PUBLIC SCHOOL DARBHANGA

SESSION (2020-21)
CLASS-IX
MATHEMATICS
HERON'S FORMULA
REVISION
WORKSHEET(ANSWER KEY)

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?

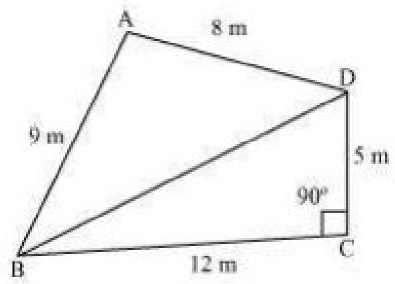
Solution:

First, construct a quadrilateral ABCD and join BD.

We know that

∠C = 90°, AB = 9 m, BC = 12 m, CD = 5 m and AD = 8 m

The diagram is:



Now, apply Pythagoras theorem in ΔBCD

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

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

$\Rightarrow BD^2 = 169$

⇒BD = 13 m

Now, the area of ΔBCD = (½ × 12 × 5) = 30

m^2 The semi perimeter of ΔABD

(s) = (perimeter/2)

= (8 + 9 + 13)/2 m

= 30/2 m = 15 m

Using Heron's formula,

Area of ΔABD

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

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

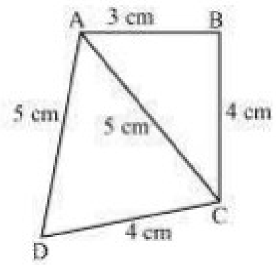
$= \sqrt{15 \times 2 \times 6 \times 7}\ m^2$

$= 6\sqrt{35}\ m^2 = 35.5\ m^2$ (approximately)

∴ The area of quadrilateral ABCD = Area of ΔBCD + Area of ΔABD

= 30 m^2 + 35.5m^2 = 65.5 m^2

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.



Now, apply Pythagorean theorem in

ΔABC, $AC^2 = AB^2 + BC^2$

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

⇒25 = 25

Thus, it can be concluded that ΔABC is a right angled at

B. So, area of ΔBCD = (½ × 3 × 4) = 6 cm^2

The semi perimeter of ΔACD (s) = (perimeter/2) = (5 + 5 + 4)/2 cm = 14/2 cm = 7 m

Now, using Heron's formula,

Area of ΔABD

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

$$= \left[\sqrt{7(7-5)(7-5)(7-4)}\right] \text{cm}^2$$

$$= \left(\sqrt{7 \times 2 \times 2 \times 3}\right) \text{cm}^2$$

= 2√21 cm^2 = 9.17 cm^2 (approximately)

Area of quadrilateral ABCD = Area of ΔABC + Area of ΔABD = 6 cm^2 + 9.17 cm^2 = 15.17 cm^2

3. Radha made a picture of an aeroplane with coloured paper as shown in Fig 12.15. Find the total area of the paper used.

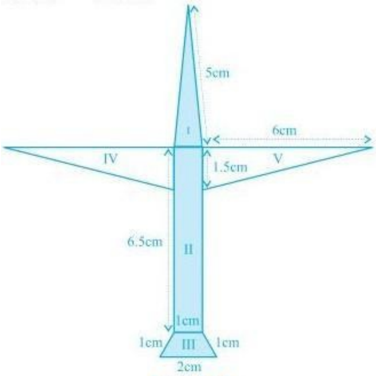
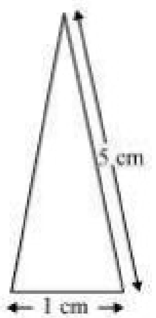


Fig. 12.15

For the triangle I section:



It is an isosceles triangle and the sides are 5 cm, 1 cm and 5 cm

Perimeter = 5 + 5 + 1 = 11 cm

So, semi perimeter = 11/2 cm = 5.5 cm

Using Heron's formula,

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

$= \sqrt{[5.5(5.5 - 5) (5.5 - 5) (5.5 - 1)]}\ cm^2$

$= \sqrt{[5.5 \times 0.5 \times 0.5 \times 4.5]}\ cm^2$

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

$= 0.75 \times 3.317 cm^2$

$= 2.488 cm^2$ (approx)

For the quadrilateral II section:
This quadrilateral is a rectangl with length and breadth as 6.5 cm and 1 cm respectively.
∴ Area = $6.5 \times 1 \text{ cm}^2 = 6.5 \text{ cm}^2$

For the quadrilateral III section:
It is a trapezoid with 2 sides as 1 cm each and the third side as 2 cm.
Area of the trapezoid = Area of the parallelogram + Area of the equilateral triangle
The perpendicular height of the parallelogram will be

$$\left(\sqrt{1^2 - (0.5)^2}\right)$$

= 0.86 cm
And, the area of the equilateral triangle will be ($\sqrt{3}/4 \times a^2$) = 0.43
∴ Area of the trapezoid = 0.86 + 0.43 = 1.3 cm^2 (approximately).

For triangle IV and V:
These triangles are are 2 congruent right angled triangles having the base as 6 cm and height 1.5 cm
Area triangles IV and V = 2 × (½ × 6 × 1.5) cm^2 = 9 cm^2
So, the total area of the paper used = (2.488 + 6.5 + 1.3 + 9) cm^2 = 19.3 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 the base 28 cm, find the height of the parallelogram.

Given,
It is given that the parallelogram and triangle have equal areas.
The sides of the triangle are given as 26 cm, 28 cm and 30 cm.
So, the perimeter = 26 + 28 + 30 = 84 cm
And its semi perimeter = 84/2 cm = 42 cm
Now, by using Heron's formula, area of the triangle =
√[s (s-a) (s-b) (s-c)]
= √[42(42 - 26) (46 - 28) (46 - 30)] cm2
= √[46 × 16 × 14 × 16] cm2

= 336 cm^2

Now, let the height of parallelogram be h.

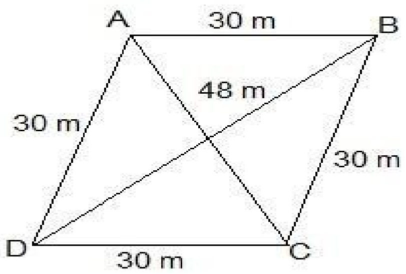
As the area of parallelogram = area of the triangle,

28 cm × h = 336 cm^2

∴ h = 336/28 cm

So, the height of the parallelogram is 12 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?**



Consider the triangle BCD,

Its semi-perimeter = (48 + 30 + 30)/2 m = 54

m Using Heron's formula,

Area of the ΔBCD =

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

$$\left(\sqrt{54(54-48)(54-30)(54-30)}\right) m^2$$

$$\left(\sqrt{54 \times 6 \times 24 \times 24}\right) m^2$$

= 432 m^2

∴ Area of field = 2 × area of the ΔBCD = (2 × 432) m^2 = 864 m^2

Thus, the area of the grass field that each cow will be getting = (864/18) m^2 = 48 m^2

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

Fig. 12.16

Solution:
For each triangular piece, The semi perimeter will be
s = (50 + 50 + 20)/2 cm = 120/2 cm = 60cm
Using Heron's formula,
Area of the triangular piece = $\sqrt{[s (s-a) (s-b) (s-c)]}$
= $\sqrt{[60(60 - 50) (60 - 50) (60 - 20)]}$ cm^2
= $\sqrt{[60 \times 10 \times 10 \times 40]}$ cm^2
= $200\sqrt{6}$ cm^2
∴ The area of all th e triangular pieces = $5 \times 200\sqrt{6}$ cm^2 = $1000\sqrt{6}$ cm^2