MATHS

BOOKS - CENGAGE PUBLICATION

PROPERTIES AND SOLUTIONS OF TRIANGLE

Example

1. In triangle ABC, D is on AC such that $AD = BC'$ and $BD = DC, \angle DBC = 2x, and \angle BAD = 3x,$ all angles are in degrees, then find the value of `x

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2. In a circle of radius r, chords of length $a and b cm$ subtend angles $\theta and 3\theta$, respectively, at the center. Show that $r = a\sqrt{\frac{a}{3a-b}} cm$

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3. Perpendiculars are drawn from the anglesA, B,C,of an acute angles Δ on the opposite sodes and products to meet the circumscribing circle. If these produced parts be $\propto, \beta, \gamma$ respectively, show that

$$\frac{a}{\propto} + \frac{b}{\beta} + \frac{c}{\gamma} = 2(\tan A + \tan B + \tan C$$

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4. D, E, F are three points on the sides BC, CA, AB, respectively, such that $\angle ADB = \angle BEC = \angle CFA = \theta$. $A', B'C'$ are the points of intersections of the lines AD, BE, CF inside the triangle. Show that are of $A'B'C' = 4\cos^2\theta$, where is the area of ABC.

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5. In ABC, as semicircle is inscribed, which lies on the side $\cdot$ If x is the lengthof the angle bisector through angle C, then prove that the radius of the semicircle is $x\sin\left(\frac{C}{2}\right)$.

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6. Given the base of a triangle, the opposite angle A, and the product k^2 of the other two sides, show that it is not possible for a to be less than $2k\frac{\sin A}{2}$

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7. In a triangle of base a, the ratio of the other sides is $r(\ <1)$. Show that the attitude of the triangle is less than or equal to $\frac{ar}{1-r^2.}$

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8. Let ABC be a triangle with incentre I. If P and Q are the feet of the perpendiculars from A to BI and CI, respectively, then prove that $\frac{AP}{BI}+\frac{AQ}{Cl}=\cot.\ \frac{A}{2}$

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9. Let O be the circumcentre and H be the orthocentre of an acute angled triangle ABC. If $A > B > C$, then show that $Ar(\Delta BOH) = Ar(\Delta AOH) + Ar(\Delta COH)$

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10. If I is the incenter of ΔABC and $R_1, R_2,$ and R_3 are, respectively, the radii of the circumcircle of the triangle IBC, ICA, and IAB, then prove that $R_1R_2R_3 = 2rR^2$

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11. Show that the line joining the incenter to the circumcenter of triangle ABC is inclined to the side BC at an angle

$\tan^{-1}\left(\frac{\cos B+\cos C-1}{\sin C-\sin B}\right)$

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12. In a ΔABC, the median to the side BC is of length $\frac{1}{\sqrt{11-6\sqrt{3}}}$ and it divides the $\angle A$ into angles 30° and 45° Find the length of the side BC.

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13. Three circle touch one another externally. The tangents at their points of contact meet at a point whose distance from the point of contant is 4. If the ratio of the product of the radii to the sum of the radii of the circle is λ, then $\frac{\lambda}{2}$ is ....

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14. Let ABC be a triangle with incentre I and inradius r. Let D, E, F be the feet of the perpendiculars from I to the sides BC, CA and AB, respectively, If $r_2 \quad \text{and} \quad r_3$ are the radii of circles inscribed in the quadrilaterls AFIE, BDIF and CEID respectively, then prove that $\frac{r_1}{r-r_1}+\frac{r_2}{r-r_2}+\frac{r_3}{r-r_3}=\frac{r_1r_2r_3}{(r-r_1)(r-r_2)(r-r_3)}$

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15. In convex quadrilateral $ABCD, AB=a, BC=b, CD=c, DA=d$. This quadrilateral is such that a circle can be inscribed in it and a circle can also be circumscribed about it. Prove that $\frac{\tan^2 A}{2}=\frac{bc}{ad}.$

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Illustration

1. If an a triangle $ABC, a = 3b$ and $B - A = 90^0$, then find the value of $\tan A$

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2. In a triangle ABC if $BC = (3)^{\frac{1}{2}}$ and $AC = 2$, then what is the maximum possible value of angle A?

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3. The perimeter of a triangle ABC is saix times the arithmetic mean of the sines of its angles. If the side $ais1$ then find angle A.

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4. If $A = 75^0, b = 45^0$, then prove that $b + c\sqrt{2} = 2a$

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5. If the base angles of triangle are $\frac{22}{12} and 112 \frac{1}{2^0}$, then prove that the altitude of the triangle is equal to $\frac{1}{2}$ of its base.

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6. If a^2, b^2, c^2 are in A.P., then prove that $\tan A, \tan B, \tan C$ are in H.P.

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7. Prove that $\frac{a^2\sin(B-C)}{\sin B+\sin C}+\frac{b^2\sin(C-A)}{\sin C+\sin A}+\frac{c^2\sin(A-B)}{\sin A+\sin B}=0$

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8. in $\triangle ABC$ if $\frac{a^2+b^2}{a^2-b^2}=\frac{\sin(A+B)}{\sin(A-B)}$ then prove that it is either a right angled or an isosceles triangle.

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9. ABCD is a trapezium such that AB,DC.are parallel and BC is perpendicular to them. If $\angle ADB=\theta, BC=p$ and $CD=q$, show that AB=$\frac{(p^2+q^2)\sin\theta}{p\cos\theta+q\sin\theta}$

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10. In a $\mathrm{Delta}\mathrm{A}\ \mathrm{B}\ \mathrm{C}, \backslash\ \angle\mathrm{C} = 60\backslash\ \ \& \angle A = 75.$ If D is a point on AC such that area of the"Delta"BAD is $\sqrt{3}$ times the area of the $\mathrm{Delta}\mathrm{B}\ \mathrm{C}\ \mathrm{D},$ then the $\angle\mathrm{A}\ \mathrm{B}\ \mathrm{D} =$ 60^0 (b) 30^0 (c) 90^0 (d) none of these

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11. In a scalene triangle ABC, D is a point on the side AB such that $CD^2 = AD \cdot DB$, sin $\sin A \cdot \sin B = \dfrac{\sin^2 C}{2}$ then prove that CD is internal bisector of $\angle C\cdot$

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12. In a triangle $ABC, \angle A = 60^0 andb : c = (\sqrt{3}+1) : 2,$ then find the value of $(\angle B - \angle C)\cdot$

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13. If the median AD of triangle ABC makes an angle $\frac{\pi}{4}$ with the side BC, then find the value of $|\cot B - \cot C|$.

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14. The base of a triangle is divided into three equal parts. If t_1, t_2, t_3 are the tangents of the angles subtended by these parts at the opposite vertex, prove that $\left(\frac{1}{t_1} + \frac{1}{t_2}\right)\left(\frac{1}{t_2} + \frac{1}{t_3}\right) = 4\left(1 + \frac{1}{t22}\right)$.

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15. In ABC, prove that $(a-b)^2 \frac{\cos^2 C}{2} + (a+b)^2 \frac{\sin^2 C}{2} = c^2$.

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16. In $ABC, \; =$ if $(a+b+c)(a-b+c)=3ac,$ then find $\angle B$.

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17. If $a=\sqrt{3}, b=\frac{1}{2}\left(\sqrt{6}+\sqrt{2}\right)$. and $c=2,$ then find $\angle A$

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18. The sides of a triangle are $x^2+x+1, 2x+1, and x^2-1$. Prove that the greatest angle is 120^0.

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19. If the angles A,B,C of a triangle are in A.P. and sides a,b,c, are in G.P., then prove that a^2, b^2, c^2 are in A.P.

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20. Let a, b and c be the three sides of a triangle, then prove that the equation $b^2x^2 + (b^2 + c^2 - a^2)x + c^2 = 0$ has imaginary roots.

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21. Let $a \leq b \leq c$ be the lengths of the sides of a triangle. If `a^2+b^2

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22. In a triangle ABC, if the sides a,b,c, are roots of $x^3 - 11x^2 + 38x - 40 = 0,$ then find the value of $\frac{\cos A}{a} + \frac{\cos B}{b} + \frac{\cos C}{c}$

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23. If in a triangle $ABC, \angle C = 60^0,$ then prove that $\frac{1}{a+c} + \frac{1}{b+c} = \frac{3}{a+b+c}.$

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24. In a triangle, if the angles $A, B, andC$ are in A.P. show that $2\frac{\cos 1}{2}(A - C) = \frac{a+c}{\sqrt{a^2 - ac + c^2}}$

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25. If $a = 9, b = 4andc = 8$ then find the distance between the middle point of BC and the foot of the perpendicular form A.

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26. Three parallel chords of a circle have lengths 2,3,4 units and subtend angles $\alpha, \beta, \alpha + \beta$ at the centre, respectively `(alpha

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27. In a cyclic quadrilateral PQRS, PQ= 2 units, QR= 5 units, RS=3 units and $\angle PQR = 60^0$, then what is the measure of SP?

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28. Prove that $a(b\cos C - c\cos B) = b^2 - c^2$

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29. If in a triangle $a\cos^2\left(\frac{C}{2}\right)+c\cos^2\left(\frac{A}{2}\right)=\frac{3b}{2}$, then find the relation between the sides of the triangle.

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30. Prove that $(b+c)\cos A+(c+a)\cos B+(a+b)\cos C=2s$.

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31. If $\cos\left(\frac{A}{2}\right)=\sqrt{\frac{b+c}{2c}}$, then prove that $a^2+b^2=c^2$.

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32. If the cotangents of half the angles of a triangle are in A.P., then prove that the sides are in A.P.

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33. If A, B and C are interior angles of a triangle ABC, then show that $\sin\left(\frac{B+C}{2}\right) = \cos\left(\frac{A}{2}\right)$

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34. In $ABC, \left(\cot\left(\frac{A}{2}\right) + \cot\left(\frac{B}{2}\right)\right)\left(a\sin^2\left(\frac{B}{2}\right) + b\sin^2\left(\frac{A}{2}\right)\right) =$

(a) $\cot C$ (b) $c\cot C$ (c) $\cot\left(\frac{C}{2}\right)$ (d) $c\cot\left(\frac{C}{2}\right)$

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35. Find the value of tan A, if area of ΔABC is $a^2 - (b-c)^2$.

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36. Prove that $a^2 \sin 2B + b^2 \sin 2A = 4\Delta$

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37. For any triangle ABC,

$\frac{(a+b+c)(b+c-a)(c+a-b)(a+b-c)}{4b^2c^2}$ is equal to

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38. If the sides of a triangle are $17, 25 and 28$, then find the greatest length of the altitude.

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39. In equilateral triangle ABC with interior point D, if the perpendicular distances from D to the sides of 4,5, and 6, respectively, are given, then find the area of $\triangle ABC$.

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40. If area of a triangle is 2 sq. units, then find the value of the product of the arithmetic mean of the lengths of the sides of a triangle and harmonic mean of the lengths of the altitudes of the triangle.

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41. A triangle has sides 6,7, and 8. The line through its incenter parallel to the shortest side is drawn to meet the other two sides at P and Q. Then find the length of the segment PQ.

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42. Each side of triangle ABC is divided into three equal parts. Find the ratio of the area of hexagon $PQRSTU$ to the area of the triangle ABC.

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43. The two adjacent sides of a cyclic quadrilateral are $2 \text{ and } 5$ and the angle between them is 60^0. If the area of the quadrilateral is $4\sqrt{3}$, find the remaining two sides.

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44. In triangle $ABC, a : b : c = 4 : 5 : 6$. The ratio of the radius of the circumcircle to that of the incircle is____.

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45. Given a triangle ABC with sides a=7, b=8 and c=5. Find the value of expression $(\sin A + \sin B + \sin C)\left(\frac{\cot A}{2} + \frac{\cot B}{2} + \frac{\cot C}{2}\right)$

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46. If $b = 3, c = 4, and B = \frac{\pi}{3}$, then find the number of triangles that can be constructed.

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47. If $A = 30^0, a = 7,$ and $b = 8$ in ABC, then find the number of triangles that can be constructed.

