



MATHS

BOOKS - RD SHARMA MATHS (HINGLISH)

TRANSFORMATION FORMULAE

Solved Examples And Exercises

1. Show that:

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

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2. Show that:

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

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3. If $\tan\alpha = \frac{x}{x+1}$ and $\tan\beta = \frac{1}{2x+1}$, then $\alpha + \beta$

is equal to $\pi/2$ (b) $\pi/3$ (c) $\pi/6$ (d) $\pi/4$

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4. If $m \sin\theta = n \sin(\theta + 2\alpha)$, prove that $\tan(\theta + \alpha)\cot\alpha = \frac{m+n}{m-n}$.

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5. If $\sin(B + C - A)$, $\sin(C + A - B)$, $\sin(A + B - C)$, are AP ; then $\cot A$, $\cot B$, $\cot C$ are $\in GP$ (b) HP (c) AP (d) none of these

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

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7. If $x \cos \theta = y \cos \left(\theta + \frac{2\pi}{3} \right) = z \cos \left(\theta + \frac{4\pi}{3} \right)$, prove that $xy + yz + zx = 0$.

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8. If $\cos ecA + \sec A = \cos ecB + \sec B$, prove that:
 $\tan A \tan B = \frac{\cot(A + B)}{2}$

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9. If $\frac{\tan(\theta + \alpha)}{a} = \frac{\tan(\theta + \beta)}{b} = \frac{\tan(\theta + \gamma)}{c}$
 $\frac{a + b}{a - b} \sin^2(\alpha - \beta) + \frac{b + c}{b - c} \sin^2(\beta - \gamma) + \frac{c + a}{c - a} \sin^2(\gamma - \alpha) = 0$

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10. If $\cos A + \cos B = \frac{1}{2}$ and $\sin A + \sin B = \frac{1}{4}$, prove that:

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

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11. If $a \sin \theta = b \sin\left(\theta + \frac{2\pi}{3}\right) = c \sin\left(\theta + \frac{2\pi}{3}\right)$, prove that

$$ab + bc + ca = 0.$$

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12. If $\sin(y+z-x)$, $\sin(z+x-y)$, $\sin(x+y-z)$ are in A.P., then $\tan x$, $\tan y$, $\tan z$ are in (a) A.P. (b) G.P. (c) H.P. (d) none of these

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13. Prove that: $\tan 20^\circ \tan 40^\circ \tan 80^\circ = \tan 60^\circ$

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14. Prove that : $\sin A \sin(60^\circ - A) \sin(60^\circ + A) = \frac{1}{4} \sin 3A$

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15. Show that: $\tan(60^\circ + \theta) \tan(60^\circ - \theta) = \frac{2 \cos 2\theta + 1}{2 \cos 2\theta - 1}$

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16. If $\alpha + \beta = 90^\circ$, find the maximum and minimum values of $\sin \alpha \sin \beta$.

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17. Prove that: $\cos 20^\circ \cos 40^\circ \cos 60^\circ \cos 80^\circ = \frac{1}{16}$

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

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19. Prove that: $4\cos 12^\circ \cos 48^\circ \cos 72^\circ = \cos 36^\circ$

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20. Prove that: $\tan \theta \tan(60^\circ - \theta) \tan(60^\circ + \theta) = \tan 3\theta$.

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21. Prove that:

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

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22. If $\sin x + \sin y = \sqrt{3}(\cos y - \cos x)$, then $\sin 3x + \sin 3y =$ (a) $2 \sin 3x$ (b) 0 (c) 1 (d) none of these

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23. Prove that:
- $$\frac{\cos(A + B + C) + \cos(-A + B + C) + \cos(A - B + C) + \cos(A + B - C)}{\sin(A + B + C) + \sin(-A + B + C) + \sin(A - B + C) - \sin(A + B - C)}$$

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24. Prove that:
- $$\left(\frac{\cos A + \cos B}{\sin A - \sin B} \right)^n + \left(\frac{\sin A + \sin B}{\cos A - \cos B} \right)^n = \left\{ 2 \cot^n \left(\frac{A - B}{2} \right) \right\}, \text{ if } n \text{ is even}$$

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25. If $\sin \theta = n \sin(\theta + 2\alpha)$, prove that $\tan(\theta + \alpha) = \frac{1 + n}{1 - n} \tan \alpha$.

