MATHS

BOOKS - KC SINHA ENGLISH

TRIGONOMETRIC FUNCTIONS - SUM AND DIFFERENCE OF ANGLES - FOR BOARDS

Solved Examples

1. find value of $\cos 15^\circ$

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2. . Find the value of $\sin 105^\circ$

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3. Find the value : $\tan 105^0$

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4. Show that: $\sin\left(\frac{\pi}{2} - x\right)$ = cos x`

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5. Show that $\tan 75^0 + \cot 75^0 = 4$

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6. Evaluate $\sin\left\{n\pi + (-1)^n \frac{\pi}{4}\right.$, where n is an integer.

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7. Prove that: $2\sin^2\left(3\frac{\pi}{4}\right) + 2\cos^2\left(\frac{\pi}{4}\right) + sec^2\frac{\pi}{3} = 10$

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8. $2\sin^2\frac{\pi}{6}+\cos ec^2\frac{7\pi}{6}\cos^2\frac{\pi}{3}=\frac{3}{2}$

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9. If A and B are positive acute angles and $\cos A=\frac{1}{7},\cos B=\frac{13}{14}$, then show that $A-B=60^0$.

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10. If $\sin A=\frac{3}{5},0<A<\frac{\pi}{2}$ and $\cos B=-\frac{12}{13},\pi<B<\frac{3\pi}{2}$, then find the values of the following:

(i) $\sin(A-B)$

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11. If $\sin A = \frac{3}{5}, 0 < A < \frac{\pi}{2}$ and $\cos B = -\frac{12}{13}, \pi < B < \frac{3\pi}{2}$, then find the values of the following:

(i) $\sin(A - B)$

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12. If $\sin A = \frac{3}{5}, 0 < A < \frac{\pi}{2}$ and $\cos B = -\frac{12}{13}, \pi < B < \frac{3\pi}{2}$, then find the values of the following:

(i) $\sin(A - B)$

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13. Show that $\sin 70^0 \cos 10^0 - \cos 70^0 \sin 10^0 = \frac{\sqrt{3}}{2}$

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14. Prove that:

i) $\sin(A+B)\cos(A-B)-\cos(A+B)\sin(A-B)=\sin 2B$

ii)

$\cos(45^\circ-A)\cos(45^\circ-B)-\sin(45^\circ-A)\sin(45^\circ-B)=\sin(A+B)$

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15. Prove that: $tan70^0=tan20^0+2tan50^0.$

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16. Prove that: $\cos 18^0-\sin 18^0=\sqrt{2}\sin 27^0$

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17. Prove that : $\frac{\sin(x+y)}{\sin(x-y)}=\frac{\sin x.\cos y+\cos x.\sin y}{\sin x.\cos y-\cos x.\sin y}$

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18. Prove that: $\frac{\sin(A-B)}{\cos As \in B}+\frac{si\ln(B-C)}{\cos B\cos C}+\frac{\sin(C-A)}{\cos C\cos A}=0$

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19. Show that $\cot\left(\frac{\pi}{4}+x\right)\cot\left(\frac{\pi}{4}-x\right)=1$

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20. Prove that: $\cot x\cot 2x-\cot 2x\cot 3x-\cot 3x\cot x=1$

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21. Prove that:$\cos^2 2x-\cos^2 6x=\sin 4x\sin 8x$

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22. Prove that

$\cos 2\theta \cos 2\phi + \sin^2(\theta - \phi) - \sin^2(\theta + \phi) = \cos(2\theta + 2\phi).$

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23. Prove that:

$\cos^2 A + \cos^2 B - 2\cos A \cos B \cos (A + B) = \sin^2(A + B)$

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24. If A + B = $\frac{\pi}{4}$, then prove that (1 + tan A) (1 + tan B) = 2

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25. If $\sin\alpha \sin\beta - \cos\alpha \cos\beta + 1 = 0,$ then the value of $1 + \cot\alpha \tan\beta$ is