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48. If in triangle ABC, $(a = (1 + \sqrt{3})cm, b = 2cm, and\angle C = 60^0$, then find the other two angles and the third side.

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49. In $ABC, sidesb, c$ and angle B are given such that a has two values a_1 and a_2. Then prove that $|a_1 - a_2| = 2\sqrt{b^2 - c^2 \sin^2 B}$

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50. In $ABC, a, c and A$ are given and b_1, b_2 are two values of the third side b such that $b_2 = 2b_1$. Then prove that $\sin A = \sqrt{\frac{9a^2 - c^2}{8c^2}}$

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51. O is the circumcenter of $ABC and R_1, R_2, R_3$ are respectively, the radii of the circumcircles of the triangle OBC, OCA and OAB. Prove that $\frac{a}{R_1} + \frac{b}{R_2} + \frac{c}{R_3} = \frac{abc}{R_3}$

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52. In $ABC, C = 60^0 and B = 45^0$. Line joining vertex A of triangle and its circumcenter (O) meets the side BC in D Find the ratio $BD : DC$ and $AO : OD$

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53. The diameters of the circumcirle of triangle ABC drawn from A,B and C meet BC, CA and AB, respectively, in L,M and N. Prove that $\frac{1}{AL} + \frac{1}{BM} + \frac{1}{CN} = \frac{2}{R}$

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54. Find the lengths of chords of the circumcircle of triangle ABC, made by its altitudes________

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55. Let ABC be a triangle with $\angle B = 90^0$. Let AD be the bisector of $\angle A$ with D on BC. Suppose AC=6cm and the area of the triangle ADC is $10cm^2$. Find the length of BD.

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56. If the distances of the vertices of a triangle =ABC from the points of contacts of the incercle with sides are $\alpha, \beta and \gamma$ then prove that $r^2 = \frac{\alpha\beta\gamma}{\alpha + \beta + \gamma}$

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57. If $x, y and z$ are the distances of incenter from the vertices of the triangle ABC , respectively, then prove that $\frac{abc}{xyz} = \cot\left(\frac{A}{2}\right)\cot\left(\frac{B}{2}\right)\cot\left(\frac{C}{2}\right)$

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58. prove that cosA +cosB+cosC=1+r/R.

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59. Prove that $\frac{a \cos A + b \cos B + c \cos C}{a+b+c} = \frac{r}{R}$.

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60. Incircle of ABC touches the sides BC, CA and AB at D, E and F, respectively. Let r_1 be the radius of incircle of BDF. Then prove that $r_1 = \frac{1}{2} \frac{(s-b)\sin B}{\left(1+\sin\left(\frac{B}{2}\right)\right)}$

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61. In an acute angled triangle ABC, a semicircle with radius r_a is constructed with its base on BC and tangent to the other two sides. $r_b and r_c$ are defined similarly. If r is the radius of the incircle of triangle ABC then prove that $\frac{2}{r} = \frac{1}{r_a} + \frac{1}{r_b} + \frac{1}{r_c}$.

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62. Let the incircle with center I of ABC touch sides BC, CA and AB at D, E, F, respectively. Let a circle is drawn touching ID, IF and incircle of ABC having radius r_2. similarly $r_1 and r_3$ are defined. Prove that $\frac{r_1}{r - r_1} \frac{\dot{r}_2}{r - r_2} \frac{\dot{r}_3}{r - r_3} = \frac{a + b + c}{8R}$

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63. In ABC, the bisector of the angle A meets the side BC at D andthe circumscribed circle at E. Prove that $DE = \frac{a^2 \frac{\sec A}{2}}{2(b+c)}$

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64. Let I be the incetre of ΔABC having inradius r. AI, BI and Ci intersect incircle at D, E and F respectively. Prove that area of ΔDEF is $\frac{r^2}{2}\left(\cos.\frac{A}{2}+\cos.\frac{B}{2}+\cos.\frac{C}{2}\right)$

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65. In ABC, the three bisectors of the angle A, B and C are extended to intersect the circumcircle at D,E and F respectively. Prove that $AD\frac{\cos A}{2}+BE\frac{\cos B}{2}+CF\frac{\cos C}{2}=2R(\sin A+\sin B+\sin C)$

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66. Given a right triangle with $\angle A = 90^{\circ}$. Let M be the mid-point of BC. If the radii of the triangle ABM and ACM are r_1 and r_2 then find the range of $\frac{r_1}{r_2}$.

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67. Prove that the distance between the circumcenter and the incenter of triangle ABC is $\sqrt{R^2 - 2Rr}$

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68. Prove that $a \cos A + b \cos B + osC \leq s$.

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69. about to only mathematics

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70. If in ABC, the distances of the vertices from the orthocentre are x, y, and z, then prove that $\frac{a}{x}+\frac{b}{y}+\frac{c}{z}=\frac{abc}{xyz}$

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71. ABC is an acute angled triangle with circumcenter O and orthocentre H. If AO=AH, then find the angle A.

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72. In a acute angled triangle ABC, proint D, E and F are the feet of the perpendiculars from A,B and C onto BC, AC and AB, respectively. H is orthocentre. If $\sin A = \frac{3}{5} and BC = 39,$ then find the length of AH

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73. Prove that he distance between the circum-centre and the ortho-centre of a triangle ABC is $R\sqrt{1 - 8\cos A \cos B \cos C.}$

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74. Let ABC be an acute angled triangle whose orthocentre is at H. If altitude from A is produced to meet the circumcircle of triangle ABC at D , then prove $HD = 4R\cos B\cos C$

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75. In ABC, let L, M, N be the feet of the altitudes. The prove that

$$\sin(\angle MLN) + \sin(\angle LMN) + \sin(\angle MNL) = 4 \sin A \sin B \sin C$$

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76. The lengths of the medians through acute angles of a right-angled triangle are 3 and 4. Find the area of the triangle.

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77. Two medians drawn from the acute angles of a right angled triangle intersect at an angle $\frac{\pi}{6}$. If the length of the hypotenuse of the triangle is $3units,$ then the area of the triangle (in sq. units) is $\sqrt{3}$ (b) 3 (c) $\sqrt{2}$ (d) 9

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78. Prove that $r_1 + r_2 + r_3 - r = 4R$

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79. If $r_1 = r_2 + r_3 + r,$ prove that the triangle is right angled.

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80. Prove that $\frac{r_{1+r_2}}{1} = 2R$

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81. Prove that (r+r1)tan((B-C)/2)+(r+r2)tan((C-A)/2)+(r+r3)tan((A-B)/2)=0

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82. If the distance between incenter and one of the excenter of an equilateral triangle is 4 units, then find the inradius of the triangle.

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83. If I_1, I_2, I_3 are the centers of escribed circles of triangle ABC, show that area of triangle $I_1 I_2 I_3 = \frac{abc}{2r}$.

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84. Prove that the sum of the radii of the circles, which are, respectively, inscribed and circumscribed about a polygon of n sides, whose side length is a, is $\frac{a}{2}\cot\frac{\pi}{2n}$

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85. If the area of the circle is A_1 and the area of the regular pentagon inscribed in the circle is A_2, then find the ratio $\frac{A_1}{A_2}$.

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86. Prove that the area of a regular polygon hawing $2n$ sides, inscribed in a circle, is the geometric mean of the areas of the inscribed and circumscribed polygons of n sides.

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Concept Application Exercise 5 1

1. Find the value of $\frac{a^2 + b^2 + c^2}{R^2}$ in any right-angled triangle.

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2. Let the angles $A, BandC$ of triangle ABC be in $A\dot{P}$. and let $b : c$ be $\sqrt{3} : \sqrt{2}$. Find angle A.

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3. In a triangle ABC, if $(\sqrt{3} - 1)a = 2b,\ A = 3B$, then $\angle C$ is

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4. If cosA/a=cosB/b=cosC/cand the side a=2, then area of triangle is

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5. In triangle ABC, if $\cos^2 A + \cos^2 B - \cos^2 C = 1$, then identify the type of the triangle

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6. Prove that $b^2 \cos 2A - a^2 \cos 2B = b^2 - a^2$

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7. In any triangle ABC , prove that following :

$$\frac{c}{a+b}=\frac{1-\tan\left(\frac{A}{2}\right)\tan\left(\frac{B}{2}\right)}{1+\tan\left(\frac{A}{2}\right)\tan\left(\frac{B}{2}\right)}$$

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8. In any $\triangle ABC$, prove that

$$\left(b^2-c^2\right)\cot A+\left(c^2-a^2\right)\cot B+\left(c^2-b^2\right)\cot C=0$$

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9. In a triangle ABC, prove that $\frac{b+c}{a}\leq \cos ec.\ \frac{A}{2}$

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10. In any triangle ABC, prove that: $\frac{1+\cos(A-B)\cos C}{1+\cos(A-C)\cos B}=\frac{a^2+b^2}{a^2+c^2}$

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11. In a triangle ABC, if a, b, c are in A.P. and $\frac{b}{c}\sin 2C+\frac{c}{b}\sin 2B+\frac{b}{a}\sin 2A+\frac{a}{b}\sin 2B=2$, then find the value of sin B

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12. Prove that $a\cos A+b\cos B+c\cos C=4R\sin A\sin B\sin C$.

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Concept Application Exercise 5 2

1. The lengths of sides of $\triangle ABC$ are a units, b units and $\sqrt{a^2 + ab + b^2}$ units show that greatest angle of the triangle is 120°

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2. If the segments joining the points $A(a, b) and B(c, d)$ subtends an angle θ at the origin, prove that : $\cos\theta = \dfrac{ac+bd}{\sqrt{(a^2+b^2)(c^2+d^2)}}$

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3. The sides of a triangle are 3x+4y,4x+3yand 5x+5y, where $x, y > 0$. The triangle is

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4. In ΔABC, angle A is 120°, $BC + CA = 20$, and $AB + BC = 21$ Find the length of the side BC

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5. In $\Delta ABC, AB = 1, BC = 1,$ and $AC = 1/\sqrt{2}$. In $\Delta MNP, MN = 1, NP = 1,$ and $\angle MNP = 2\angle ABC$. Find the side MP

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6. If in a triangle ABC, $\frac{bc}{2\cos A} = b^2 + c^2 - 2bc\cos A$ then prove that the triangle must be isosceles.

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7. In $\triangle ABC$ (b+c)/11=(c+a)/12=(a+b)/13 then prove that (cosA)/7=(cosB)/19=(cosC)/25

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8. The sides of a triangle are three consecutive natural numbers and its largest angle is twice the smallest one determine the sides of the triangle

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Concept Application Exercise 5 3

1. In ΔABC, prove that $c\cos(A-\alpha)+a\cos(C+\alpha)=b\cos\alpha$

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2. Prove that $\dfrac{\cos C+\cos A}{c+a}+\dfrac{\cos B}{b}=\dfrac{1}{b}$

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3. Prove that

$a\left(b^2+c^2\right)\cos A+b\left(c^2+a^2\right)\cos B+c\left(a^2+b^2\right)\cos C=3abc$

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Concept Application Exercise 5 4

1. In a triangle ABC if $b+c=3a$ then find the value of $\cot\left(\frac{B}{2}\right)\cot\left(\frac{C}{2}\right)$

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2. Prove that $bc\cos^2.\frac{A}{2}+ca\cos^2.\frac{B}{2}+ab\cos^2.\frac{C}{2}=s^2$

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3. If in ΔABC, $\tan.\frac{A}{2}=\frac{5}{6}$ and $\tan.\frac{C}{2}=\frac{2}{5}$, then prove that a, b, and c are in A.P.