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26. Prove that: $\frac{\sin(A - C) + 2 \sin A + \sin(A + C)}{\sin(B - C) + 2 \sin B + \sin(B + C)} = \frac{\sin A}{\sin B}$,

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27. Prove that: $\frac{\cos 8A \cos 5A - \cos 12A \cos 9A}{\sin 8A \cos 5A + \cos 12A \sin 9A} = \tan 4A$

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28. Prove that: $\frac{\sin A + \sin 3A + \sin 5A + \sin 7A}{\cos A + \cos 3A + \cos 5A + \cos 7A} = \tan 4A$

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29. Prove that: $1 + \cos 2x + \cos 4x + \cos 6x = 4 \cos x \cos 2x \cos 3x$

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



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31. Express each of the following as a product: $\sin 4\theta + \sin 2\theta$ (ii)

$\sin 6\theta - \sin 2\theta$ (iii) $\cos 4\theta + \cos 8\theta$ (iii) $\cos 6\theta - \cos 8\theta$



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32. 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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33. If $\sin \theta + \sin \phi = \sqrt{3}(\cos \phi - \cos \theta)$, prove that $\sin 3\theta + \sin 3\phi = 0$



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34. Convert each of the following products into the sum or difference of sines and cosines: $2 \sin 5\theta \cos \theta$

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

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36. Convert each of the following products into the sum or difference of sines and cosines: $2 \cos 4\theta \cos 3\theta$

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



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38. Convert each of the following products into the sum or difference of sines and cosines: $2 \sin 3\theta \sin \theta$

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39. Find the value of $2 \cos\left(\frac{\pi}{10}\right) \cos\left(\frac{9\pi}{10}\right) + \cos\left(\frac{2\pi}{10}\right)$

A. 1

B. 2

C. -1

D. None of these

Answer: C

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40. Prove that: $\sin 10^{\circ} \sin 30^{\circ} \sin 50^{\circ} \sin 70^{\circ} = \frac{1}{16}$.

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41. Prove that: $\cos A \cos(60^{\circ} - A) \cos(60^{\circ} + A) = \frac{1}{4} \cos 3A$

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42. Prove that $4 \sin \theta \sin\left(\frac{\pi}{3} + \theta\right) \sin\left(\frac{2\pi}{3} + \theta\right) = \sin 3\theta$

A. ‘

B. null

C. null

D. null

Answer: null

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

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44. Express each of the following as the sum or difference of sines and cosines: $2 \sin 4\theta \sin 3\theta$

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45. 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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46. 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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47. Prove that; $\frac{2 \sin(5\pi)}{12} \frac{\sin \pi}{12} = \frac{1}{2}$



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48. Prove that $2 \sin\left(\frac{5\pi}{12}\right) \cos\left(\frac{\pi}{12}\right) = \frac{2 + \sqrt{3}}{2}$



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49. Find the value of $2 \cos\left(\frac{5\pi}{12}\right) \cos\left(\frac{\pi}{12}\right)$ and $2 \sin\left(\frac{5\pi}{12}\right) \cos\left(\frac{\pi}{12}\right)$



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



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$$51. \sin 25^\circ \cos 115^\circ = \frac{1}{2}(\sin 40^\circ - 1)$$



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$$52. \text{ Prove that: } 4 \cos \theta \cos \left(\frac{\pi}{3} + \theta \right) \cos \left(\frac{\pi}{3} - \theta \right) = \cos 3\theta$$



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$$53. \text{ Prove that: } \cos 10^\circ \cos 30^\circ \cos 50^\circ \cos 70^\circ = \frac{3}{16}$$



