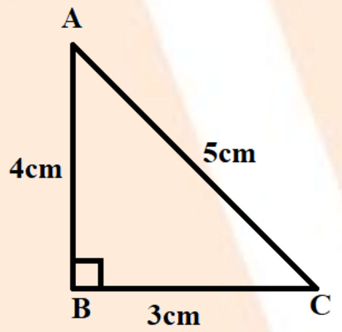
Revision Notes

Class 9 Maths

Chapter 10 – Heron's Formula

Area of Triangle:

- **Area of a triangle** when **height is known** is given by
  $\text{Area} = \frac{1}{2} \times \text{base} \times \text{height}$
- For example: Let a triangle ABC



In the triangle ABC height is 4cm and base is 3cm
Therefore, area of triangle ABC is given by

$$\text{Area} = \frac{1}{2} \times \text{base} \times \text{height}$$

$$\text{Area} = \frac{1}{2} \times 3 \times 4$$

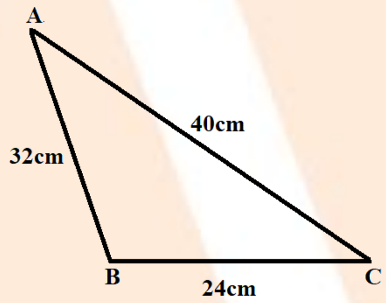
$$\text{Area} = 6\text{cm}^2$$

- This formula can be used to find the area of the right-angle **triangle, equilateral triangle and isosceles triangle.**
- But when it is difficult to find the height of the triangle like in the case of **scalene triangle**, we use heron's formula for calculating the area of triangle

Area of Triangle – by Heron's Formula:

- **Heron's formula** for calculating the area of triangle was given by mathematician Heron around 60 CE

- **Area of triangle by heron's formula is given by** $\text{Area} = \sqrt{s(s-a)(s-b)(s-c)}$
  Where, a, b, c are the sides of triangle and s is semi-perimeter of triangle
- **Semi perimeter** of triangle is the **half of perimeter of triangle** and is given by $s = \frac{a+b+c}{2}$
- Heron's Formula is very helpful where it is not possible to find the height of triangle.
- For example: Let a triangle ABC

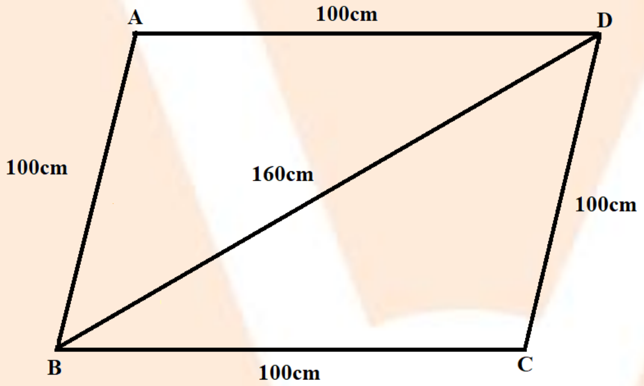


Sides of triangles are
$a = 24\text{cm}$
$b = 40\text{cm}$
$c = 32\text{cm}$
Perimeter of triangle is given by
$\text{Perimeter} = a + b + c$
$\text{Perimeter} = 24 + 40 + 32$
$\text{Perimeter} = 96\text{cm}$
Semi perimeter is given by
$s = \frac{\text{perimeter}}{2}$
$s = \frac{96}{2}$
$s = 48\text{cm}$
Now, area of triangle is given by
$\text{Area} = \sqrt{s(s-a)(s-b)(s-c)}$
$\text{Area} = \sqrt{48(48-24)(48-40)(48-32)}$
$\text{Area} = \sqrt{48(24)(8)(16)}$

$$\text{Area} = \sqrt{147456}$$
$$\text{Area} = 384\text{cm}^2$$

Area of Quadrilateral using Heron's Formula:

- A quadrilateral can be **divided into two triangular parts** by joining one of its diagonals
- And then with help of **Heron's Formula** we can find the area of two triangular parts
- Then by **adding** them we can get the area of the quadrilateral.
- For example: Let a rhombus ABCD



Area of triangle ABD is given by

$$\text{Area}_1 = \sqrt{s(s-a)(s-b)(s-c)}$$

Here, $a = 100\text{cm}, b = 100\text{cm}, c = 160\text{cm}$

And semi perimeter is

$$s = \frac{a+b+c}{2}$$
$$s = \frac{100+100+160}{2}$$
$$s = \frac{360}{2}$$
$$s = 180\text{cm}$$
$$\therefore \text{Area}_1 = \sqrt{s(s-a)(s-b)(s-c)}$$
$$\text{Area}_1 = \sqrt{180(180-100)(180-100)(180-160)}$$

$$\text{Area}_1 = \sqrt{180(80)(80)(20)}$$
$$\text{Area}_1 = \sqrt{23040000}$$
$$\text{Area}_1 = 4800\text{cm}^2$$
Now, area of triangle BCD is given by
$$\text{Area}_2 = \sqrt{s(s-a)(s-b)(s-c)}$$
Here, $a = 100\text{cm}, b = 100\text{cm}, c = 160\text{cm}$
And semi perimeter is
$$s = \frac{a+b+c}{2}$$
$$s = \frac{100+100+160}{2}$$
$$s = \frac{360}{2}$$
$$s = 180\text{cm}$$
$$\therefore \text{Area}_2 = \sqrt{s(s-a)(s-b)(s-c)}$$
$$\text{Area}_2 = \sqrt{180(180-100)(180-100)(180-160)}$$
$$\text{Area}_2 = \sqrt{180(80)(80)(20)}$$
$$\text{Area}_2 = \sqrt{23040000}$$
$$\text{Area}_2 = 4800\text{cm}^2$$
$$\therefore \text{Area of ABCD} = \text{Area}_1 + \text{Area}_2$$
$$\text{Area of ABCD} = 4800 + 4800$$
$$\text{Area of ABCD} = 9600\text{cm}^2$$