MATHS

BOOKS - TELUGU ACADEMY MATHS (TELUGU ENGLISH)

PROPERTIES OF TRIANGLES

Spq

1. Prove that $r + r_1 + r_2 - r_3 = 4R\cos C$

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2. In ΔABC, if AD , BE , CF are the perpendiculars drawn from the vertices A, B, C to the opposite sides, shot that

$$\frac{1}{AD} + \frac{1}{BE} + \frac{1}{CF} = \frac{1}{r} \text{ and } (ii)\, AD.\, BE.\, CF = \frac{(abc)^2}{8R^3} = \frac{8\Delta^3}{abc}$$

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3. If $\sin\theta = \frac{a}{b+c}$ then show that $\cos\theta = \frac{2\sqrt{bc}}{b+c}\cos\left(\frac{A}{2}\right)$

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4. In ΔABC show that

$\sin^2.\frac{A}{2} + \sin^2.\frac{B}{2} + \sin^2.\frac{C}{2} = 1 - \frac{r}{2R}$ (ii)

$\cos A + \cos B + \cos C = 1 + \frac{r}{R}$

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5. Let an object be placed at some height h cm and let P and Q two points of observation which are at a distance 10 cm a part on a line inclined at angle 15° to the horizontal. If the angles of elevation of the object from P and Q are 30° and 60° respectively then find h.

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Saq 1 D Star Q

1. Show that $\frac{\cos A}{a}+\frac{\cos B}{b}+\frac{\cos C}{c}=\frac{a^2+b^2+c^2}{2abc}$

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2. Prove that $\frac{a}{bc}+\frac{\cos A}{a}=\frac{b}{ca}+\frac{\cos B}{b}=\frac{c}{ab}+\frac{\cos C}{c}$

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3. Prove that $\cot A+\cot B+\cot C=\frac{a^2+b^2+c^2}{4\Delta}$

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4. In ΔABC, if $\frac{1}{a+c}+\frac{1}{b+c}=\frac{3}{a+b+c}$ then show that $C=60^\circ$

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5. If $C = 60^\circ$, then show that $\frac{a}{b+c} + \frac{b}{c+a} = 1$

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6. In a ΔABC if $a:b:c = 7:8:9$ then show that $\cos A : \cos B : \cos C = 14:11:6$

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7. Show that $a^2 \cot A + b^2 \cot B + c^2 \cot C = \frac{abc}{R}$

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8. 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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9. Show that $b^2 \sin 2C + c^2 \sin 2B = 2bc \sin A$

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10. In a ΔABC if $a \cos A = b \cos B$ the prove that triangle is either isosceles or right angled .

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11. In ΔABC show that $(a+b+c)\left(\tan.\frac{A}{2} + \tan.\frac{B}{2}\right) = 2\cot.\frac{C}{2}$

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12. If $\cot\frac{A}{2} : \cot\frac{B}{2} : \cot\frac{C}{2} = 3:5:7$ then show that $a:b:c = 6:5:4.$

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13. Prove that $\cot.\frac{A}{2}+\cot.\frac{B}{2}+\cot.\frac{C}{2}=\frac{s^2}{\Delta}$

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14. Prove that $\tan.\frac{A}{2}+\tan.\frac{B}{2}+\tan.\frac{C}{2}=\frac{bc+ca+ab-s^2}{\Delta}$

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15. If $\cot.\frac{A}{2}+\cot.\frac{B}{2}+\cot.\frac{C}{2}$ are in A.P , then prove that a, b, c are in A.P

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16. If $\sin^2.\frac{A}{2}+\sin^2.\frac{B}{2}+\sin^2.\frac{C}{2}$ are in H.P , show that a , b, c are in H. P

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17. In ΔABC prove that $\tan\left(\frac{B-C}{2}\right) = \frac{b-c}{b+c}\cot.\frac{A}{2}$

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

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Laq

1. Show that $r(r_1+r_2+r_3) = ab+bc+ca-s^2$.

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2. Prove that $\frac{r_1(r_2+r_3)}{\sqrt{r_1r_2+r_2r_3+r_3r_1}} = a$

