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MATHS

BOOKS - SAI MATHS (TELUGU ENGLISH)

PROPERTIES OF TRIANGLES, HEIGHTS AND DISTANCES

Problems

1. If in a $\triangle ABC, r_1 = 2r_2 = 3r_3$, then b : c =

A. $4:3$

B. $5:4$

C. $2:1$

D. $3:2$

Answer: A

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2. Show that $\frac{1}{r^2}+\frac{1}{r_1^2}+\frac{1}{r_2^2}+\frac{1}{r_3^2}=\frac{a^2+b^2+c^2}{\Delta^2}$

A. $\frac{a^2+b^2+c^2}{\triangle}$

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

C. $\frac{\triangle^2}{a^2+b^2+c^2}$

D. $\frac{\triangle}{a^2+b^2+c^2}$

Answer: B

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3. The angles of a triangle ABC are in an arithmetic progression. The larger sides a,b satisfy the relation $\frac{\sqrt{3}}{2} < \frac{b}{a} < 1$, then the possible values of the smallest side are

A. $\frac{a \pm \sqrt{4b^2 - 3a^2}}{2a}$

B. $\frac{a \pm \sqrt{4b^2 - 3a^2}}{2b}$

C. $\frac{a \pm \sqrt{4b^2 - 3b^2}}{2c}$

D. $\frac{a \pm \sqrt{4b^2 - 3a^2}}{2}$

Answer: D

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4. If ΔABC, if $\angle C = \frac{\pi}{3}$, then $\frac{3}{a+b+c} - \frac{1}{a+c}$ equals

A. $\frac{1}{a+b}$

B. $\frac{1}{b+c}$

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

D. $\frac{1}{b+2c}$

Answer: B

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5. If in a ΔABC, $r_1 = 2r_2 = 3r_3$, then the perimeter of the triangle is equal to

A. 3a

B. 3b

C. 3c

D. $3(a+b+c)$

Answer: B

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6. In a $\triangle ABC$, $\frac{a}{\tan A} + \frac{b}{\tan B} + \frac{c}{\tan c} =$

A. $2r$

B. $r + 2R$

C. $2r + R$

D. $2(r + R)$

Answer: D

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7. In a ΔABC, $(a + b + c)(b + c - a) = \lambda bc$, then

A. $\lambda < -6$

B. $\lambda > 6$

C. $0 < \lambda < 4$

D. $\lambda > 4$

Answer: C

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8. In any ΔABC, $\frac{(a+b+c)(b+c-a)(c+a-b)(a+b-c)}{4b^2c^2}$ =

A. $\sin^2 B$

B. $\cos^2 A$

C. $\cos^2 B$

D. $\sin^2 A$

Answer: D

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9. IF in a triangle ABC,$r_1 = 2, r_2 = 3$ and $r_3 = 6$ then a=

A. 4

B. 1

C. 2

D. 3

Answer: D

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10. IF the angles of triangle are in the ratio $1:1:4$ then the ratio of the perimeter of the triangle to its largest side is

A. $\sqrt{2}+2:\sqrt{3}$

B. $3:2$

C. $\sqrt{3}+2:\sqrt{2}$

D. $\sqrt{3}+2:\sqrt{3}$

Answer: D

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11. In any triangle ABC, $r_1r_2 + r_2r_3 + r_3r_1 =$

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

B. $\frac{\triangle}{r}$

C. $\frac{2\triangle}{r}$

D. $\triangle^2$

Answer: A

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12. In ΔABC if $\frac{1}{b+c} + \frac{1}{c+a} = \frac{3}{a+b+c}$ then C=

A. 30°

B. 45°

C. 60°

D. 90°

Answer: C

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13. A person observes the top of a tower from a point A on the ground. The elevation of the tower from this point is 60°. He moves 60 m in the direction perpendicular to the line joining A and base of the

tower. The angle of elevation of the tower from this point is 45°. Then, the height of the tower (in meters) is

A. $60\sqrt{\frac{3}{2}}$

B. $60\sqrt{2}$

C. $60\sqrt{3}$

D. $60\sqrt{\frac{2}{3}}$

Answer: A

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14. If α, β, γ, are lengths of the altitudes of a triangle ABC with area Δ, then $\frac{\Delta^2}{R^2}\left(\frac{1}{\alpha^2}+\frac{1}{\beta^2}+\frac{1}{\gamma^2}\right) =$

