

NCERT Solutions for 9th class Maths : Chapter 12 Heron's Formula



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NCERT Solutions for 9th class Maths : Chapter 12 Heron's Formula

Class 9: Maths Chapter 12 solutions. Complete Class 9 Maths Chapter 12 Notes.

NCERT Solutions for 9th class Maths : Chapter 12 Heron's Formula

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Exercise 12.1

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1. A traffic signal board, indicating 'SCHOOL AHEAD', is an equilateral triangle with side 'a'. Find the area of the signal board, using Heron's formula. If its perimeter is 180 cm, what will be the area of the signal board?

Answer

Length of the side of equilateral triangle = a

Perimeter of the signal board = $3a = 180$ cm

$\therefore 3a = 180$ cm $\Rightarrow a = 60$ cm

Semi perimeter of the signal board (s) = $3a/2$

Using heron's formula,

$$\begin{aligned}\text{Area of the signal board} &= \sqrt{s(s-a)(s-b)(s-c)} \\ &= \sqrt{(3a/2)(3a/2 - a)(3a/2 - a)(3a/2 - a)} \\ &= \sqrt{3a/2 \times a/2 \times a/2 \times a/2} \\ &= \sqrt{3a^4/16} \\ &= \sqrt{3a^2/4} \\ &= \sqrt{3/4} \times 60 \times 60 = 900\sqrt{3} \text{ cm}^2\end{aligned}$$

2. The triangular side walls of a flyover have been used for advertisements. The sides of the walls are 122 m, 22 m and 120 m (see Fig. 12.9). The advertisements yield an earning of ₹5000 per m^2 per year. A company hired one of its walls for 3 months. How much rent did it pay?

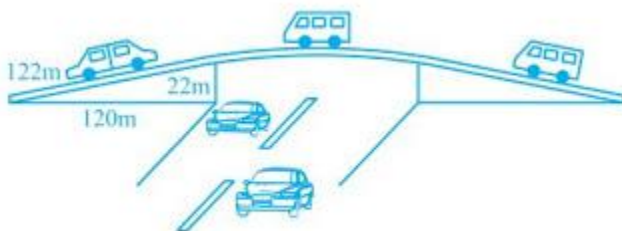


Fig. 12.9

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Answer

The sides of the triangle are 122 m, 22 m and 120 m.

Perimeter of the triangle is $122 + 22 + 120 = 264\text{m}$

Semi perimeter of triangle (s) = $264/2 = 132\text{ m}$

Using heron's formula,

$$\begin{aligned}\text{Area of the advertisement} &= \sqrt{s(s-a)(s-b)(s-c)} \\ &= \sqrt{132(132 - 122)(132 - 22)(132 - 120)}\text{ m}^2 \\ &= \sqrt{132 \times 10 \times 110 \times 12}\text{ m}^2 \\ &= 1320\text{ m}^2\end{aligned}$$

Rent of advertising per year = ₹ 5000 per m^2

Rent of one wall for 3 months = ₹ $(1320 \times 5000 \times 3)/12 = ₹ 1650000$

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3. There is a slide in a park. One of its side walls has been painted in some colour with a message “KEEP THE PARK GREEN AND CLEAN” (see Fig. 12.10). If the sides of the wall are 15 m, 11 m and 6 m, find the area painted in colour.



Answer

Sides of the triangular wall are 15 m, 11 m and 6 m.

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Semi perimeter of triangular wall (s) = $(15 + 11 + 6)/2 \text{ m} = 16 \text{ m}$

Using heron's formula,

$$\begin{aligned}\text{Area of the message} &= \sqrt{s(s-a)(s-b)(s-c)} \\ &= \sqrt{16(16-15)(16-11)(16-6)} \text{ m}^2 \\ &= \sqrt{16 \times 1 \times 5 \times 10} \text{ m}^2 = \sqrt{800} \text{ m}^2 \\ &= 20\sqrt{2} \text{ m}^2\end{aligned}$$

