CHAPTER TEST: HERON'S FORMULA

Mathematics | Class IX (2026/HERON/09/003)

Time: 1.5 Hours **Max. Marks: 40**

GENERAL INSTRUCTIONS

– All questions are compulsory.

– The question paper consists of **five sections: A, B, C, D, and E**.

– Section A contains **8 Multiple Choice Questions (MCQs)** of **1 mark each**.

– Section B contains **4 Very Short Answer questions** of **2 marks each**.

– Section C contains **3 Short Answer questions** of **3 marks each**.

– Section D contains **2 Long Answer questions** of **5 marks each**.

– Section E contains **1 Case Study–based question** of **5 marks**.

– Use of calculators or any electronic devices is **not permitted**, unless stated otherwise.

– All necessary working steps must be clearly shown for full marks.

– The use of appropriate units and correct mathematical symbols is compulsory.

Section A (Multiple Choice Questions - 1 Mark each)

1. If the side of an equilateral triangle is tripled, then its new area becomes k times the original area. The value of k is:

   (a) 3

   (b) 6

   (c) 9

   (d) 27

2. The semi-perimeter of an isosceles triangle is 12 cm. If the unequal side is 10 cm, the length of each equal side is:

   (a) 7 cm

   (b) 8 cm

   (c) 9 cm

   (d) 14 cm

3. Let a, b, and c be the sides of a triangle. If $(s-a) = 5$ cm, $(s-b) = 10$ cm, and $(s-c) = 1$ cm, then the area of the triangle is:

   (a) $20\sqrt{2}$ cm^2

(b) $10\sqrt{5}$ cm^2

(c) $4\sqrt{10}$ cm^2

(d) 20 cm^2

4. The sides of a triangle are in the ratio $3 : 4 : 5$. If its perimeter is 36 cm, its area is:

   (a) 54 cm^2

   (b) 60 cm^2

   (c) 48 cm^2

   (d) 72 cm^2

5. In Heron's formula, the term s represents:

   (a) Sum of any two sides

   (b) Half of the sum of three sides

   (c) Product of the three sides

   (d) Square root of the perimeter

6. An isosceles right-angled triangle has an area of 8 cm^2. The length of its hypotenuse is:

   (a) $\sqrt{32}$ cm

   (b) 4 cm

   (c) 4.8 cm

   (d) $\sqrt{24}$ cm

7. If the area of a triangle is A and its semi-perimeter is s, then the radius of its incircle (for a general triangle) is given by:

   (a) A/s

   (b) s/A

   (c) As

   (d) $2A/s$

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. To find the total area, we must multiply the area of one tile by:

   (a) 4

   (b) 8

   (c) 16

   (d) 32

Section B (Very Short Answer - 2 Marks each)

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

2. The base of a right triangle is 15 cm and its hypotenuse is 17 cm. Find its area using Heron's formula.

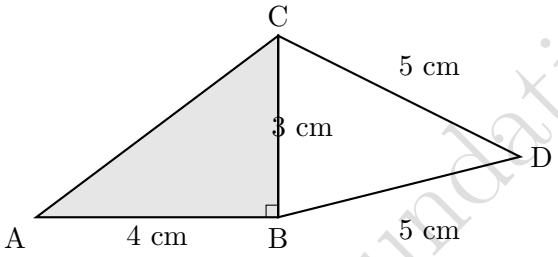
3. The sides of a triangular plot are in the ratio 3 : 5 : 7 and its perimeter is 300 m. Find its semi-perimeter and the value of $(s - c)$ where c is the longest side.

4. Find the area of an equilateral triangle whose perimeter is 60 cm. (Leave answer in surd form).

Section C (Short Answer - 3 Marks each)

1. 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.

2. Find the area of the shaded region in the figure given below:

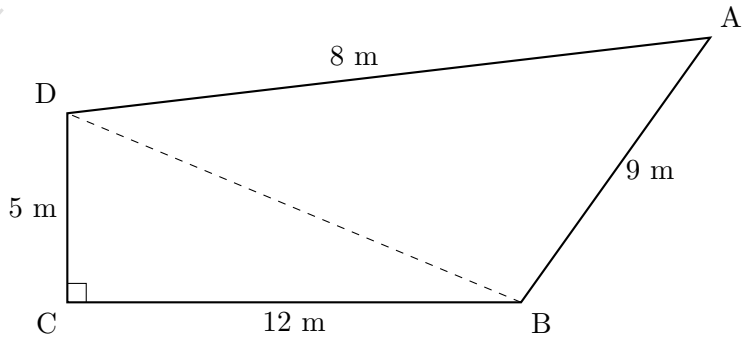


Note: Triangle ABC is right-angled at B. CD = 5 cm and BD = 5 cm. Find the area of quadrilateral ABCD.

