MATHS

BOOKS - KC SINHA MATHS (HINGLISH)

CONDITIONAL TRIGONOMETRIC IDENTITIES - FOR BOARDS

Solved Examples

1. If $\alpha + \beta + \gamma = \pi$, prove that $\sin^2 \alpha + \sin^\beta - \sin^2 \gamma = 2 \sin \alpha \sin \beta \cos \gamma$

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2. If $A + B + C = 180^0$, Prove that :

$$\sin^2\left(\frac{A}{2}\right) + \sin^2\left(\frac{B}{2}\right) + \sin^2\left(\frac{C}{2}\right) = 1 - 2\sin\left(\frac{A}{2}\right)\sin\left(\frac{B}{2}\right)\sin\left(\frac{C}{2}\right)$$

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3. Show that: $\sin^2\alpha + \sin^2\beta + 2\sin\alpha\sin\beta\cos(\alpha+\beta) = \sin^2(\alpha+\beta)$

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4. In a ΔABC, prove that : $\tan A + \tan B + \tan C = \tan A \tan B \tan C$

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5. If $A + B + C = \pi$, prove that :

$$\tan\left(\frac{A}{2}\right)\tan\left(\frac{B}{2}\right) + \tan\left(\frac{B}{2}\right)\tan\left(\frac{C}{2}\right) + \tan\left(\frac{C}{2}\right)\tan\left(\frac{A}{2}\right) = 1$$

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6. If $\alpha + \beta + \gamma = \pi$, show that :

$$\tan(\beta+\gamma-\alpha) + \tan(\gamma+\alpha-\beta) + \tan(\alpha+\beta-\gamma) = \tan(\beta+\gamma-\alpha)\text{ta}$$

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7. If $A+B+C=\pi$, prove that: $\cot B\cot C+\cot C\cot A+\cot A+\cot A\cot B=1.$

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8. In a ΔABC, if $\cot A+\cot B+\cot B=\sqrt{3}$, prove that the triangle is equilateral.

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9. If A, B, C, D be the angles of a quadrilateral, prove that : $\frac{\tan A+\tan B+\tan C+\tan D}{\cot A+\cot B+\cot C+\cot D}=\tan A\tan B\tan C\tan D$

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10. If $A+B+C=\pi$, prove that : $\sin 2A+\sin 2B+\sin 2C=4\sin A\sin B\sin C$

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11. If $A+B+C=\pi$ then prove that $\cos A+\cos B+\cos C=1+4\sin\left(\frac{A}{2}\right).\sin\left(\frac{B}{2}\right).\sin\left(\frac{C}{2}\right)$

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12. Prove that :

$$\frac{\sin 2A+\sin 2B+\sin 2C}{\cos A+\cos B+\cos C-1}=8\cos\left(\frac{A}{2}\right)\cos\left(\frac{B}{2}\right)\cos\left(\frac{C}{2}\right)$$

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13. In triangle ABC, prove that

$$\cos\left(\frac{A}{2}\right)+\cos\left(\frac{B}{2}\right)+\cos\left(\frac{C}{2}\right)=4\frac{\cos(\pi-A)}{4}\frac{\cos(\pi-B)}{4}\frac{\cos(\pi-C)}{4}$$

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14. If $A+B+C=\pi$, Prove that :

$$\sin\left(\frac{A}{2}\right)+\sin\left(\frac{B}{2}\right)+\sin\left(\frac{C}{2}\right)=1+4\sin\left(\frac{B+C}{4}\right)\sin\left(\frac{C+A}{4}\right)\sin\left(\right.$$

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15. If $A+B+C=\pi$, prove that :

$$\sin^2\left(\frac{A}{2}\right)+\sin^2\left(\frac{B}{2}\right)-\sin^2\left(\frac{C}{2}\right)=1-2\cos\left(\frac{A}{2}\right)\cos\left(\frac{B}{2}\right)\sin\left(\frac{C}{2}\right)$$

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16. $1+\cos 56^0+\cos 58^0-\cos 66^0=4\cos 28^0\cos 29^0\sin 33^0.$

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17. If $xy+yz+xz=1$,then prove that

$$\frac{x}{1-x^2}+\frac{y}{1-y^2}+\frac{z}{1-z^2}=\frac{4xyz}{(1-x^2)(1-y^2)(1-z^2)}$$

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18. If $x+y+z=xyz$, show that :

$$\frac{3x-x^3}{1-3x^2}+\frac{3y-y^3}{1-3y^2}+\frac{3z-z^3}{1-3z^2}=\frac{3x-x^3}{1-3x^2}\cdot\frac{3y-y^3}{1-3y^2}\cdot\frac{3z-z^3}{1-3z^2}$$

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19. If $A+B+C+D=2\pi$, prove that :

$$\cos A+\cos B+\cos C+\cos D=4\cos\left(\frac{A+B}{2}\right)\cos\left(\frac{B+C}{2}\right)\cos\left(\frac{C+A}{2}\right.$$

