NCERT Solutions for Class 9 Maths Chapter Heron's Formula E 1o.2

Question 1.

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

Solution.

Given: Angle C = 90^0,

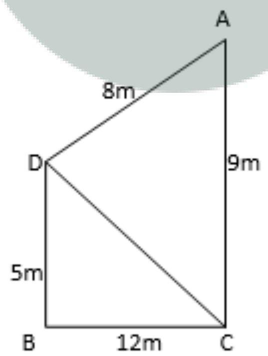
AB = 9m,

BC = 12m,

CD = 5m

And

AD = 8m



BD is joined.

In ΔBCD, by Pythagoras theorem,

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

$BD^2 = 12^2 + 5^2$

$BD^2 = 169$

BD = 13m

Area of $\Delta BCD = \frac{1}{2} \times 12 \times 5 = 30m^2$

Now,

Semi perimeter of triangle (ABD) = $\frac{8+9+13}{2}$

$= \frac{13}{2}$

= 15m

Using Heron's formula,

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

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

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

$= \sqrt{6 \times 6 \times 5 \times 7}$

$= 6\sqrt{35}$ m^2

= 35.5 m^2 (approx.)

Area of quadrilateral ABCD = $Area\ of\ \Delta BCD + Area\ of\ \Delta ABD$

= 30 + 35.5

= 65.5 m^2

Question 2.

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.

Solution.

AB = 3cm, BC = 4cm, CD = 4cm, DA =5cm and AC = 5cm

Now, in ΔABC,

Using Pythagoras theorem,

$AC^2 = BC^2 + AB^2$

$5^2 = 3^2 + 4^2$

$25 = 16 + 9$

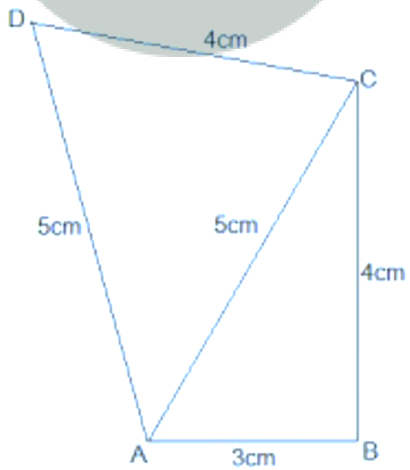
$25 = 25$

Thus,

Triangle ΔABC is right angled at B.

$Area\ of\ \Delta BCD = \frac{1}{2} \times 3 \times 4 = 6\ cm^2$

Now,



Perimeter of triangle(ACD) = 5 + 5 + 4

Semi perimeter of triangle (ACD) = $\frac{5+5+4}{2}$

$=\frac{14}{2}$

= 7cm

Using Heron's formula,

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

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

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

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

= 9.17 cm^2 (approx.)

Area of quadrilateral ABCD = $Area\ of \Delta ABC + Area\ of\ \Delta ABD$

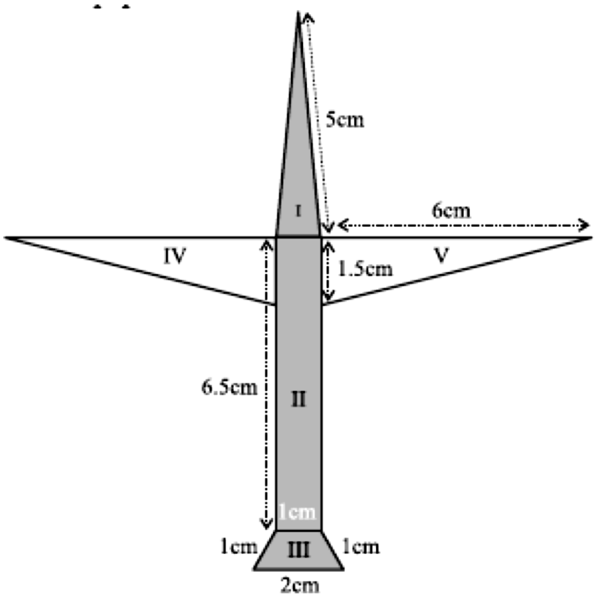
= 6 + 9.17

= 15.17 cm^2

Question 3.

