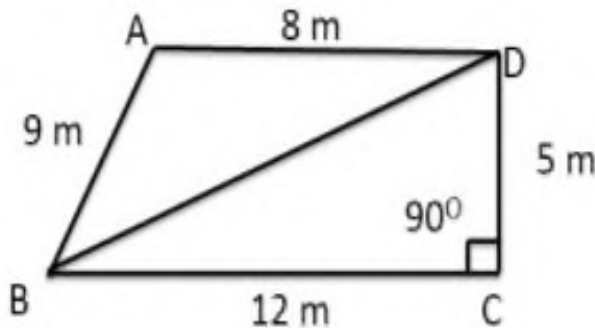


Exercise 12.2

Question: 1 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?

Solution: The figure is given below:



The dimensions of the park as follows:

Angle $C = 90^\circ$,

$AB = 9$ m,

$BC = 12$ m,

$CD = 5$ m

And, $AD = 8$ m

Now, BD is joined.

Thus quadrilateral ABCD can now be divided into two triangles ABD and BCD

Area of quadrilateral ABCD = Area of triangle ABD + Area of triangle BCD

Pythagoras Theorem: It states that the square of the hypotenuse (the side opposite the right angle) is equal to the sum of the squares of the other two sides.

In $\triangle BCD$ by Pythagoras theorem,

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

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

$$BD^2 = 169$$

$$BD = 13\text{m}$$

As triangle BCD is right angled triangle,

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

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

$$\begin{aligned}\text{Now, Semi perimeter of triangle (ABD)} &= \frac{(8 + 9 + 13)}{2} \\ &= \frac{30}{2} = 15\text{m}\end{aligned}$$

Using Heron's formula,

$$\text{ar (ABD)} = \sqrt{s(s - a)(s - b)(s - c)}$$

where, s = semi-perimeter of the triangle and a , b , and c are the sides of the triangle.

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

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

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

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

	5.91
5	<u>35 00</u>
	25
109	<u>10 00</u>
	9 81
1181	<u>1900</u>
	1181

$$= 6 \times 5.91 = 35.46 \text{ m}^2$$

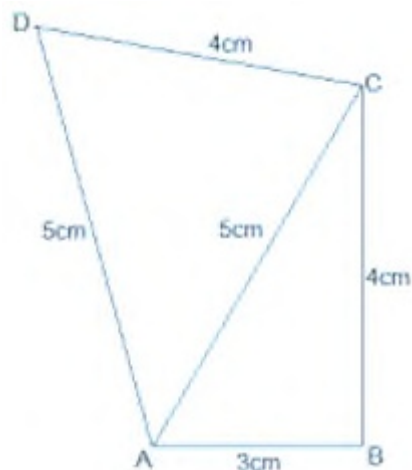
$$\text{Area of quadrilateral ABCD} = 35.46 + 30$$

$$\text{Area of quadrilateral ABCD} = 65.46 \text{ m}^2$$

Thus, the park acquires an area of 65.5 m²(approx).

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:



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

To find: Area of quadrilateral ABCD.

Now we can divide the quadrilateral into two separate triangles and then calculate their area. 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 triangle and since AB and BC are smaller sides so they work as legs.

And we know that,

$$\text{Area of right angles triangle} = \frac{1}{2} \times \text{base} \times \text{height}$$

$$\text{ar}(\Delta ABC) = \frac{1}{2} \times 3 \times 4 = 6 \text{ cm}^2$$

Now,

$$\text{Perimeter of } \Delta ACD = 5 + 5 + 4$$

$$\text{Semi perimeter of } \Delta ACD = \frac{5+5+4}{2}$$

$$= \frac{14}{2}$$

$$= 7 \text{ cm}$$

Using Heron's formula,

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

where, s = semi perimeter of the triangle and a , b , and c are the sides of the triangle

