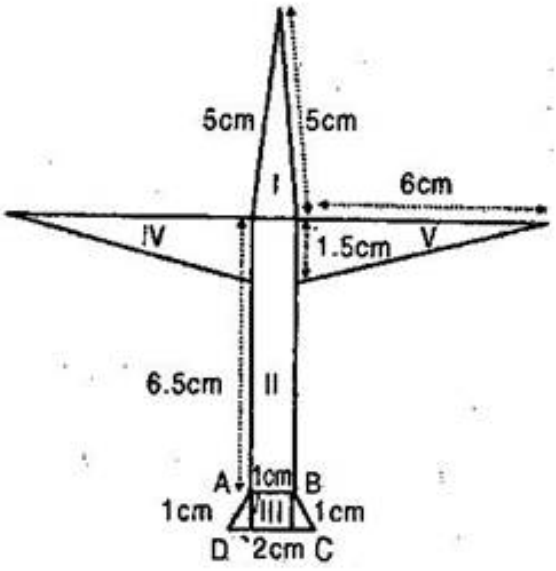
$= 2\times4.6 = 9.2\ cm^2$ (approx.)

Now area of quadrilateral ABCD = Area of Δ ABC + Area of ΔADC

= 6 + 9.2

$= 15.2\ cm^2$

Q3. Radha made a picture of an aeroplane with coloured paper as shown in figure. Find the total area of the paper used.



Ans. Area of triangular part I: Here, Semi-perimeter $(s) = \frac{5+5+1}{2} = 5.5$ cm

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

$= \sqrt{5.5(5.5-5)(5.5-5)(5.5-1)}$

$= \sqrt{5.5 \times 0.5 \times 0.5 \times 4.5} = 0.75\sqrt{11}$

$= 0.75 \times 3.31 = 2.4825\ cm^2$

Area of triangular part II = Length x Breadth $= 6.5 \times 1 = 6.5\ cm^2$

Area of triangular part III (trapezium):

$\frac{1}{2}(AB + DC) \times AE$

$= \frac{1}{2}\ (AB + DC) \times \sqrt{AD^2 - DE^2} = \frac{1}{2}\ (1 + 2) \times \sqrt{1 - .025}$

$= \frac{1}{2} \times 3 \times \frac{\sqrt{3}}{2} = \frac{3 \times 1.732}{4} = 1.299\ cm^2$

Area of triangular parts IV & V:

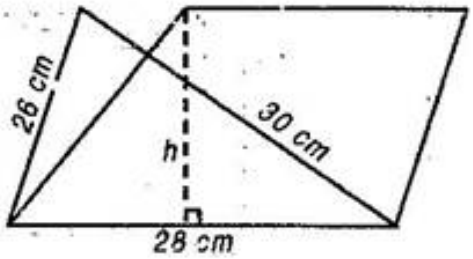
$2\left(\frac{1}{2} \times 1.5 \times 6\right) = 9\ cm^2$

$\therefore$ **Total area** = 2.4825 + 6.2 + 1.299 + 9

$= 19.28\ cm^2$

Q4. A triangle and a parallelogram have the same base and the same area. If the sides of the triangle are 26 cm, 29 cm and 30 cm and the parallelogram stands on the base 28 cm, find the height of the parallelogram.

Ans. Semi-perimeter of triangle (s) = $\frac{26+28+30}{2}$ = 42 cm



Using Heron's formula,

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

= $\sqrt{42(42-26)(42-28)(42-30)}$

= $\sqrt{42\times16\times14\times12}$ = 336 cm^2

According to question, Area of parallelogram = Area of triangle

⇒ Base x Corresponding height = 336

⇒ $28\times Height$ = 336

⇒ Height = 12 cm

Q5. 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, grass of how much area of grass field will each cow be getting?

Ans. Here, AB = BC = CD = DA = 30 m and Diagonal AC = 48 m which divides the rhombus ABCD in two congruent triangle.

$\therefore$ Area of ΔABC = Area of ΔACD

Now, Semi-perimeter of ΔABC (s) =

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

Now Area of rhombus ABCD = Area of ΔABC + Area of ΔACD

= 2 × Area of ΔABC [$\because$ Area of ΔABC = Area of ΔACD]

$= 2\sqrt{s(s-a)(s-b)(s-c)}$ [Using Heron's formula]

$= 2\times\sqrt{54(54-30)(54-30)(54-48)}$

$= 2\times\sqrt{54\times24\times24\times6} = 2\times6\times24$

$= 864\ m^2$

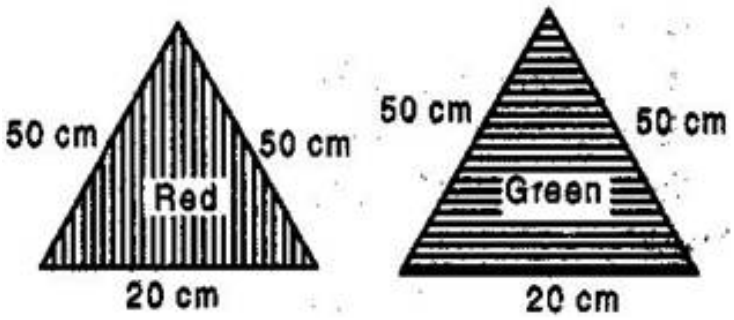
$\because$ Field available for 18 cows to graze the grass

$= 864\ m^2$

$\therefore$ Field available for 1 cow to graze the grass = $\frac{864}{18} = 48\ m^2$

Q6. An umbrella is made by stitching 10 triangular pieces of cloth of two different colours (see figure), each piece measuring 20 cm, 50 cm and 50 cm. How much cloth of each colour is required for the umbrella?

Ans. Here, sides of each of 10 triangular pieces of two different colours are 20 cm, 50 cm and 50 cm.



Semi-perimeter of each triangle (s) =

$\frac{20+50+50}{2}$ = 60 cm

Now, Area of each triangle =

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

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

$= \sqrt{60\times40\times10\times10} = 200\sqrt{6}cm^2$

According to question, there are 5 pieces of red colour and 5 pieces of green colour.

$\therefore$ Cloth required for 5 red pieces = $5\times200\sqrt{6}$ = $1000\sqrt{6}cm^2$

********** END **********