In the previous module we have learnt to find the area of a right angled triangle, isosceles triangle, equilateral triangle and scalene triangle. We also learnt heron's formula to find the area of any triangle where three sides are given.

In this module we shall find the area of quadrilaterals and some plane figures using heron's formula

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

Where s $= \frac{a+b+c}{2}$

a, b and c are sides of triangle

Supposed that a farmer has a land to be cultivated and he employs some labourers for this purpose on the term of wages calculated by area cultivated per square metre

How will you do this?

If a farmer wishes to find the area of his field which is in the shape of a quadrilateral. He needs to divide the quadrilateral in triangular parts and then use the heron's formula to find the area of the triangle

Thus, Heron's formula can be applied to find the area of a quadrilateral by dividing the quadrilateral in two triangular parts also we can use heron's formula to solve the problem from daily life situation.

Ex1. Students of a school staged a rally for cleanliness campaign. They walked through the lanes in two groups, One group walked through the lanes AB, BC and CA while other through AC, CD and DA. Then they cleaned the area enclosed within their lanes. If AB = 9m BC = 40 m and CD = 15m, DA = 28 m and B= 90. Which group cleaned more area and by how much? Find the total area cleaned by the students?

Solution :-
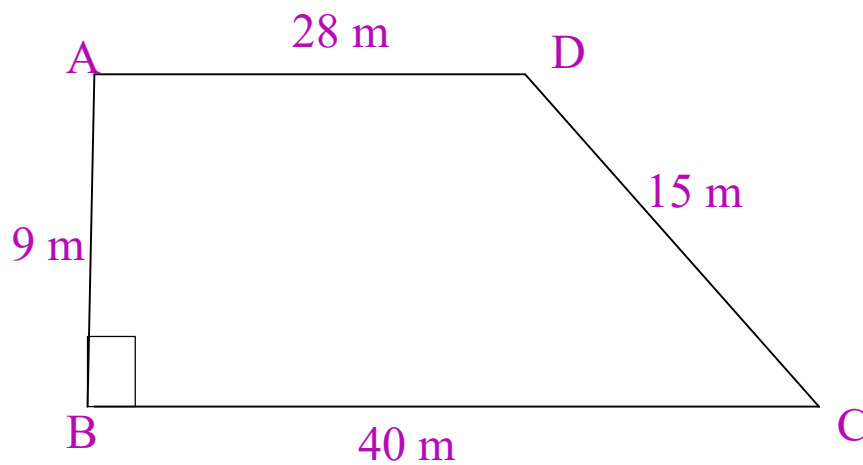
In △ ABC

∠B = 90 (By Pythagoras Theorem)

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

$AC^2 = 9^2 + 40^2 = 1681$

AC = 41m

ar(△ ABC) = ½ x b x h

= ½ x 40 x 9

= 180 m^2

Now in △ ABC, AC= 41m, AD=28m, DC= 15m

$S = \frac{a+b+c}{2} = \frac{28+41+15}{2} = 42m$

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

$A = \sqrt{42(42-28)(42-41)(42-15)}$

$A = \sqrt{42 X 14 X 1 X 27}$

A = 126 m^2

So, first group cleaned $80m^2$ and second group cleaned $126m^2$

Total area = (180+126) m^2

= $306m^2$

First group cleaned 180-126 = $56m^2$ more than the second group.

Ex 2. Kamla has a triangular field with sides 240 m, 200 m and 360 m where she grew wheat. In another triangular field with sides 240 m , 320m. 400m adjacent to the previous field she wanted to grow potatoes and onions. She divided the field in two parts by joining the midpoint of the longest side to the opposite vertex and grew potatoes in one part and onion in the other part. How much area (in hectares)has been used for wheat , potatoes and onions?

Solution :-

400m

A

E

D

240m

320m

360m

B

200m

C
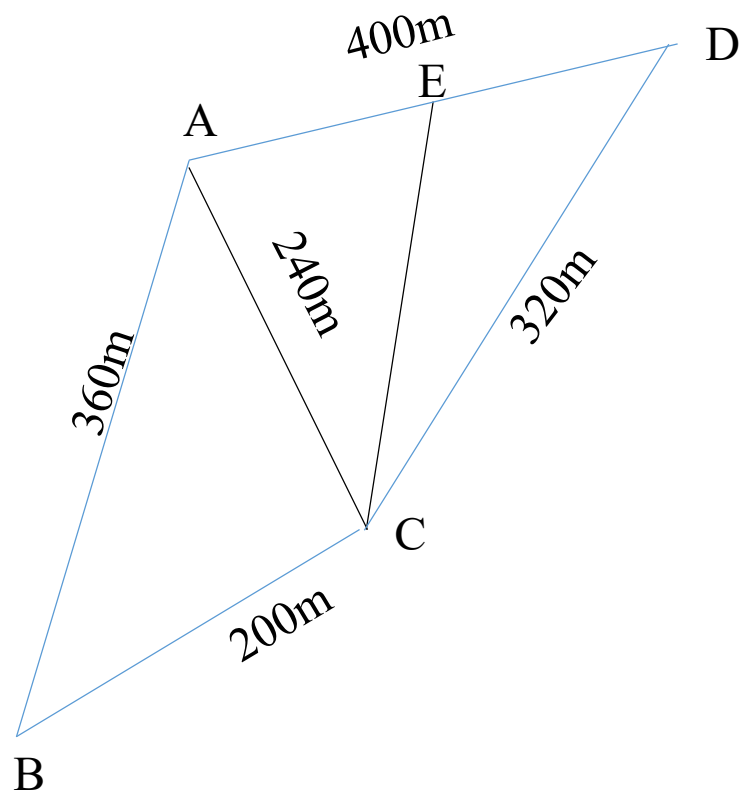
Let △ ABC be the field where wheat is grown and △ ACD be the field which has been divided into two parts by joining C to the midpoint of AD

In △ ABD a= 200m

b= 240m

c=360 m

$$S = \frac{a+b+c}{2} = \frac{200+240+360}{2} = 400m$$

A(△ ABC) = $\sqrt{s(s-a)(s-b)(s-c)}$

A = $\sqrt{400(400-200)(400-240)(400-360)}$

A = $\sqrt{400 * 200 * 160 * 40}$

A = $16000\sqrt{2}$ m^2 =$1.6\sqrt{2}$ hectares = 2.26 hectares (Approx.)

Now For △ ACD

$$S = \frac{a+b+c}{2} = \frac{240+400+320}{2} = 480m$$

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

A = $\sqrt{480(480-240)(480-400)(480-320)}$

A = $\sqrt{480 * 240 * 80 * 160}$

A = 38400 m^2 =3.84 hectares

Area of (△ AEC) = Area of (△ DEC) (same base and same height)

∴ Area for growing potatoes = area for growing onions

= 3.84/2 =1.92 hectares