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4. Prove that $(b+c-a)\left(\cot.\frac{B}{2}+\cot.\frac{C}{2}\right)=2a\cot.\frac{A}{2}$

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5. If $\sin^2\left(\frac{A}{2}\right), \sin^2\left(\frac{B}{2}\right)$, and $\sin^2\left(\frac{C}{2}\right)$ are in $H.P.$, then prove that the sides of triangle are in $H.P.$

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Concept Application Exercise 5 5

1. If $c^2=a^2+b^2$, then prove that $4s(s-a)(s-b)(s-c)=a^2b^2$

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2. If the sides of a triangle are in the ratio $3:7:8$, then find $R:r$

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3. In triangle ABC, if a = 2 and bc = 9, then prove that $R = 9/2\Delta$

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4. In ΔABC, if lengths of medians BE and CF are 12 and 9 respectively, find the maximum value of Δ

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5. Let the lengths of the altitudes drawn from the vertices of ΔABC to the opposite sides are 2, 2 and 3. If the area of

ΔABC is Δ, then find the area of triangle

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6. A triangle with equal sides has perimeter 9 cm. Then find the area of the triangle

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7. The sides of a triangle are in A.P. and its area is $\frac{3}{5}th$ of the an equilateral triangle of the same perimeter, prove that its sides are in the ratio 3:5:7.

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Concept Application Exercise 5 6

1. In which of the following cases, there exists a triangle ABC?

(a) $b \sin A = a,\ A < \pi/2$

(b) $b \sin A > a,\ A > \pi/2$

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2. If in $\Delta ABC, b = 3cm, c = 4cm$ and the length of the perpendicular from A to the side BC is 2 cm, then how many such triangle are possible ?

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3. In a triangle $ABC, \frac{a}{b} = \frac{2}{3}$ and $\sec^2 A = \frac{8}{5}$. Find the number of triangle satisfying these conditions

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4. In a triangle, the lengths of the two larger sides are 10 and 9, respectively. If the angles are in A.P, then the length of the third side can be (a) $5-\sqrt{6}$ (b) $3\sqrt{3}$ (c) 5 (d) $5+\sqrt{6}$

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5. If a, b and A are given in a triangle and c_1, c_2 are possible values of the third side, then prove that $c_1^2+c_2^2-2c_1c_2\cos 2A=4a^2\cos^2 A$

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6. In $\Delta ABC, a, b$ and A are given and c_1, c_2 are two values of the third side c. Prove that the sum of the area of two triangles with sides a, b, c_1 and a, bc_2 is $\frac{1}{2}b^2\sin 2A$

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Concept Application Exercise 5 7

1. Let f, g and h be the lengths of the perpendiculars from the circumcenter of ΔABC on the sides a, b, and c, respectively. Prove that $\frac{a}{f}+\frac{b}{g}+\frac{c}{h}=\frac{1}{4}\frac{abc}{fgh}$

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2. If AD, BE and CF are the altitudes of ΔABC whose vertex A is (-4,5). The coordinates of points E and F are (4,1) and (-1,-4), respectively. Equation of BC is

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3. If the sides of triangle are in the ratio $3:5:7$, then prove that the minimum distance of the circumcentre from the side of triangle is half the circmradius

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4. If circumradius of triangle ABC is 4 cm, then prove that sum of perpendicular distances from circumcentre to the sides of triangle cannot exceed 6 cm

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Concept Application Exercise 5 8

1. If the incircle of the triangle ABC passes through its circumcenter, then find the value of $4\sin.\frac{A}{2}\sin.\frac{B}{2}\sin.\frac{C}{2}$

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2. In $\Delta ABC, a = 10, A = \frac{2\pi}{3}$, and circle through B and C passes through the incenter. Find the radius of this circle

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3. Let ABC be a triangle with $\angle BAC = 2\pi/3$ and $AB = x$ such that (AB) (AC) = 1. If x varies, then find the longest possible length of the angle bisector AD

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4. If the incircle of the ΔABC touches its sides at L, M and N and if x, y, z be thecircumradii of the triangles MIN, NIL and

LIM respectively, where I is the incentre, then the product xyz is equal to:

(A) Rr^2 (B)rR^2

(C) $\frac{1}{2}Rr^2$ (D) $\frac{1}{2}rR^2$

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5. In a triangle ABC, CD is the bisector of the angle C. If $\cos\left(\frac{C}{2}\right)$ has the value $\frac{1}{3}$ and $l(CD) = 6$, then $\left(\frac{1}{a} + \frac{1}{b}\right)$ has the value equal to -

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6. In $\Delta ABC, \angle A = \frac{\pi}{3}$ and its incircle of unit radius. Find the radius of the circle touching the sides AB, AC internally and the incircle of ΔABC externally is x , then find the value of x.

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7. In triangle ABC, prove that the maximum value of $\frac{\tan A}{2}\frac{\tan B}{2}\frac{\tan C}{2} is \frac{R}{2s}$

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Concept Application Exercise 5 9

1. Line joining vertex A of triangle ABC and orthocenter (H) meets the side BC in D. Then prove that

(a) $BD : DC = \tan C : \tan B$

(b) $AH : HD = (\tan B + \tan C) : \tan A$

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2. In a triangle ABC, $\angle A = 30^o, BC = 2 + \sqrt{5}$, then find the distance of the vertex A from the orthocenter.

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3. If the perimeter of the triangle formed by feet of altitudes of the triangle ABC is equal to four times the circumradius of ΔABC, then identify the type of ΔABC

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4. AD, BE and CF are the medians of triangle ABC whose centroid is G. If the points A, F, G and E are concyclic, then prove that $2a^2 = b^2 + c^2$

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5. Consider an acute angled ΔABC. Let AD, BE and CF be the altitudes drawn from the vertice to the opposite sides. Prove that : $\frac{EF}{a}+\frac{FD}{b}+\frac{DE}{c}=\frac{R+r}{R}$.

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Concept Application Exercise 5 10

1. In ΔABC, if $r_1 < r_2 < r_3$, then find the order of lengths of the sides

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2. The ex-radii r_1, r_2, r_3 or ΔABC are in H.P. Show that its sides a,b,c are in A.P.

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3. If in $\Delta ABC, (a-b)(s-c)=(b-c)(s-a)$, prove that r_1, r_2, r_3 are in A.P.

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4. Prove that $2R\cos A=2R+r-r_1$

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5. If the lengths of the perpendiculars from the vertices of a triangle ABC on the opposite sides are p_1, p_2, p_3 then prove that

$$\frac{1}{p_1}+\frac{1}{p_2}+\frac{1}{p_3}=\frac{1}{r}=\frac{1}{r_1}+\frac{1}{r_2}+\frac{1}{r_3}.$$

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6. Prove that $r_1 r_2 + r_2 r_3 + r_3 r_1 = \frac{1}{4}(a+b+c)^2$

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7. In any triangle ABC, find the least value of $\frac{r_1 r_2 r_3}{r^3}$

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8. Prove that $\frac{r_1 - r}{a} + \frac{r_2 - r}{b} = \frac{c}{r_3}$

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Concept Application Exercise 5 11

1. Regular pentagons are inscribed in two circles of radius $5$and 2 units respectively. The ratio of their areas is

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2. Let A be a point inside a regular polygon of 10 sides. Let $p_1, p_2 \ldots, p_{10}$ be the distances of A from the sides of the polygon. If each side is of length 2 units, then find the value of $p_1 + p_2 + \ldots + p_{10}$

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3. If in ΔABC, Prove that, $a^2 \sin(B - C) = (b^2 - c^2) \sin A$

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4. If I_n is the area of $n - sided$ regular polygon inscribed in a circle of unit radius and O_n be the area of the polygon circumscribing the given circle, prove that $I_n = \frac{O_n}{2}\left(\sqrt{1 + \left(\frac{2I_n}{n}\right)^2}\right)$

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Exercises

1. In ΔABC, $\frac{\sin A(a - b\cos C)}{\sin C(c - b\cos A)} =$

A. -2

B. -1

C. 0

D. 1

Answer: D

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2. If in a triangle ABC, $\frac{1+\cos A}{a}+\frac{1+\cos B}{b}+\frac{1+\cos C}{c}$ $=\left(k^2(1+\cos A)(1+\cos B)\frac{1+\cos C}{abc}\right.$, then k is equal to (a) $\frac{1}{2\sqrt{2}R}$ (b) $2R$ (c) $\frac{1}{R}$ (d) none of these

A. $\frac{1}{2\sqrt{2}R}$

B. 2R

C. $\frac{1}{R}$

D. none of these

Answer: B

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3. In triangle ABC, $2ac\sin\left(\frac{1}{2}(A-B+C)\right)$ is equal to

A. $a^2+b^2-c^2$

B. $c^2+a^2-b^2$

C. $b^2-c^2-a^2$

D. $c^2-a^2-b^2$

Answer: B

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4. 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. $2:3$

Answer: A

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

A. $a, \sin A, \sin B$

B. a, b, c

C. $a, \sin B, R$

D. $a, \sin A, R$

Answer: D

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6. The sides of a triangle are in the ratio $1 : \sqrt{3} : 2$. Then the angles are in the ratio

A. $1 : 3 : 5$

B. $2 : 3 : 4$

C. $3 : 2 : 1$

D. $1 : 2 : 3$

Answer: D

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7. In $ABC, a=5, b=12, c=90^0 and D$ is a point on AB so that $\angle BCD=45^0$. Then which of the following is not true? $CD=\frac{60\sqrt{2}}{17}$ (b) $BD=\frac{65}{17}$ $AD=\frac{60\sqrt{2}}{17}$ (d) none of these

A. $CD=\frac{60\sqrt{2}}{17}$

B. $BD=\frac{65}{17}$

C. $AD=\frac{60\sqrt{2}}{17}$

D. none of these

Answer: C

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8. In a triangle ABC, (a+b+c)(b+c-a)=kbc if

A. $k<0$

B. $k > 0$

C. $0 < k < 4$

D. $k < 4$

Answer: C

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9. Let D be the middle point of the side BC of a triangle ABC. If the triangle ADC is equilateral, then $a^2 : b^2 : c^2$ is equal to $1:4:3$ (b) $4:1:3$ (c) $4:3:1$ (d) $3:4:1$

A. $1:4:3$

B. $4:1:3$

C. $4:3:1$

D. $3:4:1$

Answer: B

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10. In a triangle ABC, the altitude from A is not less than BC and the altitude from B is not less than AC. (a)The triangle is right angled (b) isosceles obtuse angled (d) equilateral

A. right angled

B. isosceles

C. obtuse angled

D. equilateral

Answer: A

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11. In ABC, if $\frac{\sin A}{c \sin B} + \frac{\sin B}{c} + \frac{\sin C}{b} = \frac{c}{ab} + \frac{b}{ac} + \frac{a}{bc}$,

then the value of angle A is 120^0 (b) 90^0 (c) 60^0 (d) 30^0

A. 120°

B. 90°

C. 60°

D. 30°

Answer: B

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12. If in ABC , side a, b, c are in A.P. then $B > 60^0$ (b) $B < 60^0$

$B \leq 60^0$ (d) $B = |A - C|$

A. $B > 60^\circ$

B. $B < 60^\circ$

C. $B \leq 60^\circ$

D. $B = |A - C|$

Answer: C

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13. In a ΔABC, AD is the altitude from A. Given $b > c, \angle C = 23^\circ$ and $AD = \dfrac{abc}{(b^2 - c^2)}$, find $\angle B$.

