MATHS

BOOKS - KC SINHA MATHS (HINGLISH)

SINE AND COSINE FORMULA - FOR BOARDS

Solved Examples

1. If in any ΔABC, $A = 30^\circ$ and $B = 60^\circ$, then find $a : b : c$

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2. If in any ΔABC, $B = 60^\circ$ and $b : c = \sqrt{3} : \sqrt{2}$, then find A.

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3. If in ΔABC, $a = 3$, $b = 5$, $c = 7$ find the greatest angle.

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4. If in ΔABC, $a = \frac{1}{\left(\sqrt{6} - \sqrt{2}\right)}$, $b = \frac{1}{\left(\sqrt{6} + \sqrt{2}\right)}$ and $C = 60^0$, then prove that $c = \frac{\sqrt{3}}{2}$

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5. In any ΔABC, prove that : $a^2 + b^2 + c^2 = 2(bc\cos A + ca\cos B + ab\cos C)$.

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6. In any ΔABC, prove that : $a(b\cos C - c\cos B) = b^2 - c^2$.

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

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8. If in any $\Delta ABC, a:b:c=4:5:6$, prove that the greatest angle is doule the smalles angle`

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9. The sides of a triangle are $8cm, 10cm$ and $12cm$. Prove that the greatest angle is double the smallest angle.

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10. In any parallelogram if a and b are the length of the two non-parallel sides, θ is the angle measure between these two sides and d is the length

of the diagonal that has a common vertex with sides a and b, then show that the measure of d can be given be : $d^2 = a^2 + b^2 + 2ab\cos x$

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11. With usual notations, if in a triangle $ABC \frac{b+c}{11} = \frac{c+a}{12} = \frac{a+b}{13}$, then prove that: $\frac{\cos A}{7} = \frac{\cos B}{19} = \frac{\cos C}{25}$

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12. 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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13. Find the unknown parts of ΔABC if $a = \sqrt{3}+1, b = \sqrt{3}-1, C = 60^0$.

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14. In any ΔABC, prove that :

$$(b+c)\cos A+(c+a)\cos B+(a+b)\cos C=a+b+c$$

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15. In any ΔABC, prove that :

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

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16. In any ΔABC, prove that :

$$2\left(b\cos^2\left(\frac{C}{2}\right)+c\cos^2\left(\frac{B}{2}\right)\right)=a+b+c$$

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17. In any ΔABC, prove that : $2\left(a\sin^2\left(\frac{C}{2}\right)+c\sin^2\left(\frac{A}{2}\right)\right)=a+c-b$

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18. In any triangle ABC prove that: $\sin\left(\frac{B-C}{2}\right)=\left(\frac{b-c}{a}\right)\frac{\cos A}{2}$

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19. In any ΔABC prove that : $\frac{\sin(A-B)}{\sin(A+B)}=\frac{a^2-b^2}{c^2}$

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20. Prove that in any ΔABC, $a\sin(B-C)+b\sin(C-A)+c\sin(A-B)=0$

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21. Prove that in any ΔABC, $a(\sin B - \sin C) + b(\sin C - \sin A) + c(\sin A - \sin B) = 0$

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22. In a triangle ABC, prove that : $a\sin\left(\frac{A}{2} + B\right) = (b + c)\sin\left(\frac{A}{2}\right)$.

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23. In any ΔABC, prove that $\frac{\sin B}{\sin C} = \frac{c - a\cos B}{b - a\cos C}$

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24. In any ΔABC, prove that : $\left(\frac{a - b}{c}\right) = \frac{\tan\left(\frac{A}{2}\right) - \tan\left(\frac{B}{2}\right)}{\tan\left(\frac{A}{2}\right) + \tan\left(\frac{B}{2}\right)}$

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25. If in ΔABC, $\frac{\tan A - \tan B}{\tan A + \tan B} = \frac{c-b}{c}$, prove that : $A = 60^0$.

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26. If a^2, b^2, c^2 are in A.P., then prove that $\cot A, \cot B, \cot C$ are in A.P.