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$$54. \text{ Prove that: } \sin 20^\circ \sin 40^\circ \sin 80^\circ = \frac{\sqrt{3}}{8}$$



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$$55. \text{ Prove that: } \tan 20^\circ \tan 40^\circ \tan 60^\circ \tan 80^\circ = 3$$



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56. Prove that: $\sin 10^\circ \sin 50^\circ \sin 60^\circ \sin 70^\circ = \frac{\sqrt{3}}{16}$



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57. Prove that: $\cos 40^\circ \cos 80^\circ \cos 160^\circ = -\frac{1}{8}$



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



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59. Prove that: $\tan 20^\circ \tan 30^\circ \tan 40^\circ \tan 80^\circ = 1$



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

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61. Prove that: $\frac{\sin 5A - \sin 3A}{\cos 5A + \cos 3A} = \tan A$

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62. Prove that: $\frac{\sin A + \sin B}{\cos A + \cos B} = \tan\left(\frac{A + B}{2}\right)$

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63. $\frac{\sin A + \sin 3A}{\cos A + \cos 3A} = \tan 2A$

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



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



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



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67. Prove that $\cot 4x(\sin 5x + \sin 3x) = \cot x(\sin 5x - \sin 3x)$



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68. Prove that : $\sin x + \sin 3x + \sin 5x + \sin 7x = 4 \cos x \cos 2x \sin 4x$



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69. Prove that: $(\sin 3A + \sin A)\sin A + (\cos 3A - \cos A)\cos A = 0$

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70. show that $\cos 2\theta \cos\left(\frac{\theta}{2}\right) - \cos 3\theta \cos\left(9\frac{\theta}{2}\right) = \sin 5\theta \sin\left(5\frac{\theta}{2}\right)$

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71. 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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72. 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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73. Prove that:

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



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



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75. Prove that:

$$\frac{\cos 2A \cos 3A - \cos 2A \cos 7A + \cos 10A \cos A}{\sin 4A \sin 3A - \sin 2A \sin 5A + \sin 4A \sin 7A} = \cot 6A \cot 5A$$



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76. If three angles A , B , and C are in A.P. prove that:

$$\cot B = \frac{\sin A - \sin C}{\cos C - \cos A}$$

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77. Prove that:
$$\frac{\cos 6\theta + 6 \cos 4\theta + 15 \cos 2\theta + 10}{\cos 5\theta + 5 \cos 3\theta + 10 \cos \theta} = 2 \cos \theta$$

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78. Express each of the following as the product of sines and cosines:

$$\sin 12\theta + \sin 4\theta$$

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79. Express each of the following as the product of sines and cosines:

$$\cos 12\theta - \cos 4\theta$$

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80. Express each of the following as the product of sines and cosines:

$$\sin 5\theta - \sin \theta$$

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81. Express each of the following as the product of sines and cosines:

$$\sin 2\theta + \cos 4\theta$$

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82. Express each of the following as the product of sines and cosines:

$$\cos 12\theta + \cos 8\theta$$

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83. Prove that: $\sin 38^\circ + \sin 22^\circ = \sin 82^\circ$





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84. Prove that: $\sin 50^\circ + \sin 10^\circ = \cos 20^\circ$



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85. Prove that: $\sin 105^\circ + \cos 105^\circ = \cos 45^\circ$



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86. Prove that: $\cos 100^\circ + \cos 20^\circ = \cos 40^\circ$



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87. Prove that: $\sin 23^\circ + \sin 37^\circ = \cos 7^\circ$



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88. Prove that: $\sin 40^\circ + \sin 20^\circ = \cos 10^\circ$



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89. Prove that: $\cos 55^\circ + \cos 65^\circ + \cos 175^\circ = 0$



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



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91. Prove that: $\sin 80^\circ - \cos 70^\circ = \cos 50^\circ$



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



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93. Prove that: $\sin 50^{\circ} - \sin 70^{\circ} + \sin 10^{\circ} = 0$

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94. Prove that: $\cos 20^{\circ} + \cos 100^{\circ} + \cos 140^{\circ} = -0$