Radha made a picture of an aero plane with colored paper as shown in figure.

Find the total area of the paper used.



Solution.

Sides of triangular section I = 5cm, 1cm and 5cm

Perimeter of the triangular section I = 5 + 5 + 1 = 11cm

Semi perimeter = $\frac{Perimeter\ of\ triangular\ section\ I}{2}$

= $\frac{11}{2}$

= 5.5cm

Using Heron's formula,

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

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

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

= $0.75\sqrt{11}$ cm^2

= 2.488 cm^2 (approx.)

Length of the sides of the rectangle of section I = 6.5cm and 1 cm

Area of section II = 6.5*1 = 6.5cm^2

Section III is an isosceles trapezium which is divided into three equilateral triangles each with side of 1cm each

Area of trapezium = 3 $\times \frac{\sqrt{3}}{4} \times 1 = 1.3\ cm^2$

Section IV and V are congruent right angled triangles with height 1.5cm and base 6cm.

Area of region IV and V = 2$\times \frac{1}{2} \times 6 \times 1.5 = 9cm^2$

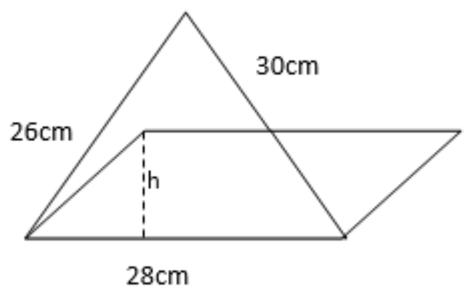
Question 4.

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 base28 cm, find the height of the parallelogram.

Solution.

Given,

Area of the parallelogram and triangle are equal



Sides of triangle are 26cm, 28cm and 30 cm.

Semi perimeter of triangle (ACD) = $\frac{26+28+30}{2}$

=$\frac{84}{2}$

= 42cm

Using Heron's formula,

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

= $\sqrt{42(42-26)(42-28)(42-30)}$ = $\sqrt{42 \times 16 \times 14 \times 12}$

= 336cm^2

Let the height of parallelogram be h,

Now,

Area of parallelogram = Area of triangle

28*h = 336

h = $\frac{336}{28}$

h = 12cm

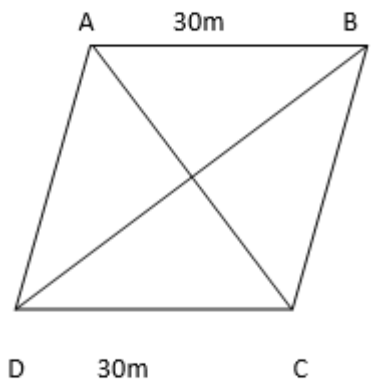
Hence, the height of the parallelogram is 12 cm

Question 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?

Solution.

Diagonals divide the rhombus ABCD into two congruent triangles of equal area.



Semi perimeter of $\Delta ABC = \frac{30+30+48}{2}$ = 54cm

Using Heron's formula,

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

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

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

= 432m^2

Area of field = 2* area ofΔABC

$= 2 \times 432$

$= 864m^2$

Thus,

Area of grass field which each cow will be getting = $\frac{864}{18}$ = 48m^2

Question 6.

An umbrella is made by stitching 10 triangular pieces of cloth of two different colors (see Fig. 12.16), each piece measuring 20 cm, 50 cm and 50 cm. How much cloth of each color is required for the umbrella?

Fig. 12.16

Solution.

Perimeter of each triangular piece of cloth = 50 + 50 + 20

Semi perimeter of each triangular piece of cloth = $\frac{50+50+20}{2}$

$=\frac{120}{2}$

= 60cm

Using Heron's formula,

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

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

= $\sqrt{60 \times 10 \times 10 \times 40}$

= $200\sqrt{6}$ cm^2

Area of triangular piece = 5* $200\sqrt{6}$

=$1000\sqrt{6}cm^2$

Question 7.

