SOLUTIONS

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SOLUTIONS: HERON'S FORMULA

Mathematics | Class IX (2026/HERON/09/002)

Section A: Multiple Choice Questions

1. **(b) 24 cm^2**: Sides ratio $3 : 4 : 5$. $3x + 4x + 5x = 24 \Rightarrow 12x = 24 \Rightarrow x = 2$. Sides are $6, 8, 10$. Since $6^2 + 8^2 = 10^2$, Area $= \frac{1}{2} \times 6 \times 8 = 24$.

2. **(b) 24 cm**: $\frac{\sqrt{3}}{4}a^2 = 16\sqrt{3} \Rightarrow a^2 = 64 \Rightarrow a = 8$. Perimeter $= 3 \times 8 = 24$.

3. **(c) Area**: This is the standard Heron's Formula for the area of a triangle.

4. **(c) 4**: Area $\propto a^2$. If $a \to 2a$, Area $\to (2)^2 = 4$ times.

5. **(a) 90 m**: $s = \frac{50+65+65}{2} = \frac{180}{2} = 90$.

6. **(b) 450 cm^2**: In an isosceles right triangle, base = height. Area $= \frac{1}{2} \times 30 \times 30 = 450$.

7. **(a) s**: $(s-a) + (s-b) + (s-c) = 3s - (a+b+c) = 3s - 2s = s$.

8. **(b) 120 cm^2**: Area of rhombus $= \frac{1}{2} \times d_1 \times d_2 = \frac{1}{2} \times 10 \times 24 = 120$.

Section B: Very Short Answer Questions

1. $s = \frac{13+14+15}{2} = 21$. Area $= \sqrt{21(21-13)(21-14)(21-15)} = \sqrt{21 \cdot 8 \cdot 7 \cdot 6} = \sqrt{7056} = 84$ cm^2.

2. Ratio $3 : 3 : 2$. $3x + 3x + 2x = 32 \Rightarrow 8x = 32 \Rightarrow x = 4$. Sides are 12 cm, 12 cm, 8 cm.

3. $s = (s-a) + (s-b) + (s-c) \Rightarrow 15 = 5 + 7 + (15-c) \Rightarrow 15 = 27 - c \Rightarrow c = 12$ cm.

4. $h = \frac{\sqrt{3}}{2}a = 6 \Rightarrow a = \frac{12}{\sqrt{3}} = 4\sqrt{3}$. Area $= \frac{\sqrt{3}}{4}(4\sqrt{3})^2 = \frac{\sqrt{3}}{4}(48) = 12\sqrt{3}$ cm^2.

Section C: Short Answer Questions

1. $s = \frac{120+80+50}{2} = 125$. Area $= \sqrt{125(125-120)(125-80)(125-50)} = \sqrt{125 \cdot 5 \cdot 45 \cdot 75} = 375\sqrt{15}$ m^2.

2. $\triangle ABC$ is right-angled ($3^2 + 4^2 = 5^2$). Area($\triangle ABC$) $= \frac{1}{2} \times 3 \times 4 = 6$ cm^2.
For $\triangle ADC$: $s = \frac{5+5+4}{2} = 7$. Area($\triangle ADC$) $= \sqrt{7(7-5)(7-5)(7-4)} = \sqrt{7 \cdot 2 \cdot 2 \cdot 3} = 2\sqrt{21}$ cm^2.
Total Area $= (6 + 2\sqrt{21})$ cm^2.

3. For one piece: $s = \frac{50+50+20}{2} = 60$. Area $= \sqrt{60(10)(10)(40)} = 200\sqrt{6}$ cm^2.
Total area for 5 pieces of one colour $= 5 \times 200\sqrt{6} = 1000\sqrt{6}$ cm^2.

Section D: Long Answer Questions

1. In $\triangle BCD$, $\angle C = 90° \Rightarrow BD = \sqrt{12^2 + 5^2} = 13$ m. Area$(\triangle BCD) = \frac{1}{2} \times 12 \times 5 = 30$ m^2.
   For $\triangle ABD$: $s = \frac{13+9+8}{2} = 15$. Area$(\triangle ABD) = \sqrt{15(15-13)(15-9)(15-8)} = \sqrt{15 \cdot 2 \cdot 6 \cdot 7} = 6\sqrt{35} \approx 35.5$ m^2.
   Total Area $\approx 30 + 35.5 = 65.5$ m^2.

2. Draw $CE \parallel DA$. $\triangle CBE$ has sides $14, 13$ and $(25 - 10) = 15$. $s = 21$.
   Area$(\triangle CBE) = \sqrt{21(7)(8)(6)} = 84$ m^2.
   Height $h = \frac{2 \times 84}{15} = 11.2$ m.
   Area of trapezium $= \frac{1}{2}(10 + 25) \times 11.2 = 196$ m^2.

Section E: Case Study

Answers: 1.(a) 25 m, 2.(b) 84 sq. m, 3.(c) 30 m, 4.(a) 150 sq. m, 5.(c) 234 sq. m.