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26. If $tan\alpha = x + 1, \tan\beta = x - 1,$ show that $2\cot(\alpha - \beta) = x^2.$

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27. If $\cos(\alpha - \beta) + \cos(\beta - \gamma) + \cos(\gamma - \alpha) = -\frac{3}{2}$, prove that $\cos\alpha + \cos\beta + \cos\gamma = s \in \alpha + s \in \beta + s \in \gamma = 0$

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28. If $tan\beta = \frac{ns \in \alpha \cos\alpha}{1 - ns \in^2 \alpha}$, show that $\tan(\alpha - \beta) = (1 - n)tan\alpha.$

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29. If $\alpha and \beta$ are the solutions of the equation $atan\theta + bsec\theta = c,$ then show that $\tan(\alpha + \beta) = \frac{2ac}{a^2 - c^2}$

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30. If $3\tan\theta\tan\phi = 1$, then prove that $2\cos(\theta+\varphi) = \cos(\theta-\varphi)$.

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31. $A + B = C$ and $\tan A = k\tan B$, then prove that $\sin(A-B) = \dfrac{k-1}{k+1}\sin C$

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32. Find the sign of the expression $\sin\theta + \cos\theta$ when $\theta = 100^0$

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33. Find the maximum and minimum values of the expression: $a\cos\theta + b\sin\theta$

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34. Find the maximum and minimum values of the following expressions.

$3\cos\theta + 5\sin\left(\theta - \frac{\pi}{6}\right)\ 4s\int h\eta - 3\cos\theta + 7$

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35. Prove that $5\cos\theta + 3\cos\left(\theta + \frac{\pi}{3}\right) + 3$ lies between -4 and 10.

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36. Express each of the following as the sum or difference of sines and cosines: $2\sin 3\theta\cos\theta$

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37. Express each of the following as the sum or difference of sines and cosines: $2\cos 7\theta\cos 3\theta$

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38. Express each of that as the sum or difference of cosines and sines: $5\sin\theta.\sin 8\theta$

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39. Express each of that as the sum or difference of cosines and sines: $\cos 75^\circ \cos 15^0$

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40. Show that: $\sin 50^0 \cos 85^0 = \frac{1-\sqrt{2}\sin 35^0}{2\sqrt{2}}$

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41. Prove that $\sin 20^\circ \sin 40^\circ \sin 80^\circ = \frac{\sqrt{3}}{8}$.

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42. Prove that: $2\cos\frac{\pi}{13}\cos\frac{9\pi}{13}+\cos\frac{3\pi}{13}+\cos\frac{5\pi}{13}=0$

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43. Prove that :$\sin As\in\left(60^0-A\right)s\in\left(60^0+A\right)=\frac{1}{4}\sin 3A$

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44. $\tan 20^\circ\tan 40^\circ\tan 80^\circ=\tan 60^\circ$

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45. Show that $4\sin\alpha.\sin\left(\alpha+\frac{\pi}{3}\right)\sin\left(\alpha+2\frac{\pi}{3}\right)=\sin 3\alpha$

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46. Prove that $\frac{2\cos 2A+1}{2\cos 2A-1}=\tan\left(60^0+A\right)\tan\left(60^0-A\right)$.

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47. Show that:

$\sin A\sin(B-C)+\sin B\sin(C-A)+\sin C\sin(A-B)=0$

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48. If $\alpha+\beta+90^0$, find the maximum and minimum values of $s\in\alpha s\in\beta$.