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95. $\frac{\cos \pi}{12} - \frac{\sin \pi}{12} = \frac{1}{\sqrt{2}}$

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96. Prove that : $\sin 51^{\circ} + \cos 81^{\circ} = \cos 21^{\circ}$

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

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99. Prove that: $\sin 65^\circ + \cos 65^\circ = \sqrt{2}\cos 20^\circ$

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100. Prove that: $\sin 47^\circ + \cos 77^\circ = \cos 17^\circ$

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101. Prove that:

$$\cos 3A + \cos 5A + \cos 7A + \cos 15A = 4 \cos 4A \cos 5A \cos 6A$$

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102. Prove that:

$$\cos A + \cos 3A + \cos 5A + \cos 7A = 4 \cos A \cos 2A \cos 4A$$

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103. Prove that

$$\sin A + \sin 2A + \sin 4A + \sin 5A = 4 \left(\frac{\cos A}{2} \right) \left(\cos 3 \frac{A}{2} \right) \sin 3A$$

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104. Prove that:

$$\cos 20^{\circ} \cos 100^{\circ} + \cos 100^{\circ} \cos 140^{\circ} - \cos 140^{\circ} \cos 200^{\circ} = -\frac{3}{4}$$



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

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106. Prove that: $\cos \theta \frac{\cos \theta}{2} - \cos 3\theta \frac{\cos(9\theta)}{2} = \sin 7\theta \sin 8\theta$.

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107. Prove that: $\frac{\sin A + \sin 3A}{\cos A - \cos 3A} = \cot A$

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108. Prove that: $\frac{\sin 9A - \sin 7A}{\cos 7A - \cos 9A} = \cot 8A$

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109. Prove that:
$$\frac{\sin A - \sin B}{\cos A + \cos B} = \tan\left(\frac{A - B}{2}\right)$$

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110. Prove that:
$$\frac{\sin A + \sin B}{\sin A - \sin B} = \tan\left(\frac{A + B}{2}\right) \cot\left(\frac{A - B}{2}\right)$$

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111. Prove that:
$$\frac{\cos A + \cos B}{\cos B - \cos A} = \cot\left(\frac{A + B}{2}\right) \cot\left(\frac{A - B}{2}\right)$$

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

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113. Prove that:
$$\frac{\cos 3A + 2 \cos 5A + \cos 7A}{\cos A + 2 \cos 3A + \cos 5A} = \frac{\cos 5A}{\cos 3A}$$



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



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115. Prove that:
$$\frac{\sin 3A + \sin 5A + \sin 7A + \sin 9A}{\cos 3A + \cos 5A + \cos 7A + \cos 9A} = \tan 6A$$



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116. Prove that:
$$\frac{\sin 5A \cos 2A - \sin 6A \cos A}{\sin A \sin 2A - \cos 2A \cos 3A} = \tan A$$



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117. Prove that:
$$\frac{\sin 3A \cos 4A - \sin A \cos 2A}{\sin 4A \sin A + \cos 6A \cos A} = \tan 2A$$



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118. Prove that:
$$\frac{\sin 11A \sin A + \sin 7A \sin 3A}{\cos 11A \sin A + \cos 7A \sin 3A} = \tan 8A$$

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119. Prove that:
$$\frac{\sin A + \sin 3A + \sin 5A + \sin 7A}{\cos A + \cos 3A + \cos 5A + \cos 7A} = \tan 4A$$

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120.
$$\frac{\sin A + 2 \sin 3A + \sin 5A}{\sin 3A + 2 \sin 5A + \sin 7A} = \frac{\sin 3A}{\sin 5A}$$

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121. Prove that:
$$\frac{\sin(\theta + \varphi) - 2 \sin \theta + \sin(\theta - \varphi)}{\cos(\theta + \varphi) - 2 \cos \theta + \cos(\theta - \varphi)} = \tan \theta$$

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122. Prove that:

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

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123. Prove that:

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

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124. If $\frac{\cos(A - B)}{\cos(A + B)} + \frac{\cos(C + D)}{\cos(C - D)} = 0$, prove that

$$\tan A \tan B \tan C \tan D = -1$$

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125. 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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126. If $(\cos \alpha + \cos \beta)^2 + (\sin \alpha + \sin \beta)^2 = \lambda \cos^2 \left(\frac{\alpha - \beta}{2} \right)$, write the value of λ .