A. 83°

B. 97°

C. 113°

D. 127°

Answer: C

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14. If the sides a, b, c of a triangle ABC form successive terms of G.P. with common ratio $r(\,>1)$ then which of the following is correct? (a) $A > \frac{\pi}{3}$ '(b)B≥π/3'(c)C<π/3'(d)A < B < π/3`

A. $A > \pi/3$

B. $B \geq \pi/3$

C. $C < \pi/3$

D. $A < B < \pi/3$

Answer: D

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15. In triangle $ABC, b^2 \sin 2C + c^2 \sin 2B = 2bc where b = 20, c = 21,$ then inradius= (a) 4 (b) 6 (c) 8 (d) 9

A. 4

B. 6

C. 8

D. 9

Answer: B

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16. In a $ABC,$ if $AB = x, BC = x + 1, \angle C = \frac{\pi}{3}$, then the least integer value of x is

A. 6

B. 7

C. 8

D. none of these

Answer: B

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17. If one side of a triangle is double the other, and the angles on opposite sides differ by 60^0, then the triangle is

A. equilateral

B. obtus angled

C. right angled

D. acute angled

Answer: C

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18. If the hypotenuse of a right-angled triangle is four times the length of the perpendicular drawn from the opposite vertex to it, then the difference of the two acute angles will be 60^0 (b) 15^0 (c) 75^0 (d) 30^0

A. 60°

B. 15°

C. 75°

D. 30°

Answer: A

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19. If P is a point on the altitude AD of the triangle ABC such the $\angle CBP = \frac{B}{3}$, then AP is equal to $2a\frac{\sin C}{3}$ (b) $2b\frac{\sin C}{3}$ (c) $2c\frac{\sin B}{3}$ (d) $2c\frac{\sin C}{3}$

A. $2a \sin. \frac{C}{3}$

B. $2b \sin. \frac{C}{3}$

C. $2c \sin. \frac{B}{3}$

D. $2c \sin. \frac{C}{3}$

Answer: C

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20. With usual notations, in triangle ABC, $a\cos(B-C) + b\cos(C-A) + c\cos(A-B)$ is equal to abc/R^2 (b) $\frac{abc}{4R^2}$ $\frac{4abc}{R^2}$ (d) $\frac{abc}{2R^2}$

A. $\frac{abc}{R^2}$

B. $\frac{abc}{4R^2}$

C. $\frac{4abc}{R^2}$

D. $\frac{abc}{2R^2}$

Answer: A

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21. If $8R^2 = a^2 + b^2 + c^2$ then show that the triangle is right angled

A. right angled

B. isosceles

C. equilateral

D. none of these

Answer: A

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22. Let ABC be a triangle with $\angle A = 45^0$. Let P be a point on side BC with PB=3 and PC=5. If O is circumcenter of triangle ABC, then length OP is $\sqrt{18}$ (b) $\sqrt{17}$ (c) $\sqrt{19}$ (d) $\sqrt{15}$

A. $\sqrt{18}$

B. $\sqrt{17}$

C. $\sqrt{19}$

D. $\sqrt{15}$

Answer: B

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23. In any triangle ABC, $\frac{a^2+b^2+c^2}{R^2}$ has the maximum value of 3 (b) 6 (c) 9 (d) none of these

A. 3

B. 6

C. 9

D. none of these

Answer: C

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24. In triangle $ABC, R(b+c) = a\sqrt{bc}, where R$ is the circumradius of the triangle. Then the triangle is isosceles but not right right but not isosceles right isosceles equilateral

A. isosceles but not right

B. right but not isosceles

C. right isosceles

D. equilateral

Answer: C

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25. In ABC, if $b^2 + c^2 = 2a^2$, then value of $\dfrac{\cot A}{\cot B + \cot C}$ is

A. $\dfrac{1}{2}$

B. $\frac{3}{2}$

C. $\frac{5}{2}$

D. $\frac{5}{3}$

Answer: A

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26. If $\sin\theta and - \cos\theta$ are the roots of the equation $ax^2 - bx - c = 0$, where $a, bandc$ are the sides of a triangle ABC, then $\cos B$ is equal to $1 - \frac{c}{2a}$ (b) $1 - \frac{c}{a}$ $1 + \frac{c}{ca}$ (d) $1 + \frac{c}{3a}$

A. $1 - \frac{c}{2a}$

B. $1 - \frac{c}{a}$

C. $1 + \frac{c}{2a}$

D. $1+\frac{c}{3a}$

Answer: C

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27. If D is the mid-point of the side BC of triangle ABC and AD is perpendicular to AC , then $3b^2 = a^2 - $c^2 (b) $3a^2 = b^2 3c^2$ $b^2 = a^2 - c^2$ (d) $a^2 + b^2 = 5c^2$

A. $3b^2 = a^2 - c^2$

B. $3a^2 = b^2 - 3c^2$

C. $b^2 = a^2 - c^2$

D. $a^2 + b^2 = 5c^2$

Answer: A

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28. In a triangle $ABC, \quad \text{if} \quad \cot A : \cot B : \cot C = 30 : 19 : 6$ then the sides a, b, c are a) in A.P. b) in G.P. c) in H.P. d) None of these

A. in A.P.

B. in G.P.

C. in H.P.

D. none of these

Answer: A

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29. In ABC, P is an interior point such that $\angle PAB = 10^0 \angle PBA = 20^0, \angle PCA = 30^0, \angle PAC = 40^0$ then

ABC is isosoceles (b) right angled equilateral (d) obtuse angled

A. isosceles

B. right angled

C. equilateral

D. obtuse angled

Answer: A

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30. In ABC, if $AB = c$ is fixed, and $\cos A + \cos B + 2\cos C = 2$ then the locus of vertex C is ellipse (b) hyperbola (c) circle (d) parabola

A. ellipse

B. hyperbola

C. circle

D. parabola

Answer: A

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31. If in $ABC, A=\frac{\pi}{7}, B=\frac{2\pi}{7}, C=\frac{4\pi}{7}$ then $a^2+b^2+c^2$ must be (a)R^2 (b) $3R^2$ (c) $4R^2$ (d) $7R^2$

A. R^2

B. $3R^2$

C. $4R^2$

D. $7R^2$

Answer: D

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32. In ΔABC, $\cot\frac{A}{2}+\cot\frac{B}{2}+\cot\frac{C}{2}$ is equal to

A. $\frac{\Delta}{r^2}$

B. $\frac{(a+b+c)^2}{abc}2R$

C. $\frac{\Delta}{r}$

D. $\frac{\Delta}{Rr}$

Answer: A

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33. In ABC, $\left(\cot\left(\frac{A}{2}\right)+\cot\left(\frac{B}{2}\right)\right)\left(a\sin^2\left(\frac{B}{2}\right)+b\sin^2\left(\frac{A}{2}\right)\right)=$

(a) $\cot C$ (b) $c\cot C$ (c) $\cot\left(\frac{C}{2}\right)$ (d) $c\cot\left(\frac{C}{2}\right)$

A. $\cot C$

B. $c \cot C$

C. $\cot . \frac{C}{2}$

D. $c \cot . \frac{C}{2}$

Answer: D

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34. In a right-angled isosceles triangle, the ratio of the circumradius and inradius is

A. $2(\sqrt{2}+1):1$

B. $(\sqrt{2}+1):1$

C. $2:1$

D. $\sqrt{2}:1$

Answer: B

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35. In a ΔABC, a semicircle is inscribed, whose diameter lies on the side c. Then find the radius of the semicircle.(Where Δ is the area of the triangle ABC)

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36. In $ABC, A\frac{2\pi}{3}, b-c=3\sqrt{3}cm$ and area of $ABC=\frac{9\sqrt{3}}{2}cm^2, thenBC=6\sqrt{3}$ (b) $9cm$ (c) $18cm$ (d) $27cm$

A. $6\sqrt{3}cm$

B. 9 cm

C. 18 cm

D. 27 cm

Answer: B

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

A. $a+b$

B. $b+c$

C. $c+a$

D. $a+b+c$

Answer: A

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38. In the given figure AB is the diameter of the circle, centred at O. If $\angle COA = 60^0$, $AB = 2r$, $AC = d$, and $CD = l$

A. $d\sqrt{3}$

B. $d/\sqrt{3}$

C. 3d

D. $\sqrt{3}d/2$

Answer: A

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39. In triangle ABC, if $P\dot{Q}, R$ divides sides BC, AC, and AB, respectively, in the ratio $k:1(\in \text{ or } der)$. If the ratio

$\left(\frac{arEAPQR}{areaABC}\right)$ IS $\frac{1}{3}$, $thenk$ is equal to $\frac{1}{3}$ (b) 2 (c) 3 (d) none of these

A. $1/3$

B. 2

C. 3

D. none of these

Answer: B

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40. If the angles of a triangle are $30^0 and 45^0$ and the included side is $(\sqrt{3}+1)cm$ then the area of the triangle is______.

A. $\frac{\sqrt{3}+1}{2}$ sq. units

B. $(\sqrt{3}+1)$ sq. units

C. $2(\sqrt{3}-1)$ sq. units

D. $\frac{2\sqrt{3}-1}{2}$ sq. units

Answer: A

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41. In triangle ABC , base BC and area of triangle are fixed. The locus of the centroid of triangle ABC is a straight line that is parallel to side BC right bisector of side BC perpendicular to BC inclined at an angle $\sin^{-1}\left(\frac{\sqrt{}}{BC}\right)$ to side BC

A. parallel to side BC

B. right bisector of side BC

C. prependicular to BC

D. inclined at an angle $\sin^{-1}(\sqrt{\Delta}/BC)$ to side BC

Answer: A

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42. Let the area of triangle ABC be $\left(\sqrt{3}-1\right)/2, b=2$ and $c=\left(\sqrt{3}-1\right),$ and $\angle A$ be acute. The measure of the angle A is

A. 15°

B. 30°

C. 60°

D. 75°

Answer: A

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43. In $\triangle ABC$,$\Delta = 6$, $abc = 60$, $r = 1$ Then the value of $\frac{1}{a} + \frac{1}{b} + \frac{1}{c}$ is nearly

A. 0.5

B. 0.6

C. 0.4

D. 0.8

Answer: D

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44. Triangle ABC is isosceles with $AB = AC$ and $BC = 65cm$. P is a point on BC such that the perpendiculardistances from P to AB and AC are

$24cm$ and $36cm$, respectively. The area of triangle ABC (in sq cm is)

A. 1254

B. 1950

C. 2535

D. 5070

Answer: C

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45. In an equilateral triangle, the inradius, circumradius, and one of the exradii are in the ratio

A. $2:4:5$

B. $1:2:3$

C. $1:2:4$

D. $2:4:3$

Answer: B

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46. In triangle ABC, if $\cos A + \cos B + \cos C = \frac{7}{4}, then \frac{R}{r}$ is equal to $\frac{3}{4}$ (b) $\frac{4}{3}$ (c) $\frac{2}{3}$ (d) $\frac{3}{2}$

A. $\frac{3}{4}$

B. $\frac{4}{3}$

C. $\frac{2}{3}$

D. $\frac{3}{2}$

Answer: B

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47. If two sides of a triangle are roots of the equation $x^2 - 7x + 8 = 0$ and the angle between these sides is 60^0 then the product of inradius and circumradius of the triangle is $\frac{8}{7}$ (b) $\frac{5}{3}$ (c) $\frac{5\sqrt{2}}{3}$ (d) 8

A. $\frac{8}{7}$

B. $\frac{5}{3}$

C. $\frac{5\sqrt{2}}{3}$

D. 8

Answer: B

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48. Given b=2,c=$\sqrt{3}$and A= 30°, then in-radius of triangle ABC is

A. $\dfrac{\sqrt{3}-1}{2}$

B. $\dfrac{\sqrt{3}+1}{2}$

C. $\dfrac{\sqrt{3}-1}{4}$

D. none of these

Answer: A

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49. In triangle ABC, if $A-B=120^0 and R=8r, where R and r$ have their usual meanings, then $\cos C$ equal $\dfrac{3}{4}$ (b) $\dfrac{2}{3}$ (c) $\dfrac{5}{6}$ (d) $\dfrac{7}{8}$

A. $3/4$

B. $2/3$

C. $5/6$

D. $7/8$

Answer: D

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50. ABC is an equilateral triangle of side $4cm$. If R, r, and, h are the circumradius, inradius, and altitude, respectively, then $\frac{R+r}{h}$ is equal to (a) 4 (b) 2 (c) 1 (d) 3

A. 4

B. 2

C. 1

D. 3

Answer: C

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51. A circle is inscribed in a triangle ABC touching the side AB at D such that $AD = 5, BD = 3, \quad \text{if} \quad \angle A = 60^0$ then length BC equals. (a) 4 (b) $\frac{120}{13}$ (c) 13(d) 12

A. 9

B. $\frac{120}{13}$

C. 13

D. 12

Answer: C

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52. The rational number which equals the number 2.126 with recurring decimal is

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53. AD is a median of the ΔABC.If AE and AFare medians of the triangles ABD respectively, and AD=$m_1, AE = m_2 AF = m_3,$ then find the value of $\frac{a^2}{8}$.