4. Find the area of a triangle two sides of which are 18cm and 10cm and the perimeter is 42cm.

Answer

Two sides of the triangle = 18cm and 10cm

Perimeter of the triangle = 42cm

Third side of triangle = $42 - (18+10) \text{ cm} = 14\text{cm}$

Semi perimeter of triangle = $42/2 = 21\text{cm}$

Using heron's formula,

$$\begin{aligned}\text{Area of the triangle} &= \sqrt{s(s-a)(s-b)(s-c)} \\ &= \sqrt{21(21-18)(21-10)(21-14)} \text{ cm}^2 \\ &= \sqrt{21 \times 3 \times 11 \times 7} \text{ m}^2 \\ &= 21\sqrt{11} \text{ cm}^2\end{aligned}$$

5. Sides of a triangle are in the ratio of 12 : 17 : 25 and its perimeter is 540cm. Find its area.

Answer

Ratio of the sides of the triangle = 12 : 17 : 25

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Let the common ratio be x then sides are $12x$, $17x$ and $25x$

Perimeter of the triangle = 540cm

$$12x + 17x + 25x = 540\text{ cm}$$

$$\Rightarrow 54x = 540\text{cm}$$

$$\Rightarrow x = 10$$

Sides of triangle are,

$$12x = 12 \times 10 = 120\text{cm}$$

$$17x = 17 \times 10 = 170\text{cm}$$

$$25x = 25 \times 10 = 250\text{cm}$$

$$\text{Semi perimeter of triangle(s)} = 540/2 = 270\text{cm}$$

Using heron's formula,

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

$$= \sqrt{270(270 - 120)(270 - 170)(270 - 250)}\text{cm}^2$$

$$= \sqrt{270 \times 150 \times 100 \times 20}\text{ cm}^2$$

$$= 9000\text{ cm}^2$$

6. An isosceles triangle has perimeter 30 cm and each of the equal sides is 12 cm. Find the area of the triangle.

Answer

Length of the equal sides = 12cm

Perimeter of the triangle = 30cm

Length of the third side = $30 - (12+12)\text{ cm} = 6\text{cm}$

Semi perimeter of the triangle(s) = $30/2\text{ cm} = 15\text{cm}$

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Using heron's formula,

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

$$= \sqrt{15(15 - 12)(15 - 12)(15 - 6)} \text{ cm}^2$$

$$= \sqrt{15 \times 3 \times 3 \times 9} \text{ cm}^2$$

$$= 9\sqrt{15} \text{ cm}^2$$

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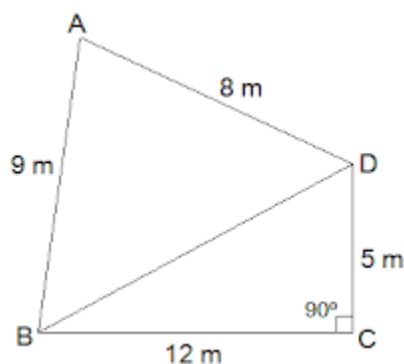
Exercise 12.2

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?

Answer

$\angle C = 90^\circ$, $AB = 9$ m, $BC = 12$ m, $CD = 5$ m and $AD = 8$ m

BD is joined.



In $\triangle BCD$,

By applying Pythagoras theorem,

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

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

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$$\Rightarrow BD^2 = 169$$

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

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

Now,

$$\text{Semi perimeter of } \triangle ABD(s) = (8 + 9 + 13)/2 \text{ m} = 30/2 \text{ m} = 15 \text{ m}$$