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

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

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

$$\text{Take } = \sqrt{21} = 4.58$$

$$= 9.16 \text{ cm}^2 \text{ (approx)}$$

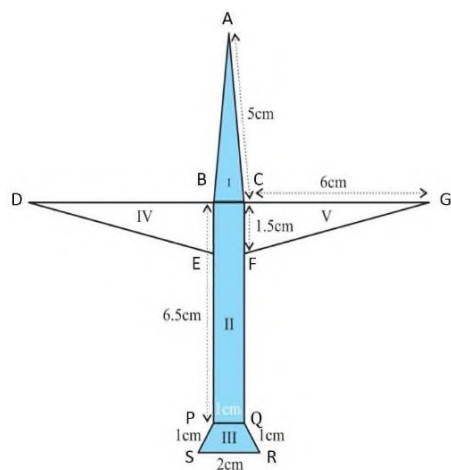
$$\text{Area of quadrilateral ABCD} = \text{Area of } \triangle ABC + \text{Area of } \triangle ACD$$

$$= 6 + 9.16$$

$$= 15.16 \text{ cm}^2$$

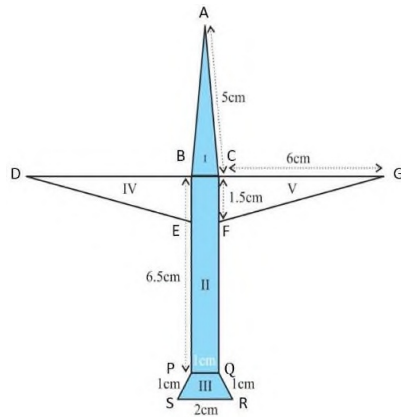
$$\text{By rounding off} = 15.2 \text{ cm}^2 \text{ (approx)}$$

Question: 3 Radha made a picture of an aero plane with colored paper as shown in Fig 12.15. Find the total area of the paper used.

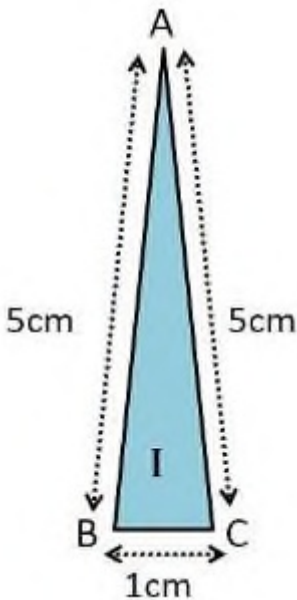


Solution:

The figure of the questions is:



Now to find area:



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

Perimeter of the triangular section I = $5 + 5 + 1 = 11\text{cm}$

Semi perimeter, $s = \frac{\text{perimeter of triangular section I}}{2} = \frac{11}{2} = 5.5\text{cm}$

We use Heron's formula to find the area of the section I,

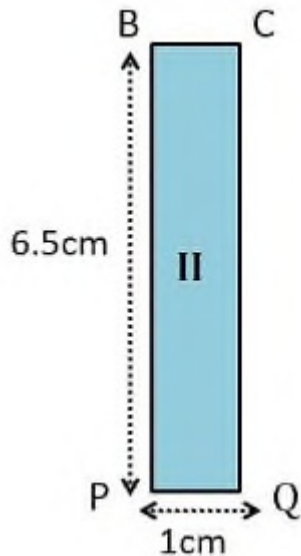
$$\text{Area of Section I} = \sqrt{s(s-a)(s-b)(s-c)}$$