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20. If $A+B+C=2S$, prove that :

$$\cos^2 S+\cos^2(S-A)+\cos^2(S-B)+\cos^2(S-C)=2+2\cos A\cos B\,\mathrm{co}$$

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21. If $A+B+C=\pi$, prove that $\frac{\tan^2 A}{2}+\frac{\tan^2 B}{2}+\frac{\tan^2 C}{2}\geq 1.$

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22. If $A+B+C=\pi$, prove that :

$(\tan A+\tan B+\tan C)(\cot A+\cot B+\cot C)=1+\sec A\sec B\sec C$

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23. If $A+B+C=\pi$, prove that :

$(\cot B+\cot C)(\cot C+\cot A)(\cot A+\cot B)=\cos ecA\cos ecB\cos ecC$

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24. If $A+B+C=\pi$, show that :

$\frac{1}{2}\sum\sin^2 A(\sin 2B+\sin 2C)=3\sin A\sin B\sin C.$

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Exercise

1. If $A+B+C=180^0$, prove that : $\cos^2 A+\cos^2 B+\cos^2 C+2\cos A\cos B\cos C=1.$

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2. If $A+B+C=180^0$, prove that : $\sin^2 A+\sin^2 B+\sin^2 C=2(1+\cos A\cos B\cos C)$

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3. If $A+B+C=180^0$, prove that : $\cos^2 A+\cos^2 B-\cos^2 C=1-2\sin A\sin B\cos C$

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4. If $A+B+C=180^0$, prove that :

$$\cos^2\left(\frac{A}{2}\right)+\cos^2\left(\frac{B}{2}\right)-\cos^2\left(\frac{C}{2}\right)=2\cos\left(\frac{A}{2}\right)\cos\left(\frac{B}{2}\right)\sin\left(\frac{C}{2}\right)$$

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5. If $A+B+C=180^0$, prove that :

$$\cos^2\left(\frac{A}{2}\right)+\cos^2\left(\frac{B}{2}\right)+\cos^2\left(\frac{C}{2}\right)=2+2\sin\left(\frac{A}{2}\right)\sin\left(\frac{B}{2}\right)\sin\left(\frac{C}{2}\right)$$

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6. If $A+B+C=\frac{\pi}{2}$, show that :

$$\sin^2 A+\sin^2 B+\sin^2 C=1-2\sin A\sin B\sin C$$

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7. If $A+B+C=\frac{\pi}{2}$, show that :

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

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8. If $\alpha + \beta + \gamma = 2\pi$, prove that : $\cos^2 \alpha + \cos^2 \beta + \cos^2 \gamma - 2 \cos \alpha \cos \beta \cos \gamma = 1.$

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9. If $\alpha + \beta = 60^0$, prove that $\cos^2 \alpha + \cos^2 \beta - \cos \alpha \cos \beta = \frac{3}{4}.$

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10. Show that $\cos^2 \theta + \cos^2 \theta(\alpha + \theta) - 2 \cos \alpha \cos \theta \cos(\alpha + \theta)$ is independent of θ.

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11. If $A+B+C=\pi$ and $A+B=2C$, prove that : $4\left(\sin^2 A+\sin^2 B-\sin A\sin B\right)=3.$

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12. If $A+B+C=2\pi$, prove that : $\cos^2 B+\cos^2 C-\sin^2 A-2\cos A\cos B\cos C=0.$

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13. If$A+B+C=0$, Prove : $\cos^2 A+\cos^2 B+\cos^2 C=1+2\cos A\cos B\cos C.$

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14. Prove that : $\cos^2(\beta-\gamma)+\cos^2(\gamma-\alpha)+\cos^2(\alpha-\beta)=1+2\cos(\beta-\gamma)\cos(\gamma-\alpha)\mathrm{co}$

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15. If $A+B+C=\pi$, prove that :

$\sin A\cos B\cos C+\sin B\cos C\cos A+\sin C\cos A\cos B=\sin A\sin B\sin C$

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16. If $A+B+C=\frac{\pi}{2}$, show that :

$\cot A+\cot B+\cot C=\cot A\cot B\cot C$

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17. If $A+B+C=\frac{\pi}{2}$, show that :

$\tan A\tan B+\tan B\tan C+\tan C\tan A=1$

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18. If $A+B+C=\pi$, prove that

$\tan 3A+\tan 3B+\tan 3C=\tan 3A\cdot\tan 3B\cdot\tan 3C$

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19. If $A+B+C=\pi$, prove that :

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

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20. If $A+B+C=\pi$, prove that :

$$\frac{\cot A+\cot B}{\tan A+\tan B}+\frac{\cot B+\cot C}{\tan B+\tan C}+\frac{\cot C+\cot A}{\tan C+\tan A}=1$$