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3. Prove that $4(r_1r_2 + r_2r_3 + r_3r_1) = (a + b + c)^2$

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4. Prove that $\left(\frac{1}{r} - \frac{1}{r_1}\right)\left(\frac{1}{r} - \frac{1}{r_2}\right)\left(\frac{1}{r} - \frac{1}{r_3}\right) = \frac{abc}{\Delta^3} = \frac{4R}{r^2s^2}$

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5. Show that $(r_1 + r_2)\sec^2.\frac{C}{2} = (r_2 + r_3)\sec^2.\frac{A}{2} = (r_3 + r_1)\sec^2.\frac{B}{2}$

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6. Show that $r_1 + r_2 + r_3 - r = 4R$

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7. Show that $r + r_3 + r_1 - r_2 = 4R\cos B.$

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8. If A, A_1, A_2, A_3 are the areas of incircle and ex-circle of a triangle respectively then prove that $\frac{1}{\sqrt{A_1}} + \frac{1}{\sqrt{A_2}} + \frac{1}{\sqrt{A_3}} = \frac{1}{\sqrt{A}}$

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9. In a ΔABC if $a = 13, b = 14, c = 15$ then show that $R = \frac{65}{8}, r = 4, r_1 =$

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10. In a ΔABC if $r_1 = 8, r_2 = 12, r_3 = 24$ find a, b,c .

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11. If $r_1 = 2, r_2 = 3, r_3 = 6$ and $r = 1,$ prove that a=3,b=4 and c=5.

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12. In ΔABC prove that $\frac{r_1}{bc}+\frac{r_2}{ca}+\frac{r_3}{ab}=\frac{1}{r}-\frac{1}{2R}$

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13. In ΔABC, show that $\frac{ab-r_1r_2}{r_3}=\frac{bc-r_2r_3}{r_1}=\frac{ca-r_3r_1}{r_2}$

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14. If p_1, p_2, p_3 are altitudes of a ΔABC then show that

$$\frac{1}{p_1}+\frac{1}{p_2}+\frac{1}{p_3}=\frac{1}{r}$$

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15. If P_1, P_2, P_3 are altitudes of a ΔABC then show that

$$\frac{1}{P_1}+\frac{1}{P_2}-\frac{1}{P_3}=\frac{1}{r_3}$$

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16. If P_1, P_2, P_3 are altitudes of a ΔABC then show that

$$P_1P_2P_3 = \frac{(abc)^2}{8R^3} = \frac{8\Delta^3}{abc}$$

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17. In ΔABC, with usual notation show that

$$\frac{(a+b+c)^2}{a^2+b^2+c^2} = \frac{\cot.\frac{A}{2} + \cot.\frac{B}{2} + \cot.\frac{C}{2}}{\cot A + \cot B + \cot C}$$

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

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19. If $a = (b-c)\sec\theta$, then prove that $\tan\theta = \frac{2\sqrt{bc}}{b-c}\frac{\sin A}{2}$.

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20. In ΔABC prove that $a\cos^2.\frac{A}{2}b\cos^2.\frac{B}{2}c\cos^2.\frac{C}{2} = s + \frac{A}{R}$

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Laq Saq Vsaq 2 Dhardq 3 Dmis Q

1. If $\frac{a^2+b^2}{a^2-b^2} = \frac{\sin C}{\sin(A-B)}$, then S.T . ΔABC is either isoceles or right angled triangle .

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2. In a $\triangle ABC$ if $a^2+b^2+c^2 = 8R^2$ then show that $\triangle ABC$ is a right angled triangle.