A. $\sin^2 A + \sin^2 B + \sin^2 C$

B. $\cos^2 A + \cos^2 B + \cos^2 C$

C. $\tan^2 A + \tan^2 B + \tan^2 C$

D. $\cot^2 A + \cot^2 B + \cot^2 C$

Answer: A

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15. A vertical pole subtends an angle $\tan^{-1}\left(\frac{1}{2}\right)$ at a point P on the ground. IF the angles subtended by the upper half and the lower half of the pole at P are respectively α and β, then $(\tan\alpha, \tan\beta)$=

A. $\left(\frac{1}{4}, \frac{1}{5}\right)$

B. $\left(\frac{1}{5}, \frac{2}{9}\right)$

C. $\left(\frac{2}{9}, \frac{1}{4}\right)$

D. $\left(\frac{1}{4}, \frac{2}{9}\right)$

Answer: C

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16. If $a\cos^2.\frac{C}{2} + c\cos^2\frac{A}{2} = \frac{3b}{2}$, then show that a, b , c are in A.P

A. An arithmetic progression

B. A geometric progression

C. A harmonic progression

D. An arithmetic-geometric progression

Answer: A

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17. In a $\triangle ABC$, if $\frac{\cos A}{a} = \frac{\cos B}{b} = \frac{\cos C}{c}$ then $\triangle ABC$ is

A. Right angled

B. Isosceles right angled

C. Equilateral

D. Scalene

Answer: C

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18. The angle of elevation of a stationary cloud from a point 2500m above a lake is 15° and from the same point the angle of depression of its reflection in the lake is 45°. The height (in meters) of the cloud above the lake, given that $\cot 15^\circ = 2 + \sqrt{3}$, is

A. 2500

B. $2500\sqrt{2}$

C. $2500\sqrt{3}$

D. 5000

Answer: C

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19. If $\Delta = a^2 - (b-c)^2$, is the area of the triangle ABC, then tan A=

A. $\frac{1}{16}$

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

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

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

Answer: B

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20. In a triangle ABC, $C = 90^\circ$. Then $\frac{a^2 - b^2}{a^2 + b^2}$=

A. $\sin(A + B)$

B. $\sin(A - B)$

C. $\cos(A + B)$

D. $\cos(A - B)$

Answer: B

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21. The sum of angles of elevation of the top of a tower from two points distance a and b from the base and in

the same straight line with it is 90°. Then the height of the tower is :

A. a^2b

B. ab^2

C. $\sqrt{ab}$

D. ab

Answer: C

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22. In any $\triangle ABC$, $a(b\cos C - c\cos B)$ equals

A. $b^2 + c^2$

B. $b^2 - c^2$

C. $\frac{1}{b} + \frac{1}{c}$

D. $\frac{1}{b^2} - \frac{1}{c^2}$

Answer: B

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23. In any ΔABC, $\frac{(a+b+c)(b+c-a)(c+a-b)(a+b-c)}{4b^2c^2}$ =

A. $\cos^2 A$

B. $\cos^2 B$

C. $\sin^2 A$

D. $\sin^2 B$

Answer: C

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24. P is a point on the segment joining the feet to vertical poles of heights a and b, The angles of elevation of the tops of the poles from P are 45° each. Then the square of the distance between the tops of the poles is:

A. $\frac{a^2 + b^2}{2}$

B. $2\left(a^2 + b^2\right)$

C. $2\left(a^2-b^2\right)$

D. $4\left(a^2+b^2\right)$

Answer: C

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25. In ΔABC if $\frac{1}{b+c}+\frac{1}{c+a}=\frac{3}{a+b+c}$ then C=

A. 90°

B. 60°

C. 45°

D. 30°

Answer: B

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26. Statement I : In $\triangle ABC, b\frac{\cos^2(C)}{2} + c\frac{\cos^2(B)}{2} = 5,$

Statement II : In $\triangle ABC, \frac{\cot(A)}{2} = \frac{b+c}{2} \Rightarrow \angle 90^\circ$

which of the following is correct?