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49. Express each of that as product of sines and cosines : $\sin 4\theta+\sin 3\theta$

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50. Express each of that as product of sines and cosines : $\sin 6\theta - \sin 2\theta$

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51. Express each of that as product of sines and cosines : $\cos 2\theta + \cos 8\theta$

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52. Express each of that as product of sines and cosines : $\cos 4\theta - \cos 6\theta$

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53. Prove that: $\cos 18^0 - \sin 18^0 = \sqrt{2}\sin 27^0$

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54. Prove that : $\frac{\sin 5\theta + \sin 3\theta}{\cos 5\theta + \cos 3\theta} = \tan 4\theta$

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55. $\frac{\sin 3\theta + \sin 5\theta + \sin 7\theta + \sin 9\theta}{\cos 3\theta + \cos 5\theta + \cos 7\theta + \cos 9\theta}$ is equal to

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56. $\frac{\sin(\theta + \phi) - 2\sin\theta + \sin(\theta - \phi)}{\cos(\theta + \phi) - 2\cos\theta + \cos(\theta - \phi)} = \tan\theta$

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57. Prove that : $(\cos\alpha + \cos\beta)^2 + (\sin\alpha + \sin\beta)^2 = 4\cos^2\left(\frac{\alpha - \beta}{2}\right)$

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58. Prove that

$\cos\alpha + \cos\beta + \cos\gamma(\alpha + \beta + \gamma) = 4\frac{\cos(\alpha + \beta)}{2}\frac{\cos(\beta + \gamma)}{2}\frac{\cos(\gamma + \alpha)}{2}$

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59. If $\cos(A+B)\sin(C-D)=\cos(A-B)\sin(C+D)$, then show that $\tan A\tan B\tan C+\tan D=0$

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60. If $s\int h\eta=n\sin(\theta+2\alpha)$, prove that $\tan(\theta+\alpha)=\frac{1+n}{1-n}\tan\alpha$.

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61. If $\frac{\sin(\theta+\alpha)}{\cos(\theta-\alpha)}=\frac{1-m}{1+m}$, prove that $\tan\left(\frac{\pi}{4}-\theta\right)\tan\left(\frac{\pi}{4}-\alpha\right)=m$

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Exercise

1. Find the value of : $\cos 210^0$

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2. Using the formula of $\sin(A - B) = \sin A \cos B - \cos A \sin B$ find the value of $\sin 15^\circ$

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3. Find the value of $\sin 75^\circ$.

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4. Find the value of : $\tan 15^0$

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5. Find the value of : $\tan 75^0$

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6. Find the value of:

$\tan(-30^\circ)$

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7. Find the value of : $\cos 1395^0$

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8. $\tan\left(\frac{11\pi}{12}\right)$

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9. Find the value of $\tan\frac{13\pi}{12}$.

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10. Prove that: $s \in 105^0 + \cos 105^0 = \cos 45^0$

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11. $\sin 300^\circ \cos ec 1050^\circ - \tan(-120^\circ)$

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12. $\sin 690^\circ \cos 930^\circ + \tan(-765^\circ)\cos ec(-1170^\circ)$

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13. $\cot^2 \frac{\pi}{6} + \cos ec \frac{5\pi}{6} + 3\tan^2 \frac{\pi}{6} = 6$

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14. Prove that: $2\frac{\sin \pi}{6} sec \frac{\pi}{3} - 4\frac{\sin(5\pi)}{6}\frac{\cos \pi}{4} = 1$

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15. $\sin^2\left(\frac{\pi}{6}\right) + \cos^2\left(\frac{\pi}{3}\right) - \tan^2\left(\frac{\pi}{4}\right) = -\frac{1}{2}$

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16. Prove that : $\sin 75^0 = \frac{\sqrt{6}+\sqrt{2}}{4}$

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17. Find the value of : $\tan 15^0$

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18. Evaluate $\tan\left\{(-1)^n \frac{\pi}{4}\right\}$ where n is an integer

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19. $\sin\alpha = \frac{1}{\sqrt{10}} \cdot \sin\beta = \frac{1}{\sqrt{5}}$ (where α, β and $\alpha + \beta$ are positive acute angles). show that $\alpha + \beta = \frac{\pi}{4}$

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20. If $\sin A = \frac{3}{5}$ and $\cos B = \frac{9}{41}, 0 < A < \frac{\pi}{2}$ and $0 < B < \frac{\pi}{2}$. Find the values of that : $\sin(A + B)$

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21. If `s in A=3/5a n d\ cos B=9/(14),\ 0

