Chapter 13 Properties of Triangle

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3) The sum of the radii of inscribed and circumscribed circles for an n sided regular polygon of side a, is (2003)

a) $\frac{a}{4}\cot\left(\frac{\pi}{2n}\right)$ c) $\frac{a}{2}\cot\left(\frac{\pi}{2n}\right)$
b) $a\cot\left(\frac{\pi}{n}\right)$ d) $a\cot\left(\frac{\pi}{2n}\right)$

4) In a triangle ABC, medians AD and BE are drawn. If $AD = 4, \angle DAB = \frac{\pi}{6}$ *and* $\angle ABE = \frac{\pi}{3}$, then the area of the ΔABC is (2003)

a) $\frac{64}{3}$ b) $\frac{8}{3}$ c) $\frac{16}{3}$ d) $\frac{32}{3\sqrt{3}}$

5) If in ΔABC $a\cos^2\left(\frac{C}{2}\right) + c\cos^2\left(\frac{A}{2}\right) = \frac{3b}{2}$, then the sides a, b *and* c (2003)

a) satisfy $a + b = c$ c) are in G.P.
b) are in A.P. d) are in H.P.

6) The sides of a triangle are $\sin\alpha, \cos\alpha$ *and* $\sqrt{1 + \sin\alpha\cos\alpha}$ for some $0 < \alpha < \frac{\pi}{2}$. Then the greatest angle of the triangle is (2004)

a) 150° b) 90° c) 120° d) 60°

7) A person standing on the bank of a river observes that the angle of elevation of the top of a tree on the opposite bank of the river is 60° and when he retires 40 meters away from the tree, the angle of elevation becomes 30°. The breadth of the river is (2004)

a) $60m$ b) $30m$ c) $40m$ d) $20m$

8) In a triangle ABC, let $\angle C = \frac{\pi}{2}$. If r is the inradius and R is the circumradius of the triangle ABC, then $2(R + r)$ equals (205)

a) $b + c$ b) $a + b$ c) $a+b+c$ d) $c + a$

9) If in a ΔABC, let the altitudes from the vertices A, B, C on opposite sides are in H.P., then $\sin A, \sin B, \sin C$ are in (2005)

a) *G.P.* c) *A.P.* – *G.P.*
b) *A.P.* d) *H.P.*

10) A tower stand at the centre of a circular park. A and B are two points on the boundary of the park such that $AB\,(= a)$ subtends an angle of 60° at the foot of the tower, and the angle of elevation of the top of the tower from A or B is 30°. The height of the tower is (2007)

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

11) AB is a vertical pole with B at the ground level and A at the top. A man finds that the angle of elevation the the point A from a certain point C on the ground is 60°. He moves away from the pole along the line BC to a point D such that $CD = 7m$. From D the angle of elevation of point A is 45°. Then the height of the pole is (2008)

a) $\frac{7\sqrt{3}}{2}\frac{1}{\sqrt{3}-1}m$ c) $\frac{7\sqrt{3}}{2}\left(\sqrt{3}-1\right)m$
b) $\frac{7\sqrt{3}}{2}\left(\sqrt{3}+1\right)m$ d) $\frac{7\sqrt{3}}{2}\frac{1}{\sqrt{3}+1}m$

12) For a regular polygon, let r and R be the radii of the inscribed and the circumscribed circles. A false statement among the following is (2010)

a) There is a regular polygon with $\frac{r}{R} = \frac{1}{\sqrt{2}}$
b) There is a regular polygon with $\frac{r}{R} = \frac{2}{3}$
c) There is a regular polygon with $\frac{r}{R} = \frac{\sqrt{3}}{2}$
d) There is a regular polygon with $\frac{r}{R} = \frac{1}{2}$

13) A bird is sitting on the top of a vertical pole $20m$ high and its elevation from a point O on the ground is 45°. It flies off horizontally straight away from the point O. After one second, the elevation of the bird from O is reduced to 30°. Then the speed in $(in\ m/s)$ of the bird is (JEE M 2014)

a) $20\sqrt{2}$ c) $40\left(\sqrt{2}-1\right)$
b) $20\left(\sqrt{3}-1\right)$ d) $40\left(\sqrt{3}-\sqrt{2}\right)$

14) If the angle of elevation of the top of a tower from three colinear points $A, B\,and\,C$ on a line leading to foot of the tower, are $30°, 45°\,and\,60°$ respectively, then the ratio, $AB : BC$, is:
(JEE M 2015)

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

15) Let a vertical tower AB have its end A on the level ground. Let C be the mid-point of AB and P be a point on the ground such that $AP = 2AB$. If $\angle BPC = \beta$, then $\tan\beta$ is equal to:
(JEE M 2017)

a) $\frac{4}{9}$
b) $\frac{6}{7}$
c) $\frac{1}{4}$
d) $\frac{2}{9}$

16) PQR is a triangular park with $PQ = PR = 200m$. A T.V. tower stands at the mid-point of QR. If the angles of the elevation of the top of the tower at P,Q and R are respectively $45°, 30°\,and\,30°$, then the height of the tower $(in\,m)$ is:
(JEE M 2018)

a) 50
b) $100\sqrt{3}$
c) $50\sqrt{2}$
d) 100