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27. Problem on sine rule Type:-1(i) In a ΔABC ; If $a = 2; b = 3$ and $\sin A = \frac{2}{3}$;find $\angle B$ (ii) In a ΔABC; the angle of a triangle are in AP ; It is being given that $b : c = \sqrt{3} : \sqrt{2}$

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28. For any triangle ABC, prove that $\left(\frac{\sin(B-C)}{\sin(B+C)} = \frac{b^2 - c^2}{a^2} \right.$

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29. In ΔABC, prove that

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

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30. In any ABC, prove that

$$\frac{b^2-c^2}{a^2}\sin 2A+\frac{c^2-a^2}{b^2}\sin 2B+\frac{a^2-b^2}{c^2}\sin 2C=0$$

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31. In any triangle ABC, prove that:

$$a^3\sin(B-C)+b^3\sin(C-A)+c^3\sin(A-B)=0$$

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32. In any ΔABC, prove that :

$$a\cos A+b\cos B+c\cos C=2a\sin B\sin C$$

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33. For any triangle ABC, prove that $(b^2c^2)\backslash\cot A\backslash \ + \backslash \ (c^2a^2)\backslash\cot B\backslash \ + \backslash \ (a^2b^2)\backslash\cot C\backslash \ = \backslash \ 0$

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34. In a triangle ABC, if $a\cos A = b\cos B$, show that the triangle is either isosceles or right angled.

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35. In any triangle. if $\frac{a^2 - b^2}{a^2 + b^2} = \frac{\sin(A - B)}{\sin(A + B)}$, then prove that the triangle is either right angled or isosceles.

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36. In ΔABC, $a = 3$, $b = 5$, $c = 6$, find the value of : $\sin\left(\frac{A}{2}\right)$

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37. In ΔABC, $a = 3$, $b = 5$, $c = 6$, find the value of : $\cos\left(\frac{A}{2}\right)$

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38. In ΔABC, $a = 3$, $b = 5$, $c = 6$, find the value of : $\tan\left(\frac{A}{2}\right)$

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39. In ΔABC, $a = 3$, $b = 5$, $c = 6$, find the value of : $\cot\left(\frac{A}{2}\right)$

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40. In any ΔABC, porve that $(a+b-c)\cot\left(\frac{B}{2}\right) = (a-b+c)\cot\left(\frac{C}{2}\right)$

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41. If in ΔABC, $(a+b+c)(b+c-a) = abc$, find the condition of a

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42. In any ΔABC, prove that: $\frac{a+b-c}{a+b+c} = \tan\left(\frac{A}{2}\right)\tan\left(\frac{B}{2}\right)$

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43. In any ΔABC, prove that : $2\left(a\frac{\sin^2 C}{2} + c\frac{\sin^2 A}{2}\right) = a+c-b$

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

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45. Show that in any triangle ABC, $(a+b+c)\left(\tan\left(\frac{A}{2}\right)+\tan\left(\frac{B}{2}\right)\right)=2c\cot\left(\frac{C}{2}\right)$

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46. In any triangle ABC, show that : $2a\sin\left(\frac{B}{2}\right)\sin\left(\frac{C}{2}\right)=(b+c-a)\sin\left(\frac{A}{2}\right)$

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47. In any triangle ABC, show that : $2a\cos\left(\frac{B}{2}\right)\cos\left(\frac{C}{2}\right)=(a+b+c)\sin\left(\frac{A}{2}\right)$

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48. If in ΔABC, reciprocals of the sides a, b, c are in A.P., prove that : $\cos ec^2 \frac{A}{2}, \cos ec^2 \frac{B}{2}, \cos ec^2 \frac{C}{2}$ are in A.P.

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49. In ΔABC, if $\angle B = 90^0$, prove that $\tan\left(\frac{A}{2}\right) = \sqrt{\frac{b-c}{b+c}}$

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50. In ΔABC, if $\angle C = 90^0$, then prove that $\tan\left(\frac{A}{2}\right) = \sqrt{\frac{c-b}{c+b}} = \frac{a}{b+c}$

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51. Find the area of ΔABC if : $a = 6, b = 8, C = 30^0$

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52. Find the area of ΔABC if : $a = 18, b = 24, C = 30$

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53. In any ΔABC, prove that $\Delta = \dfrac{b^2 + c^2 - a^2}{4 \cot A}$

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54. In any ΔABC, prove that $b^2 \sin 2C + c^2 \sin 2B = 2bc \sin A = 4\Delta$

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55. In a triangle ABC, prove that

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

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56. In any ΔABC , $\cot\left(\frac{A}{2}\right), \cot\left(\frac{B}{2}\right), \cot\left(\frac{C}{2}\right)$ are in $A.\ P.$, then

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57. If $a\cos^2\left(\frac{C}{2}\right) + c\cos^2\left(\frac{A}{2}\right) = \frac{3b}{2}$. To prove: $\cot\left(\frac{A}{2}\right), \cot\left(\frac{B}{2}\right), \cot\left(\frac{C}{2}\right)$ are in A.P.