Using heron's formula,

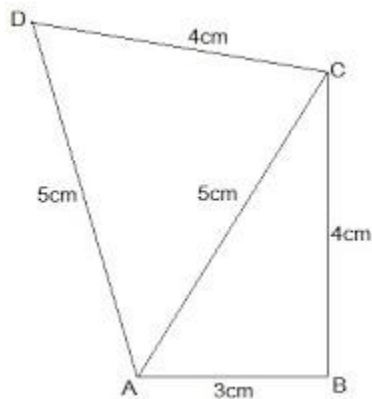
$$\begin{aligned}\text{Area of } \triangle ABD &= \sqrt{s(s-a)(s-b)(s-c)} \\ &= \sqrt{15(15-13)(15-9)(15-8)} \text{ m}^2 \\ &= \sqrt{15 \times 2 \times 6 \times 7} \text{ m}^2 \\ &= 6\sqrt{35} \text{ m}^2 = 35.5 \text{ m}^2 \text{ (approx)}\end{aligned}$$

$$\text{Area of quadrilateral ABCD} = \text{Area of } \triangle BCD + \text{Area of } \triangle ABD = 30 \text{ m}^2 + 35.5 \text{ m}^2 = 65.5 \text{ m}^2$$

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.

Answer

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



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In $\triangle ABC$,

By applying Pythagoras theorem,

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

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

$$\Rightarrow 25 = 25$$

Thus, $\triangle ABC$ is a right angled at B.

$$\text{Area of } \triangle ABC = \frac{1}{2} \times 3 \times 4 = 6 \text{ cm}^2$$

Now,

$$\text{Semi perimeter of } \triangle ABC (s) = (5 + 3 + 4)/2 \text{ cm} = 12/2 \text{ cm} = 6 \text{ cm}$$

Using heron's formula,

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

$$= \sqrt{6(6-5)(6-3)(6-4)} \text{ cm}^2$$

$$= \sqrt{6 \times 1 \times 3 \times 2} \text{ cm}^2$$

$$= 2\sqrt{6} \text{ cm}^2 = 4.90 \text{ cm}^2 \text{ (approx)}$$

$$\text{Area of quadrilateral ABCD} = \text{Area of } \triangle ABC + \text{Area of } \triangle ABC = 6 \text{ cm}^2 + 4.90 \text{ cm}^2 = 10.90 \text{ cm}^2$$

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.

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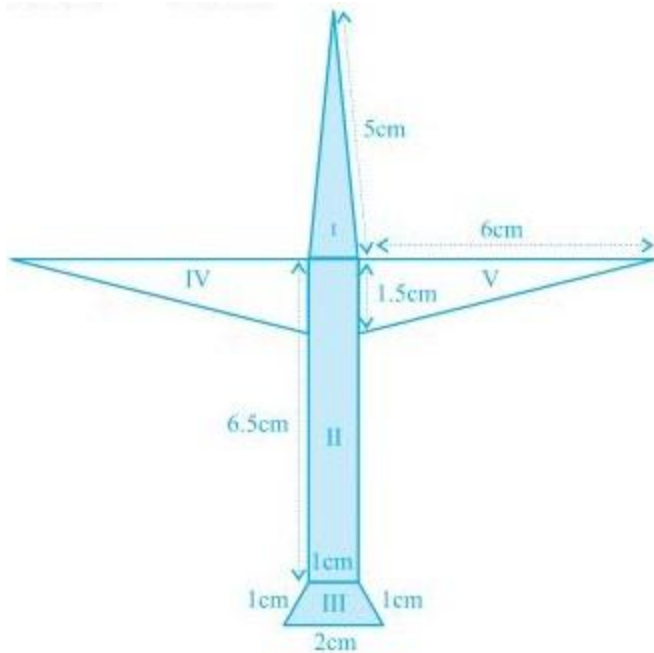


Fig. 12.15

Answer

Length of the sides of the triangle section I = 5cm, 1cm and 5cm

Perimeter of the triangle = $5 + 5 + 1 = 11\text{cm}$

Semi perimeter = $11/2 \text{ cm} = 5.5\text{cm}$

Using heron's formula,

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

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

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

$$= 0.75\sqrt{11} \text{ cm}^2 = 0.75 \times 3.317\text{cm}^2 = 2.488\text{cm}^2 \text{ (approx)}$$

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

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

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Section III is an isosceles trapezium which is divided into 3 equilateral of side 1cm each.

$$\text{Area of the trapezium} = 3 \times \frac{\sqrt{3}}{4} \times 1^2 \text{ cm}^2 = 1.3 \text{ cm}^2 \text{ (approx)}$$