A kite in the shape of a square with a diagonal 32 cm and an isosceles triangle of base8 cm and sides 6 cm each is to be made of three different shades as shown in Fig. 12.17. How much paper of each shade has been used in it?

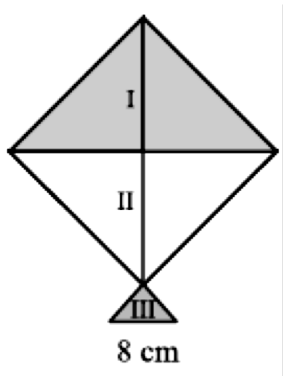


Fig. 12.17

Solution.

We know that,

The diagonal of the square bisect each other at right angle.

Hence,

Area of given kite = ½ *(diagonal)^2

= ½ *32 *32

= 512cm^2

Area of shade I = Area of shade II

$= \frac{512}{2}$ = 256cm^2

So, area of paper required in each shade = 256cm^2

For the III section,

Length of the sides of triangle = 6cm, 6cm and 8cm

Semi perimeter of triangle = $\frac{6+6+8}{2}$

$=\frac{20}{2}$

= 10cm

Using Heron's formula,

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

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

= $\sqrt{4 \times 10 \times 2 \times 4}$

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

Question 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. 12.18). Find the cost of polishing the tiles at the rate of 50p per cm^2

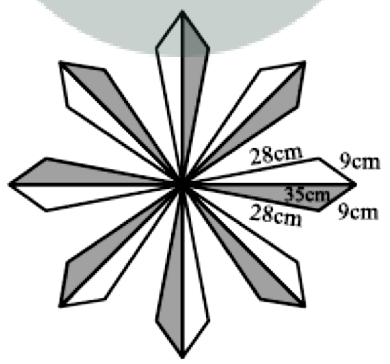


Fig. 12.18

Solution.

Perimeter of each triangular shaped tiles = 28 + 9 + 35

Semi perimeter of each triangular shaped tiles = $\frac{28+9+35}{2}$

$= \frac{72}{2}$

= 36cm

Now,

Using Heron's formula,

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

$= \sqrt{36(36-28)(36-9)(36-35)}$

$= \sqrt{36 \times 8 \times 1 \times 27}$

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

= 88.2cm^2

Total area of 16 tiles = 16*88.2 cm^2 = 1411.2 cm^2

Rate of polishing tiles = 50p per cm^2

Hence,

Total cost of polishing tiles = Rs. 705.6

Question 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.

Solution.

Let ABCD be the given trapezium whose

parallel sides are:

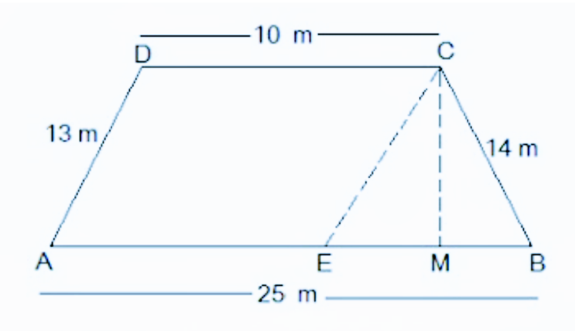
AB = 25m and CD = 10m

And,

Non-parallel sides are AD = 13m and BC = 14m

Now,

CM perpendicular to AB and CE || AD



In ΔBCE,

BC = 14m, CE = AD = 13m and

BE = AB – AE

= 25- 10

= 15m

Semi perimeter of ΔBCE = $\frac{15+13+14}{2}$

=$\frac{42}{2}$

= 21cm

Now,

Using Heron's formula,

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

= $\sqrt{21(21-15)(21-13)(21-14)}$

= $\sqrt{21 \times 8 \times 6 \times 7}$

= 84m^2

1/2 *15 *CM = 84

CM = $\frac{56}{5}$m^2

Area of parallelogram AECD = Base *Altitude

= AE *CM

= $10 \times \frac{84}{5}$ = 112m^2

Area of trapezium ABCD = Area of AECD + Area of triangle BCE

= (112 + 84) m^2

= 196m^2