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58. If P_1, P_2 and P_3 are the altitudes of a triangle from vertices A, B and C respectively and Δ is the area of the triangle, then the value of $\frac{1}{P_1} + \frac{1}{P_2} - \frac{1}{P_3} =$

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Exercise

1. The ratio of angles in a triangle ABC is $2:3:7$ then prove that $a:b:c=\sqrt{2}:2:\left(\sqrt{3}+1\right)$

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2. If in ΔABC, $a=4$, $b=12$, $\angle B=30^0$, then find $\sin A$.

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3. In any ΔABC, prove that $\dfrac{\sin B}{\sin(B+C)}=\dfrac{b}{a}$

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4. If the two angles of a triangle are 30^0 and 45^0 and the included side is $\left(\sqrt{3}+1\right)$ cm, find the other sides of the triangle).

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5. The angless of a triangle are in the proportion $7:2:1$, prove that the ratio of the least side to the greatest is $3-\sqrt{5}:2$.

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6. In ΔABC, if $c=3.4cm$, $A=25^0$, $B=85^2$, find a, b and angle C.

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7. Find the greatest angle of ΔABC if : $a=2, b=\sqrt{6}, c=\sqrt{3}-1$

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8. Find the greatest angle of ΔABC if : $a=m, b=n, c=\sqrt{m^2+mn+n^2}$

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9. Inf ΔABC, if $a = 25, b = 52$ and $c = 63$, find $\cos A$

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10. In a ABC, prove the following : In a ABC, if $a = 18,\ b = 24,\ c = 30$, find $\cos A,\ \cos B\ and\ \cos C$.

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11. In any ΔABC, if $B = 60^0$, then prove that $(c - a)^2 = b^2 - ca$

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12. If the sides of a triangle are 3, 5, and 6, prove that the triangle is obtuse - angled triangle and find the obtuse angle.

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13. In any ΔABC, prove that : $\dfrac{b^2+c^2-a^2}{(c^2+a^2-b)^2}=\dfrac{\tan B}{\tan A}$

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14. In a triangle ABC, $a^4+b^4+c^4=2c^2(a^2+b^2)$ prove that $C=45^\circ$ or 135°

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15. In ΔABC, prove that : $\dfrac{c-b\cos A}{b-c\cos A}=\dfrac{\cos B}{\cos C}$

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16. In ΔABC, $a=4, b=6, c=8$, then find the value of $8\cos A+16\cos B+4\cos C$.

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17. In any ΔABC, prove that : $(b+c)\cos\left(\frac{B+C}{2}\right) = a\cos\left(\frac{B-C}{2}\right)$.

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18. In any ΔABC, prove that : $\frac{a+b}{c} = \frac{\cos\left(\frac{A-B}{2}\right)}{\sin\left(\frac{C}{2}\right)}$

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19. In any ΔABC, prove that : $\frac{a-b}{c} = \frac{\sin\left(\frac{A-B}{2}\right)}{\cos\left(\frac{C}{2}\right)}$

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20. In any ΔABC, prove that : If $b+c = 2a\cos\left(\frac{B-C}{2}\right)$, then prove that $A = 60^0$.

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21. In any ΔABC, prove that :

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

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22. In any ΔABC, prove that : $\dfrac{1 + \cos(A - B)\cos C}{1 + \cos(A - C)\cos B} = \dfrac{a^2 + b^2}{a^2 + c^2}$

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23. In any ΔABC, prove that :

$$\frac{b^2 - c^2}{\cos B + \cos C} + \frac{c^2 - a^2}{\cos C + \cos A} + \frac{a^2 - b^2}{\cos A + \cos B} = 0$$

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24. In any ΔABC, 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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25. In any ΔABC, prove that : $\frac{b^2 - c^2}{a^2} = \frac{\sin(B - C)}{\sin(B + C)}$