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

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

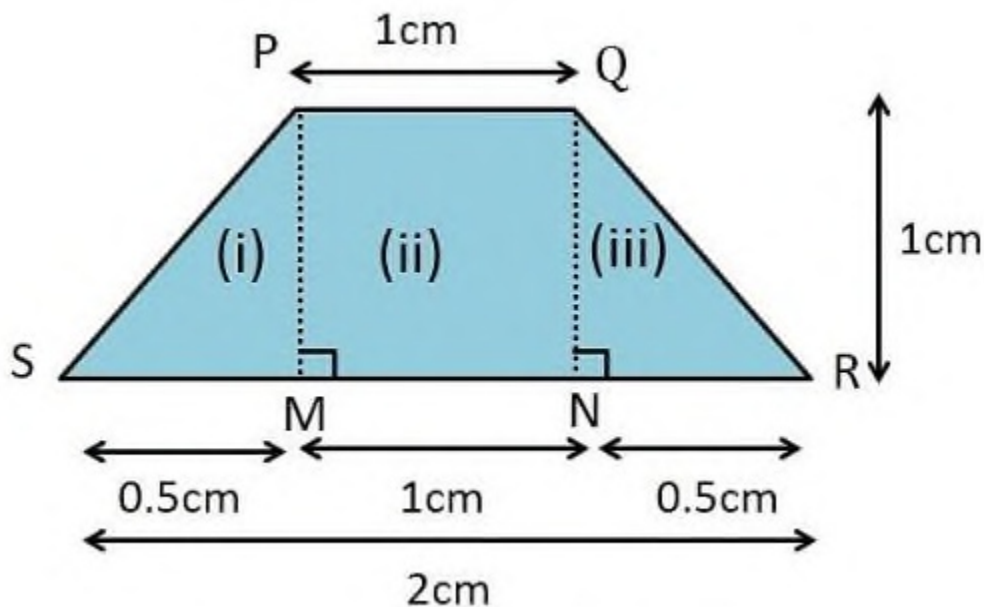
$$= \sqrt{6.1875} \text{ cm}^2$$

Area of Section I = 2.48 cm^2 (approx.) $\sim 2.5 \text{ cm}^2$



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

Area of section II = $6.5 \times 1 = 6.5 \text{ cm}^2$

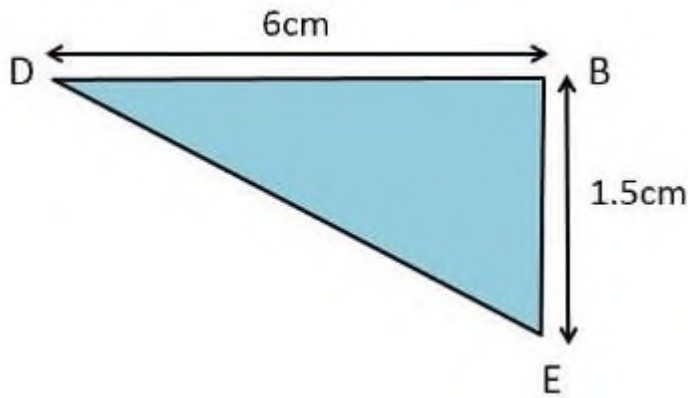


Section III is an isosceles trapezium which is divided into two right triangles and one rectangle.

Now, Area of trapezium

= Area (i) + Area (ii) + Area (iii)

$$= \frac{1}{2} \times 0.5 \times 1 + 1 \times 1 + \frac{1}{2} \times 0.5 \times 1 = 1.5 \text{ cm}^2$$



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

now area of triangle,

$$= \frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2} \times 1.5 \times 6$$

$$= 4.5 \text{ cm}^2$$

$$\text{Area of region IV and V} = 2 \times 4.5 \text{ cm}^2 = 9 \text{ cm}^2$$

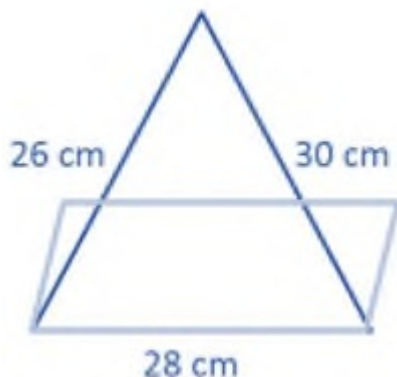
$$\text{Thus, total area is } 2.5 + 6.5 + 9 + 1.5 = 19.5 \text{ sq cm}$$

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 base 28 cm, find the height of the parallelogram.

Solution:

Given,

Area of the parallelogram and triangle are equal



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

Semi perimeter of triangle , $s = \frac{26+28+30}{2}$

$$S = \frac{84}{2}$$

$$= 42 \text{ cm}$$

Using Heron's formula,

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

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

$$= \sqrt{42 \times 16 \times 14 \times 12}$$

$$= 336 \text{ cm}^2$$

= Let the height of parallelogram be h,

As parallelogram and triangle having same base and same height have equal areas.