A. $m_2^2 + m_3^2 - 2m_1^2$

B. $m_1^2 + m_2^2 - 2m_3^2$

C. $m_1^2 + m_3^2 - 2m_2^2$

D. none of these

Answer: A

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54. For triangle ABC, $R=\frac{5}{2}$ and $r=1$. Let I be the incenter of the triangle and D, E and F be the feet of the perpendiculars from $I \rightarrow BC, CA$ and AB, respectively. The value of $\frac{ID \cdot IE \cdot IF}{IA \cdot IB \cdot IC}$ is equal to (a) $\frac{5}{2}$ (b) $\frac{5}{4}$ (c) $\frac{1}{10}$ (d) $\frac{1}{5}$

A. $\frac{5}{2}$

B. $\frac{5}{4}$

C. $\frac{1}{10}$

D. $\frac{1}{5}$

Answer: C

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55. In triangle $ABC, \angle A = 60^0, \angle B = 40^0, and \angle C = 80^0$. If P is the center of the circumcircle of triangle ABC with radius unity, then the radius of the circumcircle of triangle BPC is (a)1 (b) $\sqrt{3}$ (c) 2 (d) $\sqrt{3}\,2$

A. 1

B. $\sqrt{3}$

C. 2

D. $\sqrt{3}/2$

Answer: A

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56. If H is the othrocenter of an acute angled triangle ABC whose circumcircle is $x^2 + y^2 = 16,$ then circumdiameter of the triangle HBC is 1 (b) 2 (c) 4 (d) 8

A. 1

B. 2

C. 4

D. 8

Answer: D

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57. In triangle ABC, the line joining the circumcenter and incenter is parallel to side BC, then $\cos A + \cos C$ is equal to -1 (b) 1 (c) -2 (d) 2

A. $\frac{1}{2}$

B. 1

C. $\sqrt{3}$

D. 2

Answer: B

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58. In triangle ABC, line joining the circumcenter and orthocentre is parallel to side AC, then the value of $tanA \tan Cisequa < o \sqrt{3}$ (b) 3 (c) $3\sqrt{3}$ (d) none of these

A. $\sqrt{3}$

B. 3

C. $3\sqrt{3}$

D. none of these

Answer: B

Watch Video Solution

59. In triangle ABC, $\angle C = \dfrac{2\pi}{3}$ and CD is the internal angle bisector of $\angle C$ meeting the side AB at D. If Length CD is equal to

A. 1

B. 2

C. 3

D. 4

Answer: B

Watch Video Solution

60. In the given figure ΔABC is equilateral on side AB produced. We choose a point such that A lies between P and B. We now denote 'a' as the length of sides of ΔABC, r_1 as the radius of incircle ΔPAC and r_2 as the ex-radius of ΔPBC with respect to side BC. Then $r_1 + r_2$ is equal to

A. (a) $\frac{1}{2}$

B. (b) $\frac{3}{2}a$

C. (c) $\frac{\sqrt{3}}{2}a$

D. (d) $a\sqrt{2}$

Answer: C

Watch Video Solution

61. A variable triangle ABC is circumscribed about a fixed circle of unit radius. Side BC always touches the circle at D and has fixed direction. If B and C vary in such a way that (BD) (CD)=2, then locus of vertex A will be a straight line. (a)parallel to side BC (b)perpendicular to side BC (c)making an angle $\left(\frac{\pi}{6}\right)$ with BC (d) making an angle $\sin^{-1}\left(\frac{2}{3}\right)$ with BC

A. parallel to side BC

B. perpendicular to side BC

C. making an angle $(\pi/6)$ with BC

D. making an angle $\sin^{-1}(2/3)$ with BC

Answer: A

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62. In ABC, if $a = 10$ and $b \cot B + c \cot C = 2(r + R)$ then the maximum area of ABC will be (a) 50 (b) $\sqrt{50}$ (c) 25 (d) 5

A. 50

B. $\sqrt{50}$

C. 25

D. 5

Answer: C

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63. Let C be incircle of ABC. If the tangents of lengths t_1, t_2 and t_3 are drawn inside the given triangle parallel to sidese a, b and c , respectively, the $\frac{t_1}{a} + \frac{t_2}{b} + \frac{t_3}{c}$ is equal to 0

(b) 1 (c) 2 (d) 3

A. 0

B. 1

C. 2

D. 3

Answer: B

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64. A park is in the form of a rectangle 120m x 100m At the centre of the park there is a circular lawn. The area of park excluding lawn is $8700m^2$. Find the radius of the circular lawn. (Use $\pi = \frac{22}{7}$)

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65. In triangle ABC, if $r_1 = 2r_2 = 3r_3$, then $b : c$ is equal to

A. $\frac{5}{4}$

B. $\frac{4}{3}$

C. $\frac{7}{4}$

D. $\frac{3}{4}$

Answer: A

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66. If in a triangle $\left(1 - \frac{r_1}{r_2}\right)\left(1 - \frac{r_1}{r_3}\right) = 2$, then the triangle is

A. right angled

B. isosceles

C. equilateral

D. none of these

Answer: A

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67. If in a triangle $\frac{r}{r_1} = \frac{r_2}{r_3}$, then

A. $A = 90^\circ$

B. $B = 90^\circ$

C. $C = 90^\circ$

D. none of these

Answer: C

Watch Video Solution

68. In ΔABC, I is the incentre, Area of ΔIBC, ΔIAC and ΔIAB are, respectively, Δ_1, Δ_2 and Δ_3. If the values of Δ_1, Δ_2 and Δ_3 are in A.P., then the altitudes of the ΔABC are in

A. A.P.

B. G.P.

C. H.P.

D. none of these

Answer: C

Watch Video Solution

69. In an acute angled triangle $ABC, r + r_1 = r_2 + r_3 and \angle B > \frac{\pi}{3}$, then (a) $b + 2c < 2a < 2b + 2c$ (b) $b + 4c < 4a < 2b + 4c$ (c) $b + 4c < 4a < 4b + 4c$ (d) $b + 3c < 3a < 3b + 3c$

A. $b + 2c < 2a < 2b + 2c$

B. $b + 4 < 4a < 2b + 4c$

C. $b + 4c < 4a < 4b + 4c$

D. $b + 3c < 3a < 3b + 3c$

Answer: D

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70. If in triangle $ABC, \sum \sin\left(\frac{A}{2}\right) = \frac{6}{5} and \sum II_1 = 9$ (where $I_1, I_2 and I_3$ are excenters and I is incenter, then circumradius R is equal to $\frac{15}{8}$ (b) $\frac{15}{4}$ (c) $\frac{15}{2}$ (d) $\frac{4}{12}$

A. $\frac{15}{8}$

B. $\frac{15}{4}$

C. $\frac{15}{2}$

D. $\frac{4}{12}$

Answer: A

Watch Video Solution

71. The radii r_1, r_2, r_3 of the escribed circles of the triangle ABC are in H.P. If the area of the triangle is $24cm^2$ and its perimeter is

24 cm, then the length of its largest side is (a) 10 (b) 9 (c) 8 (d) none of these

A. 10

B. 9

C. 8

D. none of these

Answer: A

Watch Video Solution

72. In ABC with usual notations, if $r = 1, r_1 = 7$ and $R = 3$, the $(a) ABC$ is equilateral (b) acute angled which is not equilateral (c) obtuse angled (d) right angled

A. equilateral

B. acute angled which is not equilateral

C. obtuse angled

D. right angled

Answer: D

Watch Video Solution

73. Which of the following expresses the circumference of a circle inscribed in a sector OAB with radius $RandAB = 2a$?

(a)$2\pi\frac{Ra}{R+a}$ (b) $\frac{2\pi R^2}{a}$ $(c)2\pi(r-a)^2$ (d) $2\pi\frac{R}{R-a}$

A. $2\pi\frac{Ra}{R+a}$

B. $\frac{2\pi R^2}{a}$

C. $2\pi(R-a)^2$

D. $2\pi\frac{R}{R-a}$

Answer: A

Watch Video Solution

74. In ABC, the median AD divides $\angle BAC$ such that $\angle BAD : \angle CAD = 2 : 1$. Then $\cos\left(\frac{A}{3}\right)$ is equal to $\frac{\sin B}{2\sin C}$ (b) $\frac{\sin C}{2\sin B}$ $\frac{2\sin B}{\sin C}$ (d) none of these

A. $\frac{\sin B}{2\sin C}$

B. $\frac{\sin C}{2\sin B}$

C. $\frac{2\sin B}{\sin C}$

D. none of these

Answer: A

Watch Video Solution

75. The area of the circle and the area of a regular polygon inscribed the circle of n sides and of perimeter equal to that of the circle are in the ratio of

A. $\tan\left(\frac{\pi}{n}\right) : \frac{\pi}{n}$

B. $\cos\left(\frac{\pi}{n}\right) : \frac{\pi}{n}$

C. $\sin. \frac{\pi}{n} : \frac{\pi}{n}$

D. $\cot\left(\frac{\pi}{n}\right) : \frac{\pi}{n}$

Answer: A

Watch Video Solution

76. The ratio of the area of a regular polygon of n sides inscribed in a circle to that of the polygon of same number of sides circumscribing the same is 3:4. Then the value of n is 6 (b) 4 (c) 8

(d) 12

A. 6

B. 4

C. 8

D. 12

Answer: A

Watch Video Solution

77. In any triangle, the minimum value of $\dfrac{r^3}{r_1 r_2 r_3}$ is equal to

A. 1

B. 1/9

C. 1/27

D. none of these

Answer: C

Watch Video Solution

78. If R_1 is the circumradius of the pedal triangle of a given triangle $ABC, and R_2$ is the circumradius of the pedal triangle of the pedal triangle formed, and so on R_3, R_4 then the value of $\sum_{i=1}^{\infty} R_i,$ where R (circumradius) ofABC is 5 is 8 (b) 10 (c) 12 (d) 15

A. 8

B. 10

C. 12

D. 15

Answer: B

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79. A sector $OABO$ of central angle θ is constructed in a circle with centre O and of radius 6. The radius of the circle that is circumscribed about the triangle OAB, is $6\frac{\cos\theta}{2}$ (b) $6\frac{\sec\theta}{2}$ $3\frac{\sec\theta}{2}$ (d) $3\left(\frac{\cos\theta}{2}+2\right)$

A. $6\cos.\ \frac{\theta}{2}$

B. $6\sec.\ \frac{\theta}{2}$

C. $3\sec.\ \frac{\theta}{2}$

D. $3\left(\cos.\ \frac{\theta}{2}+2\right)$

Answer: C

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80. Triangle ABC is isosceles with $AB = AC$ and $BC = 65cm$. P is a point on BC such that the perpendiculardistances from P to AB and AC are $24cm$ and $36cm$, respectively. The area of triangle ABC (in sq cm is)

A. 8

B. 12

C. 16

D. 6

Answer: D

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Multiple Correct Answer Type

1. The sides of ABC satisfy the equation $2a^2 + 4b^2 + c^2 = 4ab + 2ac$ Then a) the triangle is isosceles b) the triangle is obtuse c) $B = \cos^{-1}\left(\frac{7}{8}\right)$ d) $A = \cos^{-1}\left(\frac{1}{4}\right)$

A. the triangle is isosceles

B. the triangle is obtuse

C. $B = \cos^{-1}(7/8)$

D. $A = \cos^{-1}(1/4)$

Answer: A::C::D

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2. If sides of triangle ABC are $a, bandc$ such that $2b = a + c$ then $\frac{b}{c} > \frac{2}{3}$ (b) $\frac{b}{c} > \frac{1}{3}$ $\frac{b}{c} < 2$ (d) $\frac{b}{c} < \frac{3}{2}$

A. $\frac{b}{c} > \frac{2}{3}$

B. $\frac{b}{c} > \frac{1}{3}$

C. $\frac{b}{c} < 2$

D. $\frac{b}{c} < \frac{3}{2}$

Answer: A::C

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3. If the sines of the angles A and B of a triangle ABC satisfy the equation $c^2x^2 - c(a + b)x + ab = 0$, then the triangle (a) is acute angled (b) is right angled (c) is obtuse angled (d) satisfies the equation $\sin A + \cos A \frac{(a + b)}{c}$