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26. In any ΔABC, prove that : $\tan\left(\frac{A}{2} + B\right) = \frac{c + b}{c - b}\tan\left(\frac{A}{2}\right)$

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27. In any ΔABC, prove that :

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

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28. If $A = 2B$, then prove that either $c = b$ or $a^2 = b(c + b)$

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29. In any ΔABC, prove that :

$$\frac{\cos A}{a}+\frac{a}{bc}=\frac{\cos B}{b}+\frac{b}{ca}=\frac{\cos c}{c}+\frac{c}{ab}$$

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30. In ΔABC, if $A+C=2B$, prove that

$$2\cos\left(\frac{A-C}{2}\right)=\frac{a+c}{\sqrt{a^2-ac+c^2}}$$

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31. In any ΔABC, prove that

$$\frac{\cos 2A}{a^2}-\frac{\cos 2B}{b^2}=\left(\frac{1}{a^2}-\frac{1}{b^2}\right)$$

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32. In any ΔABC, prove that :

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

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33. In any ΔABC, prove that :

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

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34. The median AD of a ΔABC is perpendicular to AB, prove that

$\tan A + 2\tan B = 0$

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35. In a ΔABC, If tan A/2, tan B/2, tan C/2 are in A.P. then cos A. cos B, cos C are in

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36. If $\frac{\sin A}{\sin C} = \frac{\sin(A-B)}{\sin(B-C)}$, prove that a^2, b^2, c^2 are in A.P.

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37. If in ΔABC, $a = 15, b = 36, c = 39$, find $\tan\left(\frac{A}{2}\right)$

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38. In a ΔABC, if $a = 18, b = 24, c = 30$, find : $\tan\left(\frac{A}{2}\right), \tan\left(\frac{B}{2}\right), \tan\left(\frac{C}{2}\right)$

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39. In any ΔABC, prove that : $\frac{b-c}{a}\cos^2\left(\frac{A}{2}\right) + \frac{c-a}{b}\cos^2\left(\frac{B}{2}\right) + \frac{a-b}{c}\cos^2\left(\frac{C}{2}\right) = 0$

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40. In any ΔABC, prove that : $1-\tan\left(\frac{A}{2}\right)\tan\left(\frac{B}{2}\right)=\frac{2c}{a+b+c}$

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41. In ΔABC prove that $a^2+b^2+c^2=2(bc\cos A+ca\cos B+ab\cos C)$

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42. In any ΔABC, prove that : $\frac{\cos^2\left(\frac{A}{2}\right)}{a}+\frac{\cos^2\left(\frac{B}{2}\right)}{b}+\frac{\cos^2\left(\frac{C}{2}\right)}{c}=\frac{s^3}{abc}$

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43. In ΔABC, prove that : $\left(\cot\left(\frac{A}{2}\right)+\cot\left(\frac{B}{2}\right)\right)\left(a\sin^2\left(\frac{B}{2}\right)+b\sin^2\left(\frac{A}{2}\right)\right)=c\cot\left(\frac{C}{2}\right)$

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44. In $\Delta ABC, \tan, \frac{A}{2} \tan, \frac{B}{2} \tan, \frac{C}{2} = \sqrt{\left(1 - \frac{a}{s}\right)\left(1 - \frac{b}{s}\left(1 - \frac{c}{s}\right)\right)}$

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45. If in a$\Delta ABC, \sin A, \sin B, \sin C$ are in A.P., show that $3 \tan, \frac{A}{2} \tan, \frac{C}{2} = 1$

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

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

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48. In a ΔABC, in the sum of two sides is $\sqrt{3}$ times their difference and the included angle is 60^0, find the difference of the remaining angles.

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49. If in ΔABC, the difference of two angles is 60^0 and the remaining angle is 30^0, then find the ratio of the sides opposite to first two angles.

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50. Find the area of ΔABC if : $a=18, b=24, C=30$

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51. The side of a triangle are in A.P. Its area is $\frac{3}{5}$ the of an equilateral triangle of the same perimeter. Show that the sides are in the proportion $3:5:7$.

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52. The sides of a quadrilateral are 3, 4, 5 and 6 cms. The sum of a pair of opposite angles is 120^0. Show that the area of the quadrilateral is $3\sqrt{30}$ sq.cm.

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