$\therefore$ Area of parallelogram = Area of triangle

$$28 \times h = 336$$

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

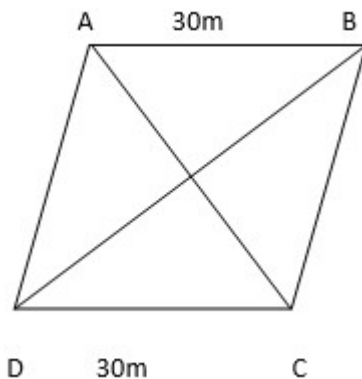
$$h = 12 \text{ cm}$$

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.



$$\text{Semi perimeter of } \triangle ABC = \frac{30+30+48}{2} = 54\text{m}$$

Using Heron's formula,

$$\begin{aligned} \text{Area of } \triangle ABC &= \sqrt{s(s-a)(s-b)(s-c)} \\ &= \sqrt{54(54-30)(54-30)(54-48)} \\ &= \sqrt{54 \times 24 \times 24 \times 6} \end{aligned}$$

$$= 432m^2$$

Area of field = 2 x area of field $\triangle ABC$

$$= 2 \times 432$$

$$= 864 m^2$$

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?



Solution: To Find: Total Amount of cloth required

Given: Umbrella is made up of 10 triangular pieces of sides 50, 50 and 20 cm

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

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

$$= \frac{120}{2}$$

$$= 60 \text{ cm}$$

Using Heron's formula,

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

where, s is the semi-perimeter of the triangle and a , b and c are the sides of the triangle.

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

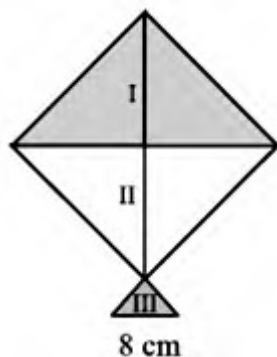
$$= \sqrt{60 \times 10 \times 10 \times 40}$$

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

$$\text{Area of piece of cloth of one colour} = 5 \times 200 \sqrt{6}$$

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

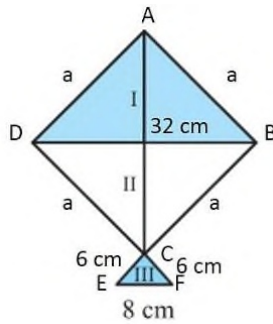
Question:7 A kite in the shape of a square with a diagonal 32 cm and an isosceles triangle of base 8 cm and sides 6 cm each is to be made of three different shades as shown in Fig. 12.17. How much paper of each shade has been used in it?



Solution:

For I and II section:

For calculating the area of the square, Let the length of side = x cm



Each Interior Angle of square = 90° Pythagoras Theorem: Square of Hypotenuse equals to the sum of squares of other two sides

Now by Pythagoras theorem, $x^2 + x^2 = 32^2 + 32^2$

$$2x^2 = 32^2 + 32^2$$

$$x^2 = 16 \times 32 = 512 \text{ cm}^2$$

Area of Square = $(\text{side})^2$

And this will be the area of Square.

$$\text{Area of square} = 512 \text{ cm}^2$$

$$\text{Area of section I} = \text{Area of section II} = \frac{1}{2} \text{ Area of square}$$

Now, we need half of this area,

$$\text{So half of the area of square} = 256 \text{ cm}^2$$

For the III section

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

$$\text{Perimeter of triangle} = 6 + 6 + 8 = 20 \text{ cm}$$

$$\text{Semi-Perimeter of Triangle, } s = 10 \text{ cm}$$

Using Heron's formula,

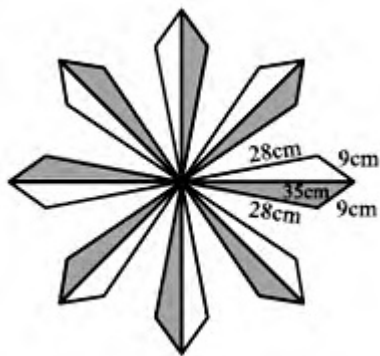
$$\text{Area of the III triangular piece} = \sqrt{s(s-a)(s-b)(s-c)}$$