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3. In ΔABC show that $\sum a^3 \cos(B-C) = 3abc$

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4. In ΔABC prove that $\cos^2.\frac{A}{2} + \cos^2.\frac{B}{2} + \cos^2.\frac{C}{2} = 2 + \frac{r}{2R}$

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5. If P_1, P_2, P_3 are the altitudes of the ΔABC then , show that $\frac{1}{P_1^2} + \frac{1}{P_2^2} + \frac{1}{P_3^2} = \frac{\cot A + \cot B + \cot C}{\Delta}$

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6. In ΔABC prove that $(b-c)^2 \cos^2.\frac{A}{2} + (b+c)^2 \sin^2.\frac{A}{2} = a^2$

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7. Show that $\frac{c - b\cos A}{b - c\cos A} = \frac{\cos B}{\cos C}$

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

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9. Show that $2(\mathrm{bc}\cos A + \mathrm{ca}\cos B + \mathrm{ab}\cos C) = a^2 + b^2 + c^2.$

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

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11. If $a = 26, b - 30, \cos C = 63/65$, then find c

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12. If $\tan.\frac{A}{2}=\frac{5}{6}$ and $\tan.\frac{C}{2}=\frac{2}{5}$ then determine the relation between a, b,c

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13. Prove that $\frac{a^2+b^2-c^2}{c^2+a^2-b^2}=\frac{\tan B}{\tan C}$

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14. What is the value of r/R in an equilateral triangle .

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15. If $rr_2=r_1r_3$then find B.

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16. Express $\sum r_1 \cot. \frac{A}{2}$ interms of s .

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17. Show that $rr_1 \cot. \frac{A}{2} = \Delta.$

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18. In ΔABC , show that the sides a, b, c are in A.P ., if and only if r_1, r_2, r_3 are in H.P

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19. If the lengths of the sides of a triangle are 3 , 4,5 find the circumradius of the triangle .

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20. If the sides of a triangle are 13,14,15 , then find circum diameter .

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21. If a=6 , b=5 ,c=9 then angle A .

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22. If a =2 , b = 3 c=4 then find cos A .

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

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24. If (a+b+c) (b+c-a) = 3bc then find angle A .

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25. In ΔABC prove that $(b-c)^2 \cos^2.\frac{A}{2} + (b+c)^2 \sin^2.\frac{A}{2} = a^2$

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26. If $\tan.\frac{C-A}{2} = k\cot.\frac{B}{2}$ then find k .

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27. Show that $\frac{c - b\cos A}{b - c\cos A} = \frac{\cos B}{\cos C}$

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28. In ΔABC, find $b\cos^2.\frac{C}{2} + c\cos^2.\frac{B}{2}$

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29. If $\cot. \frac{A}{2} = \frac{b+c}{a}$ find angle B

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30. Show that $b^2 \sin 2C + c^2 \sin 2B = 2bc \sin A$

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31. In ΔABC show that $\frac{b^2 - c^2}{a^2} = \frac{\sin(B-C)}{\sin(B+C)}$

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32. Show that $a \cos A + b \cos B + c \cos C = \frac{2\Delta}{R}$

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33. Show that $a^2 \sin 2C + c^2 \sin 2A = 4\Delta$

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34. In ΔABC, prove that $\frac{1}{r_1} + \frac{1}{r_2} + \frac{1}{r_3} = \frac{1}{r}$.

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35. Show that $rr_1r_2r_3 = \Delta^2$

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36. If $A = 90^\circ$, show that $2(r + R) = b + c$

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37. If s = 12 and $A = 90^\circ$ then find the value of r_1

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38. If a = 18 , b=24 , c=30 , find r_1 .

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39. If a , b, c are in A .P ., then show that $3\tan.\frac{A}{2}\tan.\frac{C}{2}=1$

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40. 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

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41. Two tress A and B are on the same side of a river . From a point C in the river the distane of the tress A and B are 250m and 300m respectively

. If the angle C is 45° find the distances between the tress (use $\sqrt{2} = 1.414$)

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42. The upper$3/4^{th}$ portion of a vertical pole subtends an angle $\tan^{-1}(3/5)$ at a point in the horizontal plane through its foot and at a distance 40 m from the foot . Given that the vertical pole is at a height less than 100m from the gound ,find its height .

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

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44. The angle of elevation of the toop point P of the vertical tower PQ of height h from a point A 45° and from a point B is 60° , where B is a point at a distance 30 meters from the point A measured along the line AB which makes an angle 30° with AQ . Then the height of the tower is.

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