Section IV and V are 2 congruent right angled triangles with base 6cm and height 1.5cm

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

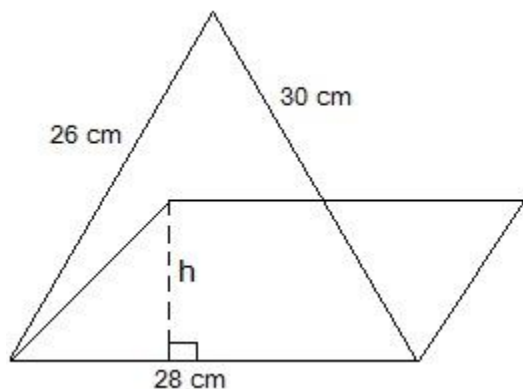
$$\text{Total area of the paper used} = (2.488 + 6.5 + 1.3 + 9) \text{ cm}^2 = 19.3 \text{ cm}^2$$

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.

Answer

Given,

Area of the parallelogram and triangle are equal.



Length of the sides of the triangle are 26 cm, 28 cm and 30 cm.

$$\text{Perimeter of the triangle} = 26 + 28 + 30 = 84 \text{ cm}$$

$$\text{Semi perimeter of the triangle} = 84/2 \text{ cm} = 42 \text{ cm}$$

Using heron's formula,

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

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$$\begin{aligned} &= \sqrt{42(42 - 26)(46 - 28)(46 - 30)} \text{ cm}^2 \\ &= \sqrt{46 \times 16 \times 14 \times 16} \text{ cm}^2 \\ &= 336 \text{ cm}^2 \end{aligned}$$

Let height of parallelogram be h .

Area of parallelogram = Area of triangle

$$28 \text{ cm} \times h = 336 \text{ cm}^2$$

$$\Rightarrow h = 336/28 \text{ cm}$$

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

The height of the parallelogram is 12 cm.

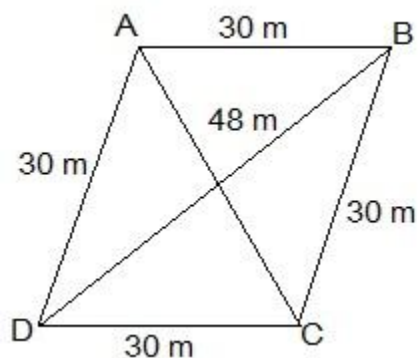
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5. A rhombus shaped field has green grass for 18 cows to graze. If each side of the rhombus is 30 m and its longer diagonal is 48 m, how much area of grass field will each cow be getting?

Answer

Diagonal AC divides the rhombus ABCD into two congruent triangles of equal area.



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

Using heron's formula,

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$$\begin{aligned}\text{Area of the } \triangle ABC &= \sqrt{s(s-a)(s-b)(s-c)} \\ &= \sqrt{54(54-30)(54-30)(54-48)} \text{ m}^2 \\ &= \sqrt{54 \times 24 \times 24 \times 6} \text{ cm}^2 \\ &= 432 \text{ m}^2\end{aligned}$$

$$\text{Area of field} = 2 \times \text{area of the } \triangle ABC = (2 \times 432) \text{ m}^2 = 864 \text{ m}^2$$

Thus,

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

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

Answer

$$\text{Semi perimeter of each triangular piece} = (50 + 50 + 20)/2 \text{ cm} = 120/2 \text{ cm} = 60 \text{ cm}$$

Using heron's formula,

$$\begin{aligned}\text{Area of the triangular piece} &= \sqrt{s(s-a)(s-b)(s-c)} \\ &= \sqrt{60(60-50)(60-50)(60-20)} \text{ cm}^2 \\ &= \sqrt{60 \times 10 \times 10 \times 40} \text{ cm}^2 \\ &= 200\sqrt{6} \text{ cm}^2\end{aligned}$$

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Area of triangular piece = $5 \times 200\sqrt{6} \text{ cm}^2 = 1000\sqrt{6} \text{ cm}^2$

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?

