MATHS

BOOKS - CENGAGE PUBLICATION

TRIGONOMETRIC RATIOS AND TRANSFORMATION FORMULAS

Illustration

1. Prove that $\frac{\sin(B-C)}{\cos B \cos C}+\frac{\sin(C-A)}{\cos C \cos A}+\frac{\sin(A-B)}{\cos A \cos B}=0$

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2. Eliminate x from equations $\sin(a+x)=2b$ and $\sin(a-x)=2c$.

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3. Let A,B,C be the three angles such that $A+B+C=\pi$, $\tan A.\tan B=2$, then find the value of $\frac{\cos A\cos B}{\cos C}$

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4. If $\sin\alpha\sin\beta-\cos\alpha\cos\beta+1=0$, then prove that $1+\cot\alpha\tan\beta=0$

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5. Evaluate: $\sin 1260^\circ$

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6. Evaluate: $\cos 1260^\circ$

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7. Evaluate: $\tan 960^\circ$

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8. Evaluate: $\tan 900^\circ$

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9. Evaluate: $\cos 1500^\circ$

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10. Evaluate: $\cos 855^\circ$

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11. Evaluate: $\cos 870^\circ$

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12. Evaluate: $\cos 960^\circ$

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13. Evaluate: $\sin 495^\circ$

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14. Evaluate: $\sin 510^\circ$

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15. Evaluate: $\sin 480^\circ$

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16. Evaluate: $\sin 540^\circ$

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17. Evaluate: $\sin 585^\circ$

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18. Evaluate: $\cos 720^\circ$

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19. Evaluate: $\cos 675^\circ$

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20. Evaluate: $\cos 765^\circ$

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21. Express the following as sum or difference of two trigonometric functions:-$2\sin 6x \cos 2x$

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22. Express the following as sum or difference of two trigonometric functions:-$2\sin 7x \cos 5x$

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23. Express the following as sum or difference of two trigonometric functions:-$2\sin 8x \cos 6x$

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24. Express the following as sum or difference of two trigonometric functions:-$2\sin 5x\cos x$

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25. Express the following as sum or difference of two trigonometric functions:-$2\sin 11x\cos 9x$

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26. Express the following as sum or difference of two trigonometric functions:-$2\sin 7x\cos x$

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27. Express the following as sum or difference of two trigonometric functions:-$2\cos 4x\sin 2x$

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28. Express the following as sum or difference of two trigonometric functions:-$2\cos 6x \sin 2x$

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29. Express the following as sum or difference of two trigonometric functions:-$2\cos 7x \sin 5x$

Watch Video Solution

30. Express the following as sum or difference of two trigonometric functions:-$2\cos 5x \sin x$

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31. Express the following as sum or difference of two trigonometric functions:-$2\cos 3x \sin x$

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32. Express the following as sum or difference of two trigonometric functions:-$2\cos 9x \sin 7x$

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33. Express the following as sum or difference of two trigonometric functions:-$2\cos 11x \sin x$

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34. Express the following as sum or difference of two trigonometric functions:-$2\cos 12x \sin 2x$

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35. Express the following as sum or difference of two trigonometric functions:-$2\cos x \sin 2x$

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36. Express the following as sum or difference of two trigonometric functions:-$2\cos 3x \sin 7x$

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37. If α and β are acute angles such that $\alpha+\beta=\lambda$, where constant, find the maximum possible value of the expression $\sin\alpha+\sin\beta+\cos\alpha+\cos\beta$.

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38. Prove that

$$\sum_{r=1}^{n}\left(\frac{1}{\cos\theta+\cos(2r+1)\theta}\right)=\frac{\sin n\theta}{2\sin\theta\cos\theta\cos(n+1)\theta},\ (where n \in N).$$

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39. Prove that:

(a) $\frac{\sin 2\theta}{1+\cos 2\theta}=\tan\theta$ (b) $\frac{1+\sin 2\theta+\cos 2\theta}{1+\sin 2\theta-\cos 2\theta}=\cot\theta$

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40. Prove that $\frac{1+\sin 2\theta}{1-\sin 2\theta}=\left(\frac{1+\tan\theta}{1-\tan\theta}\right)^2$