where, s = semi-perimeter and a , b , and c are the sides of the triangle

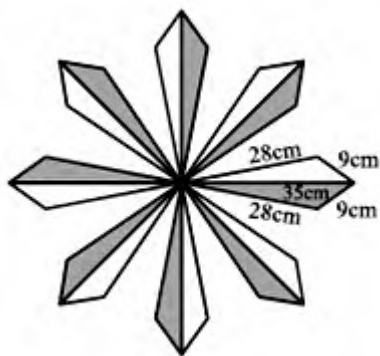
$$\begin{aligned}\text{Area of Triangle} &= \sqrt{10(10 - 6)(10 - 6)(10 - 8)} \\ &= \sqrt{4 \times 10 \times 2 \times 4}\end{aligned}$$

$$\begin{aligned}\text{Area of Triangle} &= 8\sqrt{5} \text{ cm}^2 \\ &= 17.92 \text{ cm}^2\end{aligned}$$

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



Solution:



So, we need to find the area of all 16 tiles or we can say that Area of 16 triangles.

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

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

$$S = \frac{72}{2}$$

$$s = 36 \text{ cm}$$

Now,

Using Heron's formula,

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

where s = semi perimeter of triangle and a, b, c are the sides of the triangle

$$\begin{aligned} \text{Area of 1 triangular shape} &= \sqrt{36(36-28)(36-9)(36-35)} \\ &= \sqrt{36 \times 8 \times 1 \times 27} \end{aligned}$$

$$\text{Area of 1 tile} = 36\sqrt{6} \text{ cm}^2$$

$$\text{Total area of 16 tiles} = 16 \times 36\sqrt{6} \text{ cm}^2 = 576\sqrt{6} \text{ cm}^2$$

$$\text{Total Area of 16 tiles} = 576 \times 2.45 \text{ cm}^2 \quad [\sqrt{6} = 2.45]$$

$$\text{Total Area of 16 tiles} = 1411.2 \text{ cm}^2$$

$$\text{Rate of polishing tiles} = 50 \text{ p per cm}^2$$

Hence,

$$\text{The total cost of polishing tiles} = 50 \times 1411.2$$

$$= 70560 \text{ paise As } 1 \text{ paisa} = \frac{1}{100} \text{ Rs} = \text{RS. } 705.60$$

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.

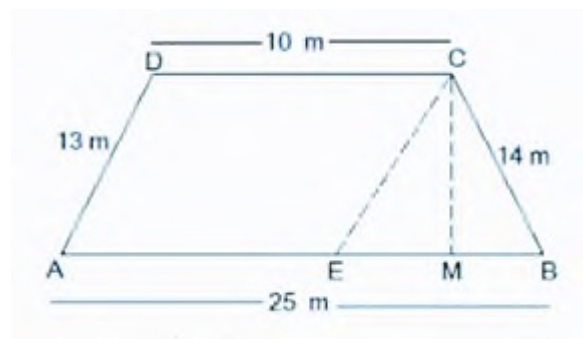
Solution:

Let ABCD be the given trapezium whose parallel sides are:

$$AB = 25\text{m and } CD = 10\text{m}$$

And,

Non-parallel sides are $AD = 13\text{m}$ and $BC = 14\text{m}$



Now,

CM perpendicular to AB and $CE \parallel AD$

In $\triangle BCE$

$$BC = 14\text{m, } CE = AD = 13\text{m and}$$

$$BE = AB - AE$$

$$= 25 - 10$$

$$= 15\text{m}$$

$$\text{Semi perimeter of } \triangle BCE = \frac{15+13+14}{2}$$

$$= \frac{42}{2}$$

$$= 21\text{cm}$$

Now,

Using Heron's formula,

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

where, s = semi perimeter, a, b and c are the sides of the triangle.

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

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

$$= 84\text{m}^2$$

Now from $\triangle CEB$, Area of triangle = $1/2 \times \text{base} \times \text{height}$

For CEB, CM will be the height and 15 cm will be base of the triangle.

And we calculated the area from above. So,

$$\frac{1}{2} \times 15 \times \text{CM} = 84$$

$$\text{CM} = \frac{56}{5}\text{m}$$

Area of parallelogram AECD = Base $\times$ Altitude

$$= \text{AE} \times \text{CM}$$

$$= 10 \times \frac{56}{5}$$

$$= 112 \text{ m}^2$$

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

$$= (112 + 84) \text{ m}^2$$

$$= 196 \text{ m}^2$$