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22. If `s in A=3/5a n d\ cos B=9/(14),\ 0

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23. If `s in A=3/5a n d\ cos B=9/(14),\ 0

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24. If $\sin A = \frac{1}{2}, \cos B = \frac{\sqrt{3}}{2}$, where $\frac{\pi}{2} < A < \pi$ and $0 < B < \frac{\pi}{2}$ find $\tan(A + B)$

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25. If $\sin A = \frac{1}{2}, \cos B = \frac{\sqrt{3}}{2}$, where $\frac{\pi}{2} < A < \pi$ and $0 < B < \frac{\pi}{2}$ find $\tan(A + B)$

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26. if $\sin x = \frac{3}{5}, \cos y = -\frac{12}{13}$ where $\frac{\pi}{2} < x < \pi$ and $\frac{\pi}{2} < y < \pi$ then show that $\sin(x + y) = -\frac{56}{65}$

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27. Evaluate : $\cos^2\left(\frac{\pi}{4}+x\right)-\sin^2\left(\frac{\pi}{4}-x\right)$

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28. Evaluate : $\sin^2\left(15^0+A\right)-\sin^2\left(15^0-A\right)$

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29. Prove that: $\sin^2\left(\frac{\pi}{8}+\frac{A}{2}\right)-\sin^2\left(\frac{\pi}{8}-\frac{A}{2}\right)=\frac{1}{\sqrt{2}}\sin A$

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30. Prove that:

$$\cos\left(\frac{3\pi}{2}+x\right)\cos(2\pi+x)\left\{\cot\left(\frac{3\pi}{2}-x\right)+\cot(2\pi+x)\right\}=1$$

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31. Prove that $\frac{\cos(\pi+\theta)\cos(-\theta)}{\cos(\pi-\theta)\cos\left(\frac{\pi}{2}+\theta\right)} = -\cot\theta$

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32. Show that : $\cos 70^0.\cos 10^0 + \sin 70^0.\sin 10^0 = \frac{1}{2}$

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33. Evaluate the following: $s \in 78^0 \cos 18^0 - \cos 78^0 s \in 18^0$

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34. Show that: $\sin(40^\circ+\theta)\cos(10^\circ+\theta) - \cos(40^\circ+\theta)\sin(10^\circ+\theta) = \frac{1}{2}$

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35. Prove that

$$\sin(n+1)x\sin(n+2)x+\cos(n+1)x\cos(n+2)x=\cos x$$

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36. Prove that:

$$\cos\left(\frac{\pi}{4}-x\right)\cos\left(\frac{\pi}{4}-y\right)-\sin\left(\frac{\pi}{4}-x\right)\sin\left(\frac{\pi}{4}-y\right)=\sin(x+y)$$

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37. Prove that: (sin 3 x +sin x) sin x + (cos 3x - cos x) cos x = 0

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38. Prove that: $\frac{\tan\left(\frac{\pi}{4}+x\right)}{\tan\left(\frac{\pi}{4}-x\right)}=\left(\frac{1+\tan x}{1-\tan x}\right)^2$

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39. Prove that : $\frac{\cos 20^0 - \sin 20^0}{\cos 20^0 + \sin 20^0} = \tan 25^0$

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40. Prove that : $\cos 9^0 + \sin 9^0 = \sqrt{2}\sin 54^0$

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41. Prove that : $\frac{\tan A + \tan B}{\tan A - \tan B} = \frac{\sin(A+B)}{\sin(A-B)}$

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42. Prove that: $\tan 8\theta - \tan 6\theta - \tan 2\theta = \tan 8\theta \tan 6\theta \tan 2\theta.$

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43. The value of $\tan 9^\circ + \tan 36^\circ + \tan 9^\circ . \tan 36^\circ$ is equal to

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44. Show that $\tan 3x \tan 2x \tan x = \tan 3x \tan 2x \tan$

.