A. Both I and II are true

B. I is true, II is false

C. I is false, II is true

D. Both I and II are false

Answer: B

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27. In a triangle , if $r_1 = 2r_2 = 3r_3$, then $\frac{a}{b} + \frac{b}{c} + \frac{c}{a} =$

A. $\frac{75}{60}$

B. $\frac{155}{60}$

C. $\frac{176}{60}$

D. $\frac{191}{60}$

Answer: D

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28. From the top of a hill h meters high the angle of depressions of the top and the bottem of a piller are α and β respectively. The height (in meters) of the piller is

A. $\frac{h(\tan\beta - \tan\alpha)}{\tan\beta}$

B. $\frac{h(\tan\alpha - \tan\beta)}{\tan\alpha}$

C. $\frac{h(\tan\beta + \tan\alpha)}{\tan\beta}$

D. $\frac{h(\tan\beta + \tan\alpha)}{\tan\alpha}$

Answer: A

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29. If two angles of a $\Delta ABCare45^\circ$ and 60°, then the ratio of the smallest and the greatest sides are

A. $(\sqrt{3}-1):1$

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

C. $1:\sqrt{3}$

D. $\sqrt{3}:1$

Answer: A

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30. In a ΔABC, $(a+b+c)\left(\tan\frac{A}{2}+\tan\frac{B}{2}\right)=$

A. $2c\frac{\cot(C)}{2}$

B. $2a\frac{\cot(A)}{2}$

C. $2b\frac{\cot(B)}{2}$

D. $\frac{\tan(C)}{2}$

Answer: A

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31. In $\triangle ABC$, with usual notation, ovserve the two statement given below,

Statement I : $rr_1r_2r_3 = \triangle^2$

Statement II $r_1r_2 + r_2r_3 + r_3r_1 = S^2$

which of the following is correct ?

A. Both I and II are true

B. I is true, II is false

C. I is false, II is true

D. Both I and II are false

Answer: A

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32. The angle of elevation of an object from a point P on the level ground is a. Moving d metres on the ground towards the object, the angle of elevation is found to be β. Then the height (in metres) of the object is

A. $d \tan \alpha$

B. $d \cot \beta$

C. $\frac{d}{\cot \alpha + \cot \beta}$

D. $\frac{d}{\cot \alpha - \cot \beta}$

Answer: D

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33. In a ΔABC, If $\tan. \frac{A}{2} = \frac{5}{6}$ and $\tan. \frac{B}{2} = \frac{20}{37}$, then show that $\tan\left(\frac{C}{2}\right) = \frac{2}{5}$

A. $b^2 = ac$

B. $2b = a + c$

C. $2ac = b(a + c)$

D. $a + b = c$

Answer: B

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34. The angles of a triangle are in the ratio $3:5:10$. Then the ratio of the smallest side to the greatest side is

A. $1:\sin 10^\circ$

B. $1:2\sin 10^\circ$

C. $1:\cos 10^\circ$

D. $1 : 2\cos 10^\circ$

Answer: D

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35. If b +c =3a , then find the value of $\cot . \frac{B}{2} \cot . \frac{C}{2}$

A. 3

B. 1

C. 4

D. 2

Answer: D

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36. The elevation of an object on a hill is observed from a certain point in the horizontal plane through its base, to be 30°. After walking 120 metres towards it on level ground the elevation is found to be 60° . Then the height of the object (in metres) is

A. 120

B. $60\sqrt{3}$

C. $120\sqrt{3}$

D. 60

Answer: B

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37. In a ΔABC, $\sum (b+c)\tan\frac{A}{2}\tan\left(\frac{B-C}{2}\right) =$

A. a

B. b

C. c

D. 0

Answer: D

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38. Two sides of a triangle are given by the roots of the equation $x^2 - 5x + 6 = 0$ and the angle between the sides is $\pi/2$. Then the perimeter of the triangle is

A. $5 + \sqrt{2}$

B. $5 + \sqrt{3}$

C. $5 + \sqrt{5}$

D. $5 + \sqrt{7}$

Answer: D

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39. In a $\Delta ABC, a\left(\cos^2 B + \cos^2 C\right) + \cos A(c\cos C + b\cos B) =$