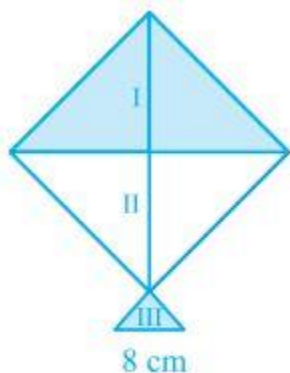


Fig. 12.17

Answer

We know that,

As the diagonals of a square bisect each other at right angle.

Area of given kite = $\frac{1}{2} (\text{diagonal})^2$

$$= \frac{1}{2} \times 32 \times 32 = 512 \text{ cm}^2$$

Area of shade I = Area of shade II

$$\Rightarrow 512/2 \text{ cm}^2 = 256 \text{ cm}^2$$

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

For the III section,

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

Semi perimeter of triangle = $(6 + 6 + 8)/2 \text{ cm} = 10 \text{ cm}$

Using heron's formula,

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$$\begin{aligned}
 \text{Area of the III triangular piece} &= \sqrt{s(s-a)(s-b)(s-c)} \\
 &= \sqrt{10(10-6)(10-6)(10-8)} \text{ cm}^2 \\
 &= \sqrt{10 \times 4 \times 4 \times 2} \text{ cm}^2 \\
 &= 8\sqrt{6} \text{ cm}^2
 \end{aligned}$$

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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 cm².

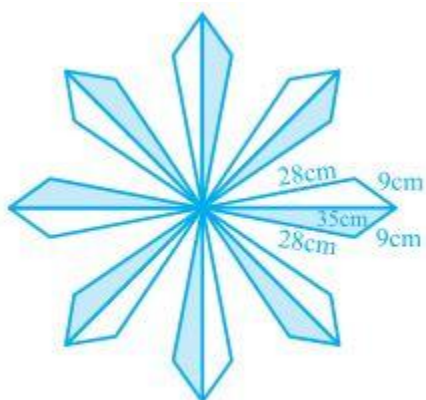


Fig. 12.18

Answer

Semi perimeter of the each triangular shape = $(28 + 9 + 35)/2 \text{ cm} = 36 \text{ cm}$

Using heron's formula,

$$\begin{aligned}
 \text{Area of the each triangular shape} &= \sqrt{s(s-a)(s-b)(s-c)} \\
 &= \sqrt{36(36-28)(36-9)(36-35)} \text{ cm}^2 \\
 &= \sqrt{36 \times 8 \times 27 \times 1} \text{ cm}^2 \\
 &= 36\sqrt{6} \text{ cm}^2 = 88.2 \text{ cm}^2
 \end{aligned}$$

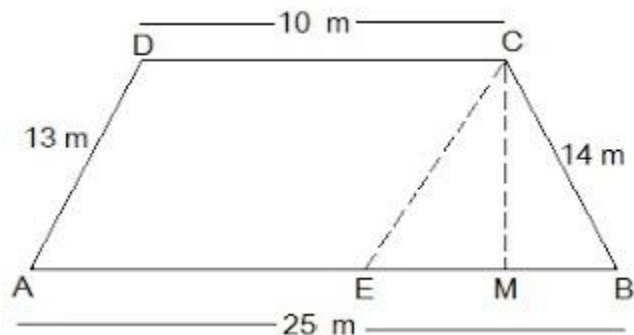
Total area of 16 tiles = $16 \times 88.2 \text{ cm}^2 = 1411.2 \text{ cm}^2$ Cost of polishing tiles = 50p per cm²

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Total cost of polishing the tiles = Rs. (1411.2×0.5) = Rs. 705.6

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.

Answer



Let ABCD be the given trapezium with parallel sides $AB = 25\text{m}$ and $CD = 10\text{m}$ and the non-parallel sides $AD = 13\text{m}$ and $BC = 14\text{m}$.

$CM \perp AB$ and $CE \parallel AD$.