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45. Show that : $\frac{1}{\tan 3A - \tan A} - \frac{1}{\cot 3A - \cot A} = \cot 2A$

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46. Show that : $\frac{1}{\tan 3A - \tan A} - \frac{1}{\cot 3A - \cot A} = \cot 2A$

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47. Prove that: $\sin^2 6x - \sin^2 4x = \sin 2x \sin 10x$

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48. Prove that: $\tan(\alpha+\beta)\tan(\alpha-\beta)=\frac{\sin^2\alpha-\sin^2\beta}{\cos^2\alpha-\sin^2\beta}$

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49. 19. Prove that

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

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50. Show that $\tan\{(2n+1)\pi+\theta\}+\tan\{(2n+1)\pi-\theta\}=0$

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51. If $\tan\alpha=\frac{m}{m+1}$ and $\tan\beta=\frac{1}{2m+1}$, then $\alpha+\beta$ is equal to

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52. If $A + B = \frac{\pi}{4}$, show that (cot A-1) (cot B-1) =2

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53. If $8\theta = \pi$ show that $\cot 7\theta + \cot \theta = 0$

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54. if $\tan\alpha - \tan\beta = x$ and $\cot\beta - \cot\alpha = y$ prove that $\cot(\alpha - \beta) = \frac{x + y}{xy}$

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55. if $\tan\alpha = 2\tan\beta$ show that $\frac{\sin(\alpha + \beta)}{\sin(\alpha - \beta)} = 3$

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56. If $\cos A + s \in B = m \; and \; s \in A + \cos B = n,$ prove that $2\sin(A+B) = m^2 + n^2 - 2.$

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57. If $tanx + \tan\left(x + \frac{\pi}{3}\right) + \tan\left(x + \frac{2\pi}{3}\right) = 3,$ then prove that $\frac{3\tan x - tan^3 x}{1 - 3tan^2 x} = 1.$

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58. If a right angle be divided into three parts α, β and γ, prove that $\cot\alpha = \frac{\tan\beta + \tan\gamma}{1 - \tan\beta\tan\gamma}.$

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59. If $\sin(\alpha+\beta) = 1 \; and \sin(\alpha-\beta) = \frac{1}{2}, \; where \; 0 \leq , \; \beta \leq \frac{\pi}{2}$, then find the values of $\tan(\alpha + 2\beta) and \; \tan(2\alpha + \beta)$.

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60. If $m\tan(\theta - 30^\circ) = n\tan(\theta + 120^\circ)$, show that $\cos 2\theta = \dfrac{m+n}{2(m-n)}$.

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61. If $\alpha + \beta = \theta$ and $\dfrac{\tan\alpha}{\tan\beta} = \dfrac{x}{y}$, prove that $\sin(\alpha - \beta) = \dfrac{x-y}{x+y}\sin\theta$

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62. If α, β are the roots of the equation $a\cos\theta + b\sin\theta = c$, then prove that $\cos(\alpha + \beta) = \dfrac{a^2 - b^2}{a^2 + b^2}$.

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63. If α and β are the solution of the equation $a\cos\theta + b\sin\theta = c$, then show that : $\cos(\alpha+\beta) = \dfrac{a^2-b^2}{a^2+b^2}$

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64. Find the maximum and minimum values of the following expressions

(i) $a\cos\theta - b\sin\theta$(ii)$7\cos\theta + 24\sin\theta$

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65. Find the maximum and minimum values of the following expressions

(i) $a\cos\theta - b\sin\theta$(ii)$7\cos\theta + 24\sin\theta$

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66. Express each of the following as the sum or difference of sines and cosines: $2\cos 3\theta\sin 2\theta$

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67. Express in the products into sums or difference of sines and cosines : $2\sin 5\theta.\cos 3\theta$

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68. Express each of the products into sums or difference of sines and cosines : $2\cos 9\theta.\cos 4\theta$

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69. Convert each of the following products into the sum or difference of sines and cosines: $\sin 75^0 \cos 15^0$

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70. Prove tha $\sin 25^0 \cos 115^0 = \frac{1}{2}(\sin 140^0 - 1)$