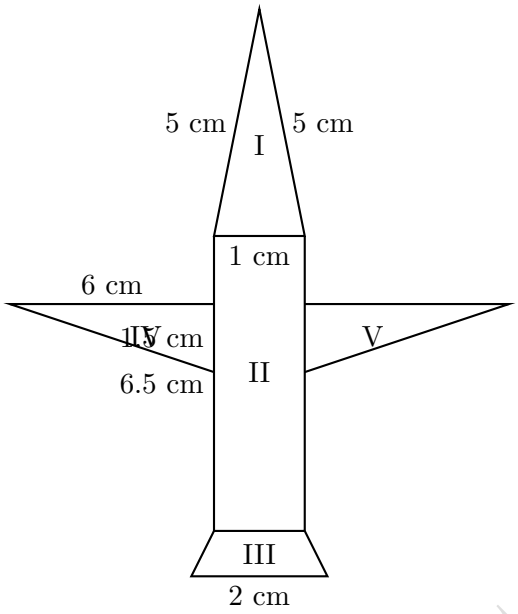
3. A traffic signal board, indicating 'SCHOOL AHEAD', is an equilateral triangle with side 'a'. Find the area of the signal board, using Heron's formula. If its perimeter is 180 cm, what will be the area of the signal board?

Section D (Long Answer - 5 Marks each)

1. A park, in the shape of a quadrilateral $ABCD$, has $\angle C = 90°$, $AB = 9$ m, $BC = 12$ m, $CD = 5$ m and $AD = 8$ m. How much area does it occupy?



2. Radha made a picture of an aeroplane with coloured paper as shown in the figure. Find the total area of the paper used.

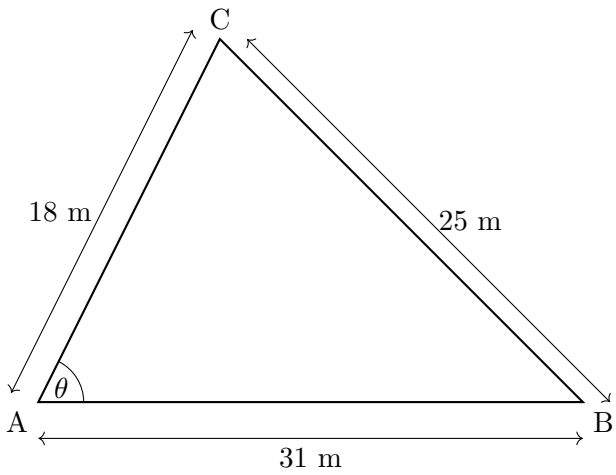


The dimensions are: Section I is an isosceles triangle (5cm, 5cm, 1cm). Section II is a rectangle (6.5cm × 1cm). Section III is an isosceles trapezium with parallel sides 1cm and 2cm and non-parallel sides 1cm each. Section IV and V are right-angled triangles with base 6cm and height 1.5cm.

Section E

Case Study Paragraph

An architect is designing a triangular glass roof for a metro station. The three steel edges of the roof measure 18 m, 25 m, and 31 m, fixed between concrete pillars at different heights. To estimate the glass required, the architect cannot rely on right angle assumptions and must compute the exact area accurately. First, the semi-perimeter of the triangular frame is calculated to combine all sides systematically. Using Heron's formula, the area is obtained without measuring any height, saving time and reducing construction error. Later, a rectangular waiting hall beside the roof is redesigned into a quadrilateral split into two triangles for area comparison. Accurate area calculations ensure material optimization, structural safety, and cost efficiency throughout the project. Budget forecasts and maintenance planning also depend on these precise geometric evaluations during long-term operations phases.



Multiple Choice Questions

1. Which mathematical quantity must be calculated first to apply Heron's formula?
   (a) Area
   (b) Height
   (c) Semi-perimeter
   (d) Base

2. Which formula is used to find the area of the triangular roof?
   (a) $\frac{1}{2}bh$
   (b) $\sqrt{s(s-a)(s-b)(s-c)}$
   (c) $a^2 + b^2 = c^2$
   (d) $l \times b$

3. Why is Heron's formula suitable in this architectural design?
   (a) All angles are right angles
   (b) Height is easily measurable
   (c) Only side lengths are known
   (d) The triangle is equilateral

4. If the waiting hall is split into two triangles, what remains unchanged?
   (a) Total area
   (b) Shape
   (c) Number of sides
   (d) Orientation

5. How does accurate area calculation benefit the project?
   (a) Increases pillar height
   (b) Reduces geometric relevance
   (c) Optimizes material and cost
   (d) Eliminates design constraints