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127. If $\sin A + \sin B = \alpha$ and $\cos A + \cos B = \beta$, then write the value of $\tan \left(\frac{A + B}{2} \right)$.

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128. If $\cos A = m \cos B$, then write the value of $\cot \left(\frac{A + B}{2} \right) \cos \left(\frac{A - B}{2} \right)$

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129. Write the value of the expression $\frac{1 - 4 \sin 10^{\circ} \sin 70^{\circ}}{2 \sin 10^{\circ}}$

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130. If $A + B = \frac{\pi}{3}$ and $\cos A + \cos B = 1$, then find the value of $\cos\left(\frac{A - B}{2}\right)$.

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131. Write the value of $\sin 12^{\circ} \sin 48^{\circ} \sin 54^{\circ}$.

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132. If $\sin 2A = \lambda \sin 2B$, then write the value of $\frac{\lambda + 1}{\lambda - 1}$.

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133. Write the value of $\frac{\sin A + \sin 3A}{\cos A + \cos 3A}$.

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134. If $\cos(A + B)\sin(C - D) = \cos(A - B)\sin(C + D)$, then write the value of $\tan A \tan B \tan C$.

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135. $\cos 40^\circ + \cos 80^\circ + \cos 160^\circ + \cos 240^\circ = 0$ b. 1 c. $1/2$ d. $-1/2$

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136. $\sin 163^\circ \cos 347^\circ + \sin 167^\circ \cos 167^\circ = 1/2$ b. 1 c. 0 d. none of these

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137. If $\sin 2\theta + \sin 2\varphi = \frac{1}{2}$ and $\cos 2\theta + \cos 2\varphi = \frac{3}{2}$, then $\cos^2(\theta - \varphi) = 3/8$ b. $5/8$ c. $3/4$ d. $5/4$

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138. The value of $\cos 52^\circ + \cos 68^\circ + \cos 172^\circ$ is 0 b. 1 c. 2 d. $3/2$

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139. The value of $\sin 78^\circ - \sin 66^\circ - \sin 42^\circ + \sin 6^\circ$ is -1 b. $1/2$ c. $-1/2$ d. none of these

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140. If $\sin \alpha + \sin \beta = a$ and $\cos \alpha - \cos \beta = b$, then $\frac{\tan(\alpha - \beta)}{2} = -\frac{a}{b}$ b. $-\frac{b}{a}$ c. $\sqrt{a^2 + b^2}$ d. none of these

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141. $\cos 35^\circ + \cos 85^\circ + \cos 155^\circ$ a. 0 b. $\frac{1}{\sqrt{2}}$ c. $\frac{1}{\sqrt{3}}$ d. $\cos 275^\circ$

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142. The value of $\sin 50^\circ - \sin 70^\circ + \sin 10^\circ$ is equal to a. 0 b. 1 c. 2 d. $1/2$

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143. If $\sin 47^\circ + \sin 61^\circ - \sin 11^\circ - \sin 25^\circ$ is equal to a. $\sin 36^\circ$ b. $\cos 36^\circ$
c. $\cos 7^\circ$ d. $\cos 7^\circ$

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144. If $\cos A = m \cos B$, then $\frac{\cot(A+B)}{2} \frac{\cot(B-A)}{2}$ a. $\frac{m-1}{m+1}$ b.
 $\frac{m+2}{m-2}$ c. $\frac{m+1}{m-1}$ d. none of these

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145. If A, B, C are in A.P. then $\frac{\sin A - \sin C}{\cos C - \cos A} =$ a. $\tan B$ b. $\cot B$ c. $\tan 2B$ d. none of these



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