In $\triangle BCE$,

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

$BE = AB - AE = 25 - 10 = 15\text{m}$

Semi perimeter of the $\triangle BCE = (15 + 13 + 14)/2\text{ m} = 21\text{ m}$

Using heron's formula,

$$\begin{aligned} \text{Area of the } \triangle BCE &= \sqrt{s(s-a)(s-b)(s-c)} \\ &= \sqrt{21(21-14)(21-13)(21-15)}\text{ m}^2 \\ &= \sqrt{21 \times 7 \times 8 \times 6}\text{ m}^2 \\ &= 84\text{ m}^2 \end{aligned}$$

also, area of the $\triangle BCE = 1/2 \times BE \times CM = 84\text{ m}^2$

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

$$\Rightarrow CM = 168/15 \text{ m}^2$$

$$\Rightarrow CM = 56/5 \text{ m}^2$$

$$\text{Area of the parallelogram AECD} = \text{Base} \times \text{Altitude} = AE \times CM = 10 \times 84/5 = 112 \text{ m}^2$$

$$\begin{aligned} \text{Area of the trapezium ABCD} &= \text{Area of AECD} + \text{Area of } \triangle BCE \\ &= (112 + 84) \text{ m}^2 = 196 \text{ m}^2 \end{aligned}$$

Chapter 12 Heron's Formula NCERT Solutions is a great way through which you can find area of triangles. You know area of a triangles is $\frac{1}{2} \times \text{base} \times \text{height}$. When it is not possible to find the height of the triangle easily and measures of all the three sides are known then we use Heron's formula.

• Area of a Triangle — by Heron's Formula:

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

where a, b and c are the sides of the triangle, and s = semi-perimeter, i.e., half the perimeter of the triangle = $a+b+c/2$

• Application of Heron's Formula in Finding Areas of Quadrilaterals: We will extend the use of Heron's Formula to find the area of quadrilaterals. We can divide the quadrilateral in triangular parts and then use the formula for area of the triangle.

There are only two exercises in chapter 12 Heron's Formula where you will learn to grasp key concepts of the chapter properly. Below you can find **exercisewise NCERT Solutions of Heron's Formula** just by clicking on the links.

Indcareer Schools experts have prepared these **Chapter 12 NCERT Solutions** that are detailed and accurate through which a student can clear their doubts easily. By solving the questions from Class 9 NCERT textbook, a student will gain confidence that is going to help them in exams.

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FAQ on Chapter 12 Heron's Formula

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What are the benefits of NCERT Solutions for Chapter 12 Heron's Formula Class 9 NCERT Solutions?

NCERT Solutions are very important in improving problem skills and understand all the important points of the chapter. Here we have detailed every solutions step by step so you can easily know the concepts.

How many exercises in Chapter 12 Heron's Formula?

Only two exercises are there in the chapter 12 Heron's Formula. In the first exercise, you need to find the area of triangles by using heron's formula. In the second exercise, you have to find the area of quadrilaterals. For finding area of a quadrilateral we divide it into various triangles. After we need to use Heron's formula to find the area of the triangles.

Find the length of a diagonal of a square whose side is 2 cm.

The diagonal of a square = $(\sqrt{2})$ a cm

$\therefore$ Length of the diagonal = $(\sqrt{2}) \times 2 \text{ cm} = 2\sqrt{2}\text{cm}$.

Find the height of an equilateral triangle whose side is 2 cm.

Since height of an equilateral triangle is given by

Height = $(\sqrt{3}/2) \times \text{side}$

$\Rightarrow \text{height} = (\sqrt{3}/2) \times 2 \text{ cm} = \sqrt{3} \text{ cm}$.

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- Chapter 2 Polynomials
- Chapter 3 Coordinate Geometry
- Chapter 4 Linear Equations in Two Variables
- Chapter 5 Introduction to Euclid's Geometry
- Chapter 6 Lines and Angles
- Chapter 7 Triangles
- Chapter 8 Quadrilaterals
- Chapter 9 Areas of Parallelograms and Triangles
- Chapter 10 Circles
- Chapter 11 Constructions
- Chapter 12 Heron's Formula
- Chapter 13 Surface Areas and Volumes
- Chapter 14 Statistics
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