A. is acute angled

B. is right angled

C. is obtus angled

D. satisfies the equation $\sin A + \cos A = \frac{(a+b)}{c}$

Answer: B::D

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4. There exist a triangle ABC satisfying

A. $\tan A + \tan B + \tan C = 0$

B. $\frac{\sin A}{2} = \frac{\sin B}{3} = \frac{\sin C}{7}$

C. $(a+b)^2 = c^2 + ab$ and $\sqrt{2}(\sin A + \cos A) = \sqrt{3}$

D.

$$\sin A+\sin B=\frac{\sqrt{3}+1}{2}, \cos A\cos B=\frac{\sqrt{3}}{4}=\sin A\sin B$$

Answer: C::D

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5. In triangle, ABC if $2a^2b^2+2b^2c^2=a^2+b^4+c^4$, then angle B is equal to 45^0 (b) 135^0 120^0 (d) 60^0

A. 45°

B. 135°

C. 120°

D. 60°

Answer: A::B

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6. If in triangle ABC, a, c and angle A are given and $c \sin A < a < c$, then (b_1 and b_2 are values of b) (a) $b_1 + b_2 = 2c \cos A$ (b) $b_1 + b_2 = c \cos A$ (c)$b_1 b_2 = c^2 - a^2$ (d) $b_1 b_2 = c^2 + a^2$

A. $b_1 + b_2 = 2c \cos A$

B. $b_1 + b_2 = c \cos A$

C. $b_1 b_2 = c^2 - a^2$

D. $b_1 b_2 = c^2 + a^2$

Answer: A::C

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7. If area of $\Delta ABC(\Delta)$ and angle C are given and if the side c opposite to given angle is minimum, then $a = \sqrt{\frac{2\Delta}{\sin C}}$ (b) $b = \sqrt{\frac{2\Delta}{\sin C}}$ $a = \sqrt{\frac{4\Delta}{\sin C}}$ (d) $b = \sqrt{\frac{4\Delta}{\sin C}}$

A. $a = \sqrt{\frac{2\Delta}{\sin C}}$

B. $b = \sqrt{\frac{2\Delta}{\sin C}}$

C. $a = \frac{4\Delta}{\sin C}$

D. $b = \frac{4\Delta}{\sin^2 C}$

Answer: A::B

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8. If Δ represents the area of acute angled triangle ABC, then $\sqrt{a^2b^2 - 4\Delta^2} + \sqrt{b^2c^2 - 4\Delta^2} + \sqrt{c^2a^2 - 4\Delta^2} =$ (a)

$a^2+b^2+c^2$ (b) $\dfrac{a^2+b^2+c^2}{2}$ (c) $ab\cos C+bc\cos A+ca\cos B$

(d) $ab\sin C+bc\sin A+ca\sin B$

A. $a^2+b^2+c^2$

B. $\dfrac{a^2+b^2+c^2}{2}$

C. $ab\cos C+bc\cos A+ca\cos B$

D. $ab\sin C+bc\sin A+ca\sin B$

Answer: B::C

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9. Sides of a triangle ABC are in A.P. If $a< \min\{b,c\}$,then cosA may be equal to

A. $\dfrac{4b-3c}{2b}$

B. $\dfrac{3c-4b}{2c}$

C. $\frac{4c-3b}{2b}$

D. $\frac{4c-3b}{2c}$

Answer: A::D

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10. If the angles of a triangle are $30^0 and 45^0$ and the included side is $(\sqrt{3}+1)$ cm, then area of the triangle is $\frac{1}{2}(\sqrt{3}+1) squnitsareaofthe \triangle is$1/2(sqrt(3)-1)sq units`

A. area of the triangle is $\frac{1}{-}(\sqrt{3}+1)$ sq. units

B. area of the triangle is $\frac{1}{2}(\sqrt{3}-1)$ sq. units

C. ratio of greater side to smaller side is $\frac{\sqrt{3}+1}{\sqrt{2}}$

D. ratio of greater side to smaller side is $\frac{1}{4\sqrt{3}}$

Answer: A::C

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11. Lengths of the tangents from A,B and C to the incircle are in A.P., then (a) r_1, r_2, r_3 are in H.P (b) r_1, r_2, r_3 are in A.P (c)a, b, c are in A.P (d)$\cos A = \dfrac{4c - 3b}{2c}$

A. $r_1, r_2 r_3$ are in H.P

B. r_1, r_2, r_3 are in AP

C. a, b, c are in A.P

D. $\cos A = \dfrac{4c - 3b}{2c}$

Answer: A::C::D

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12. CF is the internal bisector of angle C of ABC , then CF is equal to (a) $\frac{2ab}{a+b}\cos\left(\frac{C}{2}\right)$ (b) $\frac{a+b}{2ab}\frac{\cos C}{2}$ (c) $\frac{b\sin A}{\sin\left(B+\frac{C}{2}\right)}$

(d) none of these

A. $\frac{2ab}{a+b}\cos.\ \frac{C}{2}$

B. $\frac{a+b}{2ab}\cos.\ \frac{C}{2}$

C. $\frac{b\sin A}{\sin\left(B+\frac{C}{2}\right)}$

D. none of these

Answer: A::C

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13. The incircle of ΔABC touches side BC at D. The difference between BD and CD (R is circumradius of ΔABC) is (a)

$\left|4R\sin.\ \frac{A}{2}\sin.\ \frac{B-C}{2}\right|$ (b) $\left|4R\cos.\ \frac{A}{2}\sin.\ \frac{B-C}{2}\right|$ (c) $|b-c|$

(d) $\left|\frac{b-c}{2}\right|$

A. $\left|4R\sin.\ \frac{A}{2}\sin.\ \frac{B-C}{2}\right|$

B. $\left|4R\cos.\ \frac{A}{2}\sin.\ \frac{B-C}{2}\right|$

C. $|b-c|$

D. $\left|\frac{b-c}{2}\right|$

Answer: A::C

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14. A circle of radius 4 cm is inscribed in ΔABC, which touches side BC at D. If BD = 6 cm, DC = 8 cm then

A. the triangle is necessarily acute angled

B. $\tan.\ \frac{A}{2}=\frac{4}{7}$

C. perimeter of the triangle ABC is 42 cm

D. area of ΔABC is $84 cm^2$

Answer: A::B::C::D

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15. If H is the orthocentre of triangle ABC, R = circumradius and $P = AH + BH + CH$, then (a) $P = 2(R + r)$ (b) max. of P is 3R (c) min. of P is 3R (d) $P = 2(R - r)$

A. $P = 2(R + r)$

B. max. of P is 3R

C. min. of P is 3R

D. $P = 2(R - r)$

Answer: A::B

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16. Let ABC be an isosceles triangle with base BC. If r is the radius of the circle inscribsed in ΔABC and r_1 is the radius of the circle ecribed opposite to the angle A, then the product $r_1 r$ can be equal to (where R is the radius of the circumcircle of ΔABC)

A. $R^2 \sin^2 A$

B. $R^2 \sin^2 2B$

C. $\frac{1}{2}a^2$

D. $\frac{a^2}{4}$

Answer: A::B::D

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17. If inside a big circle exactly $n(n \leq 3)$ small circles, each of radius r, can be drawn in such a way that each small circle touches the big circle and also touches both its adjacent small circles, then the radius of big circle is $r\left(1+\cos ec\frac{\pi}{n}\right)$ (b) $\left(\frac{1+\frac{\tan\pi}{n}}{\frac{\cos\pi}{\pi}}\right)$ $r\left[1+\cos ec\frac{2\pi}{n}\right]$ (d) $\frac{r\left[s\in\frac{\pi}{2n}+\frac{\cos(2\pi)}{n}\right]^2}{\frac{\sin\pi}{n}}$

A. $r\left(1+\cos ec.\ \frac{\pi}{n}\right)$

B. $\left(\frac{1+\tan\pi/n}{\cos\pi/n}\right)$

C. $r\left[1+\cos ec.\ \frac{2\pi}{n}\right]$

D. $\frac{r\left[\sin.\ \frac{\pi}{2n}+\cos.\ \frac{2\pi}{n}\right]^2}{\sin\pi/n}$

Answer: A::D

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18. The area of a regular polygon of n sides is (where r is inradius, R is circumradius, and a is side of the triangle (a) $\frac{nR^2}{2}\sin\left(\frac{2\pi}{n}\right)$ (b) $nr^2\tan\left(\frac{\pi}{n}\right)$ (c) $\frac{na^2}{4}\frac{\cot\pi}{n}$ (d) $nR^2\tan\left(\frac{\pi}{n}\right)$

A. $\frac{nR^2}{2}\sin\left(\frac{2\pi}{n}\right)$

B. $nr^2\tan\left(\frac{\pi}{n}\right)$

C. $\frac{na^2}{4}\cot.\ \frac{\pi}{n}$

D. $nR^2\tan\left(\frac{\pi}{n}\right)$

Answer: A::B::C

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19. In acute angled triangle ABC, AD is the altitude. Circle drawn with AD as its diameter cuts $ABandACatPandQ,$

respectively. Length of PQ is equal to $/(2R)$ (b) $\frac{abc}{4R^2}$ $2R\sin A\sin B\sin C$ (d) Δ/R

A. $\frac{\Delta}{2R}$

B. $\frac{abc}{4R^2}$

C. $2R\sin A\sin B\sin C$

D. $\frac{\Delta}{R}$

Answer: C::D

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20. If A is the area and $2s$ is the sum of the sides of a triangle, then

A. $A \leq \frac{s^2}{4}$

B. $A \leq \frac{s^2}{3\sqrt{3}}$

C. $A < \frac{s^2}{\sqrt{3}}$

D. none of these

Answer: A::B

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21. In ABC, internal angle bisector of $\angle A$ meets side BC in D. $DE \perp AD$ meets AC at E and AB at F. Then (a) AE is in $H.P.$ of b and c (b) $AD = \frac{2bc}{b+c}\frac{\cos A}{2}$ (c) $EF = \frac{4bc}{b+c}\frac{\sin A}{2}$ (d) AEF is isosceles

A. AE in H.M of b and c

B. $AD = \frac{2bc}{b+c}\cos.\frac{A}{2}$

C. $EF = \frac{4bc}{b+c}\sin.\frac{A}{2}$

D. ΔAEF is isosceles

Answer: A::B::C::D

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22. In a triangle ABC, AB = 5 , BC = 7, AC = 6. A point P is in the plane such that it is at distance '2' units from AB and 3 units form AC then prove its distance from BC is $\frac{12\sqrt{6}-28}{7}$ when P is inside the trinagle

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23. The base BC of ABC is fixed and the vertex A moves, satisfying the condition $\cot\left(\frac{B}{2}\right)+\cot\left(\frac{C}{2}\right)=2\cot\left(\frac{A}{2}\right)$, then (a) $b+c=a$ (b) $b+c=2a$ (c) vertex A moves along a straight line (d) Vertex A moves along an ellipse

A. $b+c=a$

B. $b+c=2a$

C. vertex A moves along a straight line

D. vertex A moves along an ellipse

Answer: B::D

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24. If D,E and F are the middle points of the sides BC,CA and AB of the ΔABC, then AD+BE+CF is

A. a zero vector

B. 0

C. a unit vector

D. none of these

Answer: A::B

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Linked Comprehension Type

1. Given that $\Delta = 6, r_1 = 2, r_2 = 3, r_3 = 6$

Circumradius R is equal to a) 2.5 b)3.5 c)1.5 d)none of these

A. 2.5

B. 3.5

C. 1.5

D. none of these

Answer: A

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2. Given that $\Delta = 6, r_1 = 2, r_2 = 3, r_3 = 6$

then Inradius is equal to

A. 2

B. 1

C. 1.5

D. 2.5

Answer: B

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3. Given that $\Delta = 6, r_1 = 2, r_2 = 3, r_3 = 6$ Difference between

the greatest and the least angles is

A. $\cos^{-1}.\ \frac{4}{5}$

B. $\tan^{-1}.\ \frac{3}{4}$

C. $\cos^{-1}.\ \frac{3}{5}$

D. none of these

Answer: C

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4. Let a = 6, b = 3 and $\cos(A - B) = \frac{4}{5}$

