CHAPTER - 13
Properties of Triangles

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I. C. MCQs with One Correct Answer

1) In a triangle ABC, $\angle B = \frac{\pi}{3}$ and $\angle C = \frac{\pi}{4}$. Let D divide BC internally in the ratio 1 : 3 then $\frac{\sin \angle BAD}{\sin \angle CAD}$ is equal to
   (a) $\frac{1}{\sqrt{6}}$
   (b) $\frac{1}{3}$
   (c) $\frac{1}{\sqrt{3}}$
   (d) $\sqrt{\frac{2}{3}}$

   (1995S)
2) In a triangle ABC, $2ac \sin \frac{1}{2}(A - B + C) =$
   (a) $a^2 + b^2 - c^2$
   (b) $c^2 + a^2 - b^2$
   (c) $b^2 - c^2 - a^2$
   (d) $c^2 - a^2 - b^2$

   (2000S)
3) In a triangle ABC, let $\angle C = \frac{\pi}{2}$. If r is the inradius and R is the circumradius of the triangle, then $2(r + R)$ is equal to
   (a) $a + b$
   (b) $b + c$
   (c) $c + a$
   (d) $a + b + c$

   (2000S)
4) A pole stands vertically inside a triangular park $\triangle ABC$. If the angle of elevation of the top of the pole from each corner of the park is same, then in $\triangle ABC$ the foot of the pole is at the
   (a) centroid
   (b) circumcentre
   (c) incentre
   (d) orthocentre

   (2000S)
5) A man from the top of a 100 metres high tower sees a car moving towards the tower at an angle of depression of 30°. After some time, the angle of depression becomes 60°. The distance (in metres) travelled by the car during this time is
   (a) $100\sqrt{3}$
   (b) $\frac{200\sqrt{3}}{3}$
   (c) $\frac{100\sqrt{3}}{3}$
   (d) $200\sqrt{3}$

   (2001S)
6) Which of the following pieces of data does NOT uniquely determine an acute-angled triangle $\triangle ABC$ (R being the radius of the circumcircle)?
   (a) $a, \sin A, \sin B$
   (b) a, b, c
   (c) $a, \sin B, R$
   (d) $a, \sin A, R$

   (2002S)
7) If the angles of a triangle are in the ratio 4 : 1 : 1, then the ratio of the longest side to the perimeter is
   (a) $\sqrt{3} : 2 + \sqrt{3}$
   (b) 1 : 6
   (c) $1 : 2 + \sqrt{3}$
   (d) 2 : 3

   (2003S)
8) The sides of a triangle are in the ratio $1 : \sqrt{3} : 2$, then the angles of the triangle are in the ratio
   (a) 1 : 3 : 5
   (b) 2 : 3 : 4
   (c) 3 : 2 : 1
   (d) 1 : 2 : 3

   (2004S)
9) In an equilateral triangle, 3 coins of radii 1 unit each are kept so they touch each other and also the sides of the triangle. Area of the triangle is
   (a) $4 + 2\sqrt{3}$
   (b) $6 + 4\sqrt{3}$
   (c) $12 + \frac{7\sqrt{3}}{4}$
   (d) $3 + \frac{7\sqrt{3}}{4}$

   (2005S)
10) In a triangle ABC, a, b, c are the lengths of its

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sides and A, B, C are the angles of triangle ABC. The correct relation is given by

(a) $(b-c)\sin\left(\frac{B-C}{2}\right) = a\cos\left(\frac{A}{2}\right)$
(b) $(b-c)\cos\frac{A}{2} = a\sin\left(\frac{B-C}{2}\right)$
(c) $(b+c)\sin\left(\frac{B+C}{2}\right) = a\cos\left(\frac{A}{2}\right)$
(d) $(b-c)\cos\frac{A}{2} = a\sin\left(\frac{B+C}{2}\right)$

(2005S)

11) One angle of an isosceles $\triangle$ is $120°$ and radius of its incircle $= \sqrt{3}$. Then the area of the triangle in sq. units is

(a) $7 + 12\sqrt{3}$
(b) $12 - 7\sqrt{3}$
(c) $12 + 7\sqrt{3}$
(d) 4π

(2006 - 3M, -1)

12) Let $ABCD$ be a quadrilateral with area 18, with side AB parallel to the side CD and $2AB = CD$. Let AD be perpendicular to AB and CD. If a circle is drawn inside the quadrilateral $ABCD$ touching all the sides, then the radius is

(a) 3
(b) 2
(c) $\frac{3}{2}$
(d) 1

(2007 - 3 Marks)

13) If the angles A, B and C of a triangle are in an arithmetic progression and if $a, bandc$ denote the lengths of the sides opposite to A, B and C respectively, then the value of the expression $\frac{a}{c}\sin 2C + \frac{c}{a}\sin 2A$ is

(a) $\frac{1}{2}$
(b) $\frac{\sqrt{3}}{2}$
(c) 1
(d) $\sqrt{3}$

(2010)

14) Let PQR be a triangle of area Δ with $a = 2, b = \frac{7}{2}$ and $c = \frac{5}{2}$, where a, b and c are the lengths of the sides of the triangle opposite to the angles at P, Q and R respectively. Then $\frac{2\sin P - \sin 2P}{2\sin P + \sin 2P}$ equals

(a) $\frac{3}{4\Delta}$
(b) $\frac{45}{4\Delta}$
(c) $\left(\frac{3}{4\Delta}\right)^2$
(d) $\left(\frac{45}{4\Delta}\right)^2$

(2012)

15) In a triangle the sum of two sides is x and the product of the same sides is y. If $x^2 - c^2 = y$, where c is the third side od the triangle, then the ratio of the inradius to the circum-radius of the triangle is

(a) $\frac{3y}{2x(x+c)}$
(b) $\frac{3y}{2c(x+c)}$
(c) $\frac{3y}{4x(x+c)}$
(d) $\frac{3y}{4c(x+c)}$

(JEE Adv. 2014)