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

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42. If $\sin A = \frac{3}{5}, where 0^0 < A < 90^0$, then find the values of $\sin 2A, \cos 2A, \tan 2A$ and $\sin 4A$

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43. Find the Value of $\sqrt{2 + \sqrt{2 + 2\cos 4\theta}}$

A. $2\cos\theta$

B. $\cos\theta$

C. $2\cos\left(\frac{\theta}{2}\right)$

D. $2\cos\left(\frac{\theta}{4}\right)$

Answer: A

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44. Prove that : $\frac{\sec 8\theta - 1}{\sec 4\theta - 1} = \frac{\tan 8\theta}{\tan 2\theta}$

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45. Prove that $\tan\left(\frac{\pi}{16}\right) + 2\tan\left(\frac{\pi}{8}\right) + 4 = \cot\left(\frac{\pi}{6}\right)$.

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46. Prove that:

$$\cos^4\left(\frac{\pi}{8}\right) + \cos^4\left(\frac{3\pi}{8}\right) + \cos^4\left(\frac{5\pi}{8}\right) + \cos^4\left(\frac{7\pi}{8}\right) = \frac{3}{2}$$

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47. If $\pi < x < 2\pi$, prove that

$$\frac{\sqrt{1+\cos x} + \sqrt{1-\cos x}}{\sqrt{1+\cos x} - \sqrt{1-\cos x}} = \cot\left(\frac{x}{2} + \frac{\pi}{4}\right).$$

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48. If $\sin\alpha + \sin\beta = a$ and $\cos\alpha + \cos\beta = b$, prove that $\tan\left(\frac{\alpha-\beta}{2}\right) = \pm\sqrt{\frac{4-a^2-b^2}{a^2+b^2}}$.

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49. Prove that $\frac{1-\tan^2\left(\frac{\pi}{4}-A\right)}{1+\tan^2\left(\frac{\pi}{4}-A\right)} = \sin 2A$.

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50. If $tan\frac{\theta}{2} = \sqrt{\frac{a-b}{a+b}}\frac{\tan\varphi}{2}$, prove that $\cos\theta = \frac{a\cos\varphi + b}{a + b\cos\varphi}$.

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51. If $(\cos\theta = \cos\alpha\cos\beta$, prove that $tan\frac{\theta+\alpha}{2}tan\frac{\theta-\alpha}{2} = tan^2\frac{\beta}{2}$.

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52. If $\tan\beta = \frac{\tan\alpha + \tan\gamma}{1 + \tan\alpha\tan\gamma}$. prove that $s \in 2\beta = \frac{\sin 2\alpha + \sin 2\gamma}{1 + \sin 2\alpha \sin 2\gamma}$.

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53. Prove that $\left(4\cos^2 9^\circ - 3\right)\left(4\cos^2 27^\circ - 3\right) = \tan 9^\circ$.

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54. Prove that $4\cos\left(\frac{2\pi}{7}\right).\cos\left(\frac{\pi}{7}\right) - 1 = 2\cos\left(\frac{2\pi}{7}\right)$.

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55. Evaluate $\cos\alpha\cos 2\alpha\cos 3\alpha ....\cos 999\alpha$, where $\alpha = \frac{2\pi}{1999}$

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56. prove that $\sin\theta\dot{\sec}3\theta+\sin 3\theta, \sec 3^2\theta+\sin 3^2\theta\dot{\sec}3^{3}\theta+up\to n$ terms $=\frac{1}{2}[\tan 3^n\theta-\tan\theta]$

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57. Let $f(x)=2\cos ec2x+\sec x+\cos ecx\cdot$ Then find the minimum value of $f(x)f$ or $x\in\left(0,\frac{\pi}{2}\right)\cdot$

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58. Find the maximum and minimum values of $\cos^2\theta-6s\int h\eta\cos\theta+3\sin^2\theta+2.$

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59. If $\tan\alpha=\frac{1}{7}, \sin\beta=\frac{1}{\sqrt{10}}$, prove that$\alpha+2\beta=\frac{\pi}{4}$, where `0

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60. Prove that $\tan\left(\frac{\pi}{10}\right)$ is a root of polynomial equation $5x^4 - 10x^2 + 1 = 0.$

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61. If $x + y + z = xyz$ 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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62. Prove that `1+cotthetalt=cottheta/2for0

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63. Find the angle θ whose cosine is equal to its tangent.