Area (in sq. units) of the triangle is equal to

A. 9

B. 12

C. 11

D. 10

Answer: A

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5. Let a = 6, b = 3 and $\cos(A - B) = \frac{4}{5}$

Angle C is equal to

A. $\frac{3\pi}{4}$

B. $\frac{\pi}{4}$

C. $\frac{\pi}{2}$

D. none of these

Answer: C

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6. Let a = 6, b = 3 and $\cos(A - B) = \frac{4}{5}$

Value of $\sin C$ is equal to

A. 1

B. $\frac{1}{\sqrt{3}}$

C. $\frac{1}{\sqrt{5}}$

D. $\frac{2}{\sqrt{5}}$

Answer: D

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7. Let ABC be an acute angled triangle with orthocenter H.D, E, and F are the feet of perpendicular from A,B, and C, respectively, on opposite sides. Also, let R be the circumradius of ΔABC. Given $AH.\,BH.\,CH = 3$ and $(AH)^2 + (BH)^2 + (CH)^2 = 7$

Then answer the following

Value of $\dfrac{\cos A.\cos B.\cos C}{\cos^2 A+\cos^2 B+\cos^2 C}$ is

A. $\dfrac{3}{14R}$

B. $\dfrac{3}{7R}$

C. $\dfrac{7}{3R}$

D. $\dfrac{14}{3R}$

Answer: A

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8. Let ABC be an acute angled triangle with orthocenter H.D, E, and F are the feet of perpendicular from A,B, and C, respectively, on opposite sides. Also, let R be the circumradius of ΔABC. Given $AH.BH.CH=3$ and $(AH)^2+(BH)^2+(CH)^2=7$

Then answer the following

Value of R is

A. 1

B. $\frac{3}{2}$

C. $\frac{5}{2}$

D. none

Answer: B

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9. Let ABC be an acute angled triangle with orthocenter H.D, E, and F are the feet of perpendicular from A,B, and C, respectively, on opposite sides. Also, let R be the circumradius of ΔABC. Given $AH.\ BH.\ CH = 3$ and $(AH)^2 + (BH)^2 + (CH)^2 = 7$

Then answer the following

Value of $HD.\ HE.\ HF$ is

A. $\dfrac{9}{64R^3}$

B. $\dfrac{9}{8R^3}$

C. $\dfrac{8}{9R^3}$

D. $\dfrac{64}{9R^3}$

Answer: B

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10. Let O be a point inside a triangle ABC such that $\angle OAB = \angle OBC = \angle OCA = \omega$, then show that: $\cos ec^2\omega = \cos ec^2 A + \cos ec^2 B + \cos ec^2 C$

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11. find the principle value of $\cos^{-1}\left(\frac{\sqrt{3}}{2}\right)$

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12. Let O be a point inside a triangle ABC such that $\angle OAB = \angle OBC = \angle OCA = \omega$, then show that: $\cot\omega = \cot A + \cot B + \cot C$

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13. Given an isoceles triangle with equal side of length b and angle $\alpha < \pi/4$, then

the circumradius R is given by

A. $\frac{1}{2}b\cos ec\alpha$

B. $b\cos ec\alpha$

C. $2b$

D. none of these

Answer: A

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14. Given an isoceles triangle with equal side of length b and angle $\alpha < \pi/4$, then

the inradius r is given by

A. $\dfrac{b\sin 2\alpha}{2(1-\cos\alpha)}$

B. $\dfrac{b\sin 2\alpha}{2(1+\cos\alpha)}$

C. $\dfrac{b\sin\alpha}{2}$

D. $\dfrac{b\sin\alpha}{2(1+\sin\alpha)}$

Answer: B

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15. An isosceles triangle has two equal sides of length 'a' and angle between them is $\propto$. The area of the triangle is

A. $\left|\frac{b\cos(3\alpha/2)}{2\sin\alpha\cos(\alpha/2)}\right|$

B. $\left|\frac{b\cos 3\alpha}{\sin 2\alpha}\right|$

C. $\left|\frac{b\cos 3\alpha}{\cos\alpha\sin(\alpha/2)}\right|$

D. $\left|\frac{b}{\sin\alpha\cos\alpha/2}\right|$

Answer: A

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16. Incircle of ΔABC touches the sides BC, AC and AB at D, E and F, respectively. Then answer the following question

$\angle DEF$ is equal to

A. $\frac{\pi - B}{2}$

B. $\pi - 2B$

C. $A - C$

D. none of these

Answer: A

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17. Incircle of ΔABC touches the sides BC, AC and AB at D, E and F, respectively. Then answer the following question

$\angle DEF$ is equal to

A. $2r^2 \sin(2A)\sin(2B)\sin(2C)$

B. $2r^2 \cos.\ \frac{A}{2}\cos.\ \frac{B}{2}\cos.\ \frac{C}{2}$

C. $2r^2 \sin(A - B)\sin(B - C)\sin(C - A)$

D. none of these

Answer: B

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18. Incircle of ΔABC touches the sides BC, AC and AB at D, E and F, respectively. Then answer the following question

The length of side EF is

A. $r \sin.\ \frac{A}{2}$

B. $2r \sin.\ \frac{A}{2}$

C. $r \cos.\ \frac{A}{2}$

D. $2r\cos.\ \dfrac{A}{2}$

Answer: D

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19. Bisectors of angles A, B and C of a triangle ABC intersect its circumcircle at D, E and F respectively. Prove that the angles of the triangle DEF are $90^\circ - \frac{1}{2}A, 90^\circ - \frac{1}{2}B$ and $90^\circ - \frac{1}{2}C$

A. $2R\cos.\ \dfrac{A}{2}$

B. $2R\sin\left(\dfrac{A}{2}\right)$

C. $R\cos\left(\dfrac{A}{2}\right)$

D. $2R\cos\left(\dfrac{B}{2}\right)\cos\left(\dfrac{C}{2}\right)$

Answer: A

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20. Internal bisectors of ΔABC meet the circumcircle at point

D, E, and F

Area of ΔDEF is

A. $2R^2\cos^2\left(\frac{A}{2}\right)\cos^2\left(\frac{B}{2}\right)\cos^2\left(\frac{C}{2}\right)$

B. $2R^2\sin\left(\frac{A}{2}\right)\sin\left(\frac{B}{2}\right)\sin\left(\frac{C}{2}\right)$

C. $2R^2\sin^2\left(\frac{A}{2}\right)\sin^2\left(\frac{B}{2}\right.\sin^2\left(\frac{C}{2}\right)$

D. $2R^2\cos\left(\frac{A}{2}\right)\cos\left(\frac{B}{2}\right)\cos\left(\frac{C}{2}\right)$

Answer: D

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21. Internal bisectors of ΔABC meet the circumcircle at point D, E, and F

Area of ΔDEF is

A. ≥ 1

B. ≤ 1

C. $\geq 1/2$

D. $\leq 1/2$

Answer: B

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22. The area of any cyclic quadrilateral ABCD is given by $A^2 = (s-a)(s-b)(s-c)(s-d)$, where $2s = a+b+ +c+d, a, b, c$ and d are the sides of the

quadrilateral

Now consider a cyclic quadrilateral ABCD of area 1 sq. unit and answer the following question

The minium perimeter of the quadrilateral is

A. 4

B. 2

C. 1

D. none of these

Answer: A

Watch Video Solution

23. The area of any cyclic quadrilateral ABCD is given by $A^2 = (s-a)(s-b)(s-c)(s-d)$, where $2s = a + b + \ + c + d, a, b, c$ and d are the sides of the

quadrilateral

Now consider a cyclic quadrilateral ABCD of area 1 sq. unit and answer the following question

The minimum value of the sum of the lenghts of diagonals is

A. $2\sqrt{2}$

B. 2

C. $\sqrt{2}$

D. none of these

Answer: A

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24. The area of any cyclic quadrilateral ABCD is given by $A^2=(s-a)(s-b)(s-c)(s-d)$, where $2s=a+b+\ +c+d, a, b, c$ and d are the sides of the

quadrilateral

Now consider a cyclic quadrilateral ABCD of area 1 sq. unit and answer the following question

When the perimeter is minimum, the quadrilateral is necessarily

A. a square

B. a rectangle but not a square

C. a rhombus but not a square

D. none of these

Answer: A

Watch Video Solution

25. In $\Delta ABC, R, r, r_1, r_2, r_3$ denote the circumradius, inradius, the exradii opposite to the vertices A,B, C respectively. Given that

$r_1 : r_2 : r_3 = 1 : 2 : 3$

The sides of the triangle are in the ratio

A. $1 : 2 : 3$

B. $3 : 5 : 7$

C. $1 : 5 : 9$

D. $5 : 8 : 9$

Answer: D

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26. In ΔABC, R, r, r_1, r_2, r_3 denote the circumradius, inradius, the exradii opposite to the vertices A,B, C respectively. Given that

$r_1 : r_2 : r_3 = 1 : 2 : 3$

The sides of the triangle are in the ratio

A. $5:2$

B. $5:4$

C. $5:3$

D. $3:2$

Answer: A

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27. In ΔABC, R, r, r_1, r_2, r_3 denote the circumradius, inradius, the exradii opposite to the vertices A,B, C respectively. Given that

$r_1 : r_2 : r_3 = 1 : 2 : 3$

The sides of the triangle are in the ratio

A. $\cos^{-1}\left(\frac{1}{30}\right)$

B. $\cos^{-1}\left(\frac{1}{3}\right)$

C. $\cos^{-1}\left(\frac{1}{10}\right)$

D. $\cos^{-1}\left(\frac{1}{5}\right)$

Answer: C

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28. In ΔABC, P, Q, R are the feet of angle bisectors from the vertices to their opposite sides as shown in the figure. ΔPQR is constructed

If $\angle BAC = 120^\circ$, then measusred of $\angle RPQ$ will be

A. 60°

B. 90°

C. 120°

D. 150°

Answer: B

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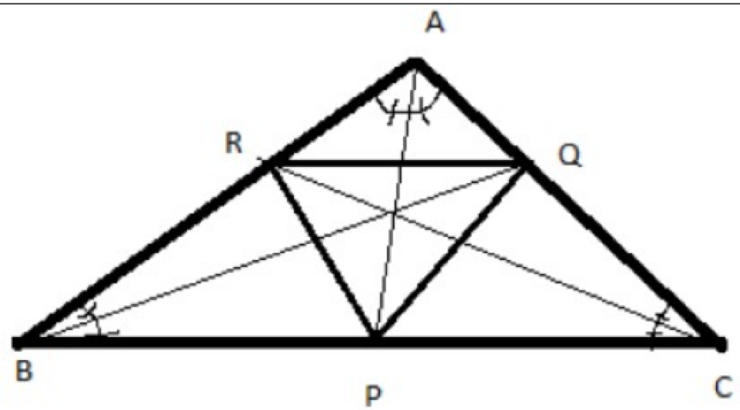
29. In $\triangle ABC, P, Q, R$ are the feet of angle bisectors from the vertices to their opposite sides as shown in the figure. $\triangle PQR$ is constructed



If $AB = 7$ units, BC = 8 units, AC = 5 units, then the side PQ will be

A. $\frac{\sqrt{28}}{3}$ units

B. $\frac{\sqrt{88}}{3}$ units

C. $\frac{\sqrt{78}}{3}$ units

D. $\frac{\sqrt{84}}{3}$ units

Answer: D

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30. Let G be the centroid of triangle ABC and the circumcircle of triangle AGC touches the side AB at A

If $BC = 6, AC = 8$, then the length of side AB is equal to

A. $\frac{1}{2}$

B. $\frac{2}{\sqrt{3}}$

C. $5\sqrt{2}$

D. none of these

Answer: C

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31. Let G be the centroid of triangle ABC and the circumcircle of triangle AGC touches the side AB at A If $\angle GAC = \frac{\pi}{3}$ and $a = 3b$, then sin C is equal to

A. $\frac{3}{4}$

B. $\frac{1}{2}$

C. $\frac{2}{\sqrt{3}}$

D. none of these

Answer: B

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32. Let G be the centroid of triangle ABC and the circumcircle of triangle AGC touches the side AB at A

If AC = 1, then the length of the median of triangle ABC through the vertex A is equal to

A. $\frac{\sqrt{3}}{2}$

B. $\frac{1}{2}$

C. $\frac{2}{\sqrt{3}}$

D. $\frac{5}{\sqrt{2}}$

Answer: A

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33. The inradius in a right angled triangle with integer sides is r

If r = 4, the greatest perimeter (in units) is

A. 96

B. 90

C. 60

D. 48

Answer: B

Watch Video Solution

34. The inradius in a right angled triangle with integer sides is r

If r = 5, the greatest area (in sq. units) is

A. 150

B. 210

C. 330

D. 450

Answer: C

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Matrix Match Type

1. show that $\tan^{-1}\left(\frac{1}{2}\right)+\tan^{-1}\left(\frac{2}{11}\right)=\tan^{-1}\left(\frac{3}{4}\right)$

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2. find the value of $\sin^{-1}\left(\frac{\sqrt{3}}{2}\right)+\cos^{-1}\left(-\frac{\sqrt{3}}{2}\right)$

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3. show that

$$\tan^{-1}x + \tan^{-1}\left(\frac{2x}{1-x^2}\right) = \tan^{-1}\left(\frac{3x - x^3}{1 - 3x^2}\right), |x| < \frac{1}{\sqrt{3}}$$

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4. Show that $\sin^{-1}\left(\frac{3}{5}\right) - \sin^{-1}\left(\frac{8}{17}\right) = \cos^{-1}\left(\frac{84}{85}\right)$.