A. a

B. b

C. c

D. $a + b + c$

Answer: A

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40. A tower, of x metres high, has a flagstaff at its top. The tower and the flagstaff subtend equal angles at a

point distant y metres from the foot of the tower. Then the length of the flagstaff in metres in

A. $\frac{y\left(x^2-y^2\right)}{\left(x^2+y^2\right)}$

B. $\frac{x\left(y^2+x^2\right)}{\left(y^2-x^2\right)}$

C. $\frac{x\left(x^2+y^2\right)}{\left(x^2-y^2\right)}$

D. $\frac{x\left(x^2-y^2\right)}{\left(x^2+y^2\right)}$

Answer: B

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41. IF in a $\Delta ABC, r_3 = r_1 + r_2 + r,$ then $\angle A + \angle B =$

A. 120°

B. 100°

C. 90°

D. 80°

Answer: C

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42. In a $\triangle ABC$, $(a-b)^2\frac{\cos^2(C)}{2}+(a+b)^2\frac{\sin^2(C)}{2}$ is equal to

A. a^2

B. c^2

C. b^2

D. $a^2 + b^2$

Answer: B

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43. In a $\triangle ABC$, the correct formulae, among the following are

I $r = 4R\dfrac{\sin(A)}{2}\dfrac{\sin(B)}{2}\dfrac{\sin(C)}{2}$

II $r_1 = (s-a)\dfrac{\tan(A)}{2}$

III $r_3 = \dfrac{\triangle}{(s-c)}$

A. only I, II

B. only II, III

C. only I, III

D. I, II, III

Answer: C

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44. An aeroplane flying with uniform speed horizontally one kilometer above the ground id observed at an elevation of 60°. Aftar 10s if the elevation is observed to be 30°, then the speed of the aeroplane (in km/h) is

A. $\frac{240}{\sqrt{3}}$

B. $200\sqrt{3}$

C. $240\sqrt{3}$

D. $\frac{120}{\sqrt{3}}$

Answer: C

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45. In ΔABC, if $r_1 < r_2 < r_3$ then

A. $a < b < c$

B. $a > b > c$

C. $b < a < c$

D. $a < c < b$

Answer: A

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46. In ΔABC if $b = 20, c = 21$ and $\sin A = 3/5$, then a=

A. 12

B. 13

C. 14

D. 15

Answer: B

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47. A tower subtends angles $\alpha, 2\alpha, 3\alpha$ respectively at points A,B and C all lying on a horizontal line through the foot of the tower, Then $\frac{AB}{BC} =$

A. $\frac{\sin 3\alpha}{\sin 2\alpha}$

B. $1 + 2\cos 2\alpha$

C. $2\cos 2\alpha$

D. $\frac{\sin 2\alpha}{\sin \alpha}$

Answer: B

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48. If the altitudes of a triangle are in arithmetic progression, then the sides of the triangle are in

A. A.P

B. H.P

C. G.P

D. A.G.P

Answer: B

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49. In ΔABC, $\frac{\cos C + \cos A}{c + a} + \frac{\cos B}{b} =$

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

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

C. $\frac{c + a}{b}$

D. 1

Answer: B

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50. If $\triangle ABC$ is right angle at A, then $r_2 + r_3$ is equal to

A. $r_1 - r$

B. $r_1 + r$

C. $r - r_1$

D. R

Answer: A

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51. From a point on the level ground, the angle of elevation of the top of a pole is 30°. On moving 20 metres nearer, the angle of elevation is 45°. Then the height of the pole, in metres , is

A. $10\left(\sqrt{3}-1\right)$

B. $10\left(\sqrt{3}+1\right)$

C. 15

D. 20

Answer: B

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52. In ΔABC, if $\frac{a}{b^2-c^2}+\frac{c}{b^2-a^2}=0$ then B=

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

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

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

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

Answer: D

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53. In ΔABC, $a^2 \sin 2C + c^2 \sin 2A =$

A. $\triangle$

B. $2\triangle$

C. $3\triangle$

D. $4\triangle$

Answer: D

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54. The shadow of the tower standing on a level ground is found to be 60 metres longer when the sun's altitude is 30° then when it is 45°. The height of the tower is

A. $30m$

B. $90m$

C. $60\sqrt{3}m$

D. $30\left(\sqrt{3}+1\right)m$

Answer: D

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