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71. Prove that $\sin 20^\circ \sin 40^\circ \sin 60^\circ \sin 80^\circ = \frac{3}{16}$

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72. Prove that: $\cos 20^0 \cos 40^0 \cos 80^0 = \frac{1}{8}$

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73. Prove that : $\tan 20^0 \tan 40^0 \tan 60^0 \tan 80^0 = 3$

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74. Prove that: $\cos 10^0 \cos 30^0 \cos 50^0 \cos 70^0 = \frac{3}{16}$

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75. Prove $\tan 20^0 \tan 30^0 \tan 40^0 \tan 80^0 = 1$

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76. Prove that: $2\cos\theta\cos\left(\frac{\pi}{3}+\theta\right)\cos\left(\frac{\pi}{3}-\theta\right) = \cos 3\theta$

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77. Prove that $\cos 2x \cos\left(\frac{x}{2}\right) - \cos 3x \cos\left(\frac{9x}{2}\right) = \sin 5x \sin\left(\frac{5x}{2}\right)$.

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78. Prove that:

$\sin(B-C)\cos(A-D) + \sin(C-A)\cos(B-D) + \sin(A-B)\cos(C-D$

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79. If $\alpha + \beta = 90^0$, show that the maximum value of $\cos\alpha . \cos\beta$ is $\frac{1}{2}$.

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80. Prove that $\tan\theta \cdot \tan(60 - \theta) \cdot \tan(60 + \theta) = \tan 3\theta$ and hence find the value of $\tan 5^0 \cdot \tan 55^0 \cdot \tan 65^0 \cdot \tan 75^0$

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81. If $\cos\alpha = \frac{1}{\sqrt{2}}, \sin\beta = \frac{1}{\sqrt{3}}$, show that $\tan\left(\frac{\alpha+\beta}{2}\right)\cot\left(\frac{\alpha-\beta}{2}\right) = 5 + 2\sqrt{6}$ or $5 - 2\sqrt{6}$

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82. Express each of that as product of sines and cosines : $\cos 9\theta + \cos 3\theta$

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83. Express each of that as product of sines and cosines : $\sin 2\theta + \sin 4\theta$

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84. Express each of that as product of sines and cosines : $\cos 12\theta - \cos 4\theta$

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85. Express each of that as product of sines and cosines : $\sin 9\theta + \sin 5\theta$

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86. Prove that: $s \in 65^0 + \cos 65^0 = \sqrt{2}\cos 20^0$

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87. Prove that: $\sin 47^0 + \cos 77^0 = \cos 17^0$

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88. Prove that : $\frac{\cos 7x + \cos 5x}{\sin 7x - \sin 5x} = \cot x$

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89. Prove that : $\frac{\cos 9x - \cos 5x}{\sin 17x - \sin 3x} = \frac{-\sin 2x}{\cos 10x}$

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90. Prove that : $\frac{\sin x + \sin 3x}{\cos x + \cos 3x} = \tan 2x$

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91. Prove that : $\frac{\cos 10^0 - \sin 10^0}{\cos 10^0 + \sin 10^0} = \tan 35^0$

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92. Prove that: $\cos 80^0 + \cos 40^0 - \cos 20^0 = 0$

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93. Prove that :

$\sin 10^\circ + \sin 20^\circ + \sin 40^\circ + \sin 50^\circ = \sin 70^\circ + \sin 80^\circ .$

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94. Prove that: $\cos 20^0 + \cos 100^0 + \cos 140^0 = 0$

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95. Prove that $\cos \frac{\pi}{5} + \cos \frac{2\pi}{5} + \cos \frac{6\pi}{5} + \cos \frac{7\pi}{5} = 0.$

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96. prove that :$\cos\left(\frac{\pi}{12}\right) - \sin\left(\frac{\pi}{12}\right) = \frac{1}{\sqrt{2}}$

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97. prove that :$\sin\left(\frac{5\pi}{18}\right) - \cos\left(\frac{4\pi}{9}\right) = \sqrt{3}\sin\left(\frac{\pi}{9}\right)$