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5. simplify $\cos^{-1}\left(\frac{\sin x + \cos x}{\sqrt{2}}\right), \frac{\pi}{4} < x < \frac{5\pi}{4}$

Watch Video Solution

6. In a triangle ABC, $a=7, b=8, c=9$, BD is the median and BE the altitude from the vertex B. Match the following lists

$a.\ BD =$ $p.\ 2$

$b.\ BE =$ $q.\ 7$

$c.\ ED =$ $r.\ \sqrt{45}$

$d.\ AE =$ $s.\ 6$

A. 1. $\begin{matrix} a & b & c & d \\ p & r & q & q \end{matrix}$

B. 2. $\begin{matrix} a & b & c & d \\ r & q & s & p \end{matrix}$

C. 3. $\begin{matrix} a & b & c & d \\ q & r & p & s \end{matrix}$

D. 4. $\begin{matrix} a & b & c & d \\ s & p & q & r \end{matrix}$

Answer: C

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Numerical Value Type

1. Suppose $\alpha, \beta, \gamma and \delta$ are the interior angles of regular pentagon, hexagon, decagon, and dodecagon, respectively, then the value of $|\cos \alpha \sec \beta \cos \gamma \cos ec\delta|$ is ________

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2. Let ABCDEFGHIJKL be a regular dodecagon. Then the value of $\frac{AB}{AF} + \frac{AF}{AB}$ is equal to ____

Watch Video Solution

3. In a $\Delta ABC, b = 12$ units, c = 5 units and $\Delta = 30$sq. units. If d is the distance between vertex A and incentre of the triangle then the value of d^2 is _____

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4. In ΔABC, if $r = 1, R = 3,$ and $s = 5$, then the value of $a^2 + b^2 + c^2$ is _____

Watch Video Solution

5. Consider a ΔABC in which the sides are $a = (n+1), b = (n+2), c = n$ with $\tan C = 4/3$, then the value of Δ is _____

Watch Video Solution

6. In $\Delta AEX, T$ is the midpoint of XE and P is the midpoint of ET. If ΔAPE is equilateral of side length equal to unity, then the vaue of $(AX)^2$ is _____

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7. In ΔABC, the incircle touches the sides BC, CA and AB, respectively, at D, E,and F. If the radius of the incircle is 4 units and BD, CE, and AF are consecutive integers, then

A. Sides are also consecutive integers

B. Perimeter of the triangle is 42 units

C. Area of triangle is 84 sq. units

D. Diameter of circumcircle is 65 units

Answer: 21

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8. The altitudes from the angular points A,B, and C on the opposite sides BC, CA and AB of ΔABC are 210, 195 and 182 respectively. Then the value of a is ____

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9. In ΔABC, If $\angle C = 3\angle A,\ BC = 27,\ \text{ and } AB = 48$. Then the value of AC is ______

Watch Video Solution

10. The area of a right triangle is 6864 sq. units. If the ratio of its legs is $143 : 24$, then the value of r is ______

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11. In $\Delta ABC,\ \text{ if } \cos A + \sin A - \dfrac{2}{\cos B + \sin B} = 0,\ \text{ then}$ the value of $\left(\dfrac{a+b}{c}\right)^4$ is

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12. In $\Delta ABC, \angle C = 2\angle A, \text{ and } AC = 2BC$, then the value of $\frac{a^2+b^2+c^2}{R^2}$ (where R is circumradius of triangle) is ______

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13. In ΔABC, if $b(b+c) = a^2$ and $c(c+a) = b^2$, then $|\cos A . \cos B . \cos C|$ is______

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14. The sides of triangle ABC satisfy the relations $a+b-c=2$ and $2ab-c^2=4$, then the square of the area of triangle is ______

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15. prove that $\sec^2(\tan^{-1}3) + \cos ec^2(\cot^{-1}4) = 27$

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16. If a, b and c represent the lengths of sides of a triangle then the possible integeral value of $\frac{a}{b+c} + \frac{b}{c+a} + \frac{c}{a+b}$ is _____

Watch Video Solution

17. In triangle ABC, $\sin A \sin B + \sin B \sin C + \sin C \sin A = 9/4$ and $a = 2$, then the value of $\sqrt{3}\Delta$, where Δ is the area of triangle, is ______

Watch Video Solution

18. In a ΔABC, $AB = 52$, $BC = 56$, $CA = 60$. Let D be the foot of the altitude from A and E be the intersection of the internal angle bisector of $\angle BAC$ with BC. Find the length DE.

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19. Point D,E are taken on the side BC of an acute angled triangle ABC,, such that $BD = DE = EC$. If $\angle BAD = x$, $\angle DAE = y$ and $\angle EAC = z$ then the value of $\frac{\sin(x+y)\sin(y+z)}{\sin x \sin z}$ is ______

Watch Video Solution

20. For triangle ABC, $R = \frac{5}{2}$ and $r = 1$. Let I be the incenter of the triangle and D, E and F be the feet of the perpendiculars from $I \rightarrow BC, CA$ and $AB,$ respectively. The value of $\dfrac{ID \cdot IE \cdot IF}{IA \cdot IB \cdot IC}$ is equal to (a) $\dfrac{5}{2}$ (b) $\dfrac{5}{4}$ (c) $\dfrac{1}{10}$ (d) $\dfrac{1}{5}$

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21. Circumradius of ΔABC is 3 cm and its area is $6cm^2$. If DEF is the triangle formed by feet of the perpendicular drawn from A,B and C on the sides BC, CA and AB, respectively, then the perimeter of ΔDEF (in cm) is _____

Watch Video Solution

22. The distance of incentre of the right-angled triangle ABC (right angled at A) from B and C are $\sqrt{10}$ and $\sqrt{5}$, respectively. Then find the perimeter of the triangle.

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Archives Single Correct Answer Type

1. 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

A. There is a regular polygon with $\frac{r}{R} = \frac{\sqrt{3}}{2}$

B. There is a regular polygon with $\frac{r}{R} = \frac{1}{2}$

C. There is a regular polygon with $\frac{r}{R} = \frac{1}{\sqrt{2}}$

D. There is a regular polygon with $\frac{r}{R} = \frac{2}{3}$

Answer: D

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2. ABCD is a trapezium such that AB,DC.are parallel and BC is perpendicular to them. If $\angle ADB = \theta, BC = p$ and $CD = q$, show that AB=$\frac{(p^2+q^2)\sin\theta}{p\cos\theta+q\sin\theta}$

A. $\left(\frac{p^2+q^2\sin\theta}{p\cos\theta+q\sin\theta}\right.$

B. $\frac{(p^2+q^2)\cos\theta}{p\cos\theta+q\sin thet}$

C. $\frac{p^2+q^2}{p^2\cos\theta+q^2\sin\theta}$

D. $\frac{(p^2+q^2)\sin\theta}{(p\cos\theta+q\sin\theta)}$

Answer: A

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Archives Jee Advanced

1. Let ABC be a triangle such that $\angle ACB = \frac{\pi}{6}$ and let a , b and c denote the lengths of the side opposite to A, B ,and C respectively. The value(s) of x for which $a = x^2 + x + 1, b = x^2 - 1, \text{ and } c = 2x + 1$ is(are) $-(2+\sqrt{3})$ (b) $1+\sqrt{3}$ (c)$2+\sqrt{3}$ (d) $4\sqrt{3}$

A. $-(2+\sqrt{3})$

B. $1+\sqrt{3}$

C. $2+\sqrt{3}$

D. $4\sqrt{3}$

Answer: B

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2. If the angle $A, BandC$ of a triangle are in an arithmetic propression and if $a, bandc$ denote the lengths of the sides opposite to $A, BandC$ 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) $\sqrt{3}$

A. $\frac{1}{2}$

B. $\frac{\sqrt{3}}{2}$

C. 1

D. $\sqrt{3}$

Answer: D

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3. 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 $\left(\frac{2\sin P - \sin 2P}{2\sin P + \sin 2P}\right)$ equals

A. $\frac{3}{4\Delta}$

B. $\frac{45}{4\Delta}$

C. $\left(\frac{3}{4\Delta}\right)^2$

D. $\left(\frac{45}{4\Delta}\right)^2$

Answer: C

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Archives Multiple Correct Answer Type

1. a triangle ABC with fixed base BC, the vertex A moves such that $\cos B + \cos C = 4\sin^2\left(\frac{A}{2}\right)$. If a, b and c, denote the length of the sides of the triangle opposite to the angles A, B and C , respectively, then (a) $b+c=4a$ (b) $b+c=2a$ (c) the locus of point A is an ellipse (d) the locus of point A is a pair of straight lines

A. $b+c=4a$

B. $b+c=2a$

C. locus of point A is an ellipse

D. locus of point A is a pair of straight lines

Answer: B::C

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2. about to only mathematics

A. 16

B. 18

C. 24

D. 22

Answer: B::D

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3. In a triangle XYZ, let x, y, z be the lengths of sides opposite to the angles X, Y, Z, respectively, and 2s = x + y + z. If $\frac{s-x}{4}=\frac{s-y}{3}=\frac{s-z}{2}$ and area of incircle of the triangle XYZ is $\frac{8\pi}{3}$. then the area of triangle XYZ is _

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4. In a triangle PQR, let $\angle PQR = 30^{\circ}$ and the sides PQ and QR have lengths $10\sqrt{3}$ and 10, respectively. Then, which of the following statement(s) is (are) TRUE ?

$\angle QPR = 45^{\circ}$ and

The area of the triangle PQR is $25\sqrt{3}$ and $\angle QRP = 120^{\circ}$

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Archives Matrix Match Type

1. Solve the equation $2\tan^{-1}(\cos x) = \tan^{-1}(2\cos ecx)$

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Archives Numerical Value Type

1. Let $ABC and ABC'$ be two non-congruent triangles with sides $AB = 4, AC = AC' = 2\sqrt{2}$ and angle $B = 30^0$. The absolute value of the difference between the areas of these triangles is

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2. Two parallel chords of a circle of radius 2 are at a distance. $\sqrt{3} + 1$ apart. If the chord subtend angles $\frac{\pi}{k}$ and $\frac{2\pi}{k}$ at the center, where $k > 0$, then the value of [k] is

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3. Consider a triangle ABC and let $a, b and c$ denote the lengths of the sides opposite to vertices $A, B, and C$, respectively. Suppose $a = 6, b = 10,$ and the area of triangle is $15\sqrt{3}$. If

$\angle ACB$ is obtuse and if r denotes the radius of the incircle of the triangle, then the value of r^2 is

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