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21. Prove that:

$\tan(\alpha-\beta)+\tan(\beta-\gamma)+\tan(\gamma-\alpha)=\tan(\alpha-\beta)\tan(\beta-\gamma)\tan(\gamma-$

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22. If $x+y+z=0$, show that :

$\cot(x+y-z)\cot(z+x-y)+(\cot(x+y-z)\cot(y+z-x)+\cot(y+$

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23. If $A+B+C=n\pi$ (n being an integer). Show that $\tan A+\tan B+\tan C=\tan A\tan B\tan C.$

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24. If $A+B+C=\pi$, prove that :

$\cos 2A+\cos 2B-\cos 2C=1-4\sin A\sin B\cos C$

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25. If $A+B+C=180^0$, prove that

$\sin 2A+\sin 2B-\sin 2C=4\cos A\cos B\sin C$

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26. If $A+B+C=\pi$, prove that :

$\sin A+\sin B+\sin C=4\cos\left(\frac{A}{2}\right)\cos\left(\frac{B}{2}\right)\cos\left(\frac{C}{2}\right)$

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27. If $A+B+C=\pi$, prove that :

$\cos A+\cos B-\cos C=4\cos\left(\frac{A}{2}\right)\cos\left(\frac{B}{2}\right)\sin\left(\frac{C}{2}\right)-1$

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28. If $A+B+C=\pi$, prove that :

$$\sin(B+C-A)+\sin(C+A-B)+\sin(A+B-C)=4\sin A\sin B\sin$$

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29. If $A+B+C=\pi$, prove that :

$$\frac{\cos A}{\sin B\sin C}+\frac{\cos B}{\sin C\sin A}+\frac{\cos C}{\sin A\sin B}=2.$$

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30. If $A+B+C=\pi$, prove that :

$$\frac{\sin 2A+\sin 2B+\sin 2C}{\sin A+\sin B+\sin C}=8\sin\left(\frac{A}{2}\right)\sin\left(\frac{B}{2}\right)\sin\left(\frac{C}{2}\right)$$

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31. If $x+y+z=\frac{\pi}{2}$, prove that :

$$\cos(x-y-z)+\cos(y-z-x)+\cos(z-x-y)-4\cos x\cos y\cos z=0$$

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32. Show that

$$\sin(x-y)+\sin(y-z)+\sin(z-x)+4\sin\left(\frac{x-y}{2}\right)\sin\left(\frac{y-z}{2}\right)\sin\left(\frac{z}{}\right.$$

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33.

$$\sin(B+2C)+\sin(C+2A)+\sin(A+2B)=4\sin\left(\frac{B-C}{2}\right)\sin\left(\frac{C-A}{2}\right.$$

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34. If $A+B+C=\pi$, prove that :

$$\sin\left(\frac{B+C}{2}\right)+\sin\left(\frac{C+A}{2}\right)+\sin\left(\frac{A+B}{2}\right)=4\cos\left(\frac{\pi-A}{4}\right)\cos\left(\frac{\pi}{}\right.$$

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35. If $x+y+z=xzy,$ prove that :

$$\frac{2x}{1-x^2}+\frac{2y}{1-y^2}+\frac{2z}{1-z^2}=\frac{2x}{1-x^2}\frac{2y}{1-y^2}\frac{2z}{1-z^2}$$

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36. If $x+y+z=xzy,$ prove that :

$$x\left(1-y^2\right)\left(1-z^2\right)+y\left(1-z^2\right)\left(1-x^2\right)+z\left(1-x^2\right)\left(1-y^2\right)=4xyz.$$

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37. If $A+B+C+D=2\pi,$ show that :

$$\cos A-\cos B+\cos C-\cos D=4\sin\left(\frac{A+B}{2}\right)\sin\left(\frac{A+D}{2}\right)\cos\left(\frac{A+C}{2}\right.$$

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38. If A, B, C, D be the angles of acyclic quadrilateral, show that : $\cos A + \cos B + \cos C + \cos D = 0.$

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39. If $A + B + C = \pi,$ prove that : $\cos A \sin B \sin C + \cos B \sin C \sin A + \cos C \sin A \sin B = 1 + \cos A \cos B c$

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40. If $A + B + C = \pi,$ prove that: $\cot^2 A + \cot^2 B + \cot^2 C \geq 1$

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41. If $A+B+C=\pi$ then prove

$$\cos\left(\frac{A}{2}\right)\cos\left(\frac{B-C}{2}\right)+\cos\left(\frac{B}{2}\right)\cos\left(\frac{C-A}{2}\right)+\cos\left(\frac{C}{2}\right)\cos\left(\frac{A-B}{2}\right.$$

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42. Prove that, in triangle ABC

$$\sin^3 A\cos(B-C)+\sin^3 B\cos(C-A)+\sin^3 C\cos(A-B)=3\sin A\sin$$

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