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98. Prove that: $\cos\left(\frac{3\pi}{4} + x\right) - \cos\left(\frac{3\pi}{4} - x\right) = \sqrt{2}\sin x$

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99. Prove that: $\cos\left(\frac{\pi}{4} + x\right) + \cos\left(\frac{\pi}{4} - x\right) = \sqrt{2}\cos x$

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100. Prove that

$$\cos\alpha+\cos\beta+\cos\gamma(\alpha+\beta+\gamma)=4\frac{\cos(\alpha+\beta)}{2}\frac{\cos(\beta+\gamma)}{2}\frac{\cos(\gamma+\alpha)}{2}$$

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101. Prove that : $\frac{\sin x-\sin y}{\cos x+\cos y}=\tan\left(\frac{x-y}{2}\right)$

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102. Prove that : $\frac{\sin x+\sin y}{\cos x+\cos y}=\tan\left(\frac{x+y}{2}\right)$

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103. Prove that : $\frac{\sin x+\sin y}{\sin x-\sin y}=\tan\left(\frac{x+y}{2}\right).\cot\left(\frac{x-y}{2}\right)$

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104. Prove that: $\sin 3x + \sin 2x - \sin x = 4 \sin x \cos \frac{x}{2} \cos \frac{3x}{2}$

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105. Show that $\sin x + \sin 3x + \sin 5x + \sin 7x = 4 \sin 4x \cos 2x \cos x$.

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106. Prove that : $\frac{\sin \theta + \sin 3\theta + \sin 5\theta}{\cos \theta + \cos 3\theta + \cos 5\theta} = \tan 3\theta$

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107. Prove that : $\frac{\cos 4\theta + \cos 3\theta + \cos 2\theta}{\sin 4\theta + \sin 3\theta + \sin 2\theta} = \cot 3\theta$

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108. Prove that : $\frac{\sin \theta + 2 \sin 3\theta + \sin 5\theta}{\sin 3\theta + 2 \sin 5\theta + \sin 7\theta} = \frac{\sin 3\theta}{\sin 5\theta}$

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109. Prove $\frac{\cos 3\theta + 2\cos 5\theta + \cos 7\theta}{\cos\theta + 2\cos 3\theta + \cos 5\theta} = \cos 2\theta - \sin 2\theta \tan 3\theta.$

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110. Prove that : $\frac{\sin 5\theta - 2\sin 3\theta + \sin\theta}{\cos 5\theta - \cos\theta} = \tan\theta$

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111. If $\operatorname{cosec} A + \sec A = \operatorname{cosec} B + \sec B$, prove that $\tan A \tan B = \frac{\cot(A+B)}{2}$

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112. Prove that: $(\cos\alpha - \cos\beta)^2 + (\sin\alpha - \sin\beta)^2 = 4\sin^2\left(\frac{\alpha-\beta}{2}\right)$

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113. Prove that:

$s \in \alpha + s \in \beta + s \in \gamma - \sin(\alpha + \beta + \gamma) = 4\sin\left(\frac{\alpha+\beta}{2}\right)\sin\left(\frac{\beta+\gamma}{2}\right)si$

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114. $\frac{\cos(A-B)}{\cos(A+B)} + \frac{\cos(C+D)}{\cos(C-D)} = 0 \Rightarrow \tan A \tan B \tan C \tan D =$

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115. If $\sin 2A = \lambda \sin 2B$ prove that $\left(\frac{\tan(A+B)}{\tan(A-B)}\right) = \frac{\lambda+1}{\lambda-1}$

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116. If $\cos(\alpha+\beta)\sin(\gamma+\delta) = \cos(\alpha-\beta)\sin(\gamma-\delta)$, prove that $\cot\alpha \cot\beta \cot\gamma = \cot\delta$

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117. If $y \sin j\phi = x \sin(2\theta + \phi)$, show that $(x + y)\cot(\theta + \phi)$

$= (y - x)\cot\theta$

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