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64. Find the value of $\cos 12^\circ + \cos 84^\circ + \cos 156^\circ + \cos 132^\circ$

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65. Prove that $\cos 36^\circ \cos 72^\circ \cos 108^\circ \cos 144^\circ = 1/16.$

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66. Show that $4\sin 27^0 = \left(5+\sqrt{5}\right)^{\frac{1}{2}} - \left(3-\sqrt{5}\right)^{\frac{1}{2}}$

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67. Prove that: $\tan\frac{\pi}{16} = \sqrt{4+2\sqrt{2}} - \left(\sqrt{2}+1\right)$

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68. Find the quadratic equation whose roots are $\tan\left(\frac{\pi}{8}\right)$ and $\tan\left(\frac{5\pi}{8}\right)$

?

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69. Prove that : $\cos 20^{0} \cos 40^{0} \cos 60^{0} \cos 80^{0} = \frac{1}{16}$

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70. The value of $\sin 10^{\circ} \sin 30^{\circ} \sin 50^{\circ} \sin 70^{\circ}$ is equal to .

A. $\frac{1}{8}$

B. $\frac{1}{32}$

C. $\frac{1}{16}$

D. $\frac{1}{12}$

Answer: C

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71. The value of $\tan 20^\circ \tan 40^\circ \tan 80^\circ$ is equal to

A. $\tan 60^\circ$

B. $\cot 60^\circ$

C. $\tan 45^\circ$

D. $\tan 80^\circ$

Answer: A

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72. If $\theta = \dfrac{\pi}{2^n + 1}$, prove that: $2^n \cos\theta \cos 2\theta \cos 2^2\theta \cos 2^{n-1}\theta = 1.$

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73. $\cos\dfrac{2\pi}{15}\cos\dfrac{4\pi}{15}\cos\dfrac{8\pi}{15}\cos\dfrac{16\pi}{15} = \dfrac{1}{16}$

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74. Prove that $\sin 6^0 \sin 42^0 \sin 66^0 \sin 78^0 = \frac{1}{16}$

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75. Find the value of $2\frac{\cos^2 \pi}{7} - \frac{\cos^2 \pi}{7} - \frac{\cos \pi}{7}$

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76. Find the value of $\frac{\cos(2\pi)}{7} + \frac{\cos(4\pi)}{7} + \frac{\cos(6\pi)}{7}$

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77. Prove that $\sin \theta + s \in 3\theta + \sin 5\theta + \; + \sin(2n-1)\theta = \frac{\sin^2 n\theta}{\sin \theta}$.

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78. Prove that

$$\frac{\cos 3x}{\sin 2x \sin 4x} + \frac{\cos 5x}{\sin 4x \sin 6x} + \frac{\cos 7x}{\sin 6x \sin 8x} + \frac{\cos 9x}{\sin 8x \sin 10x}$$
$$= \frac{1}{2}(co\sec x)[co\sec 2x - co\sec 10x]$$

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79. Prove that

$2\sin 2^\circ + 4\sin 4^\circ + 6\sin 6^\circ + \ldots\ldots. + 180\sin 180^\circ = 90\cot 1^\circ$.

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80. If $A + B + C = 180^\circ$, then prove that

$\cos^2 A + \cos^2 B + \cos^2 C = 1 - 2\cos A \cos B \cos C$.

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81. If $A+B+C=180^{\circ}$, then prove that $\cos^2 A+\cos^2 B+\cos^2 C=1-2\cos A\cos B\cos C$.

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82. In triangle ABC, prove that $\sin(B+C-A)\sin(C+A-B)+\sin(A+B-C)=4s\in As\in Bs\in C$

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83. If $A+B+C=\pi$, prove that $\frac{\sin^2 A}{2}+\frac{\sin^2 B}{2}-\frac{\sin^2 C}{2}=1-2\frac{\cos A}{2}\frac{\cos B}{2}\frac{\sin C}{2}$.

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84. In any triangle ABC, prove that $\sin^3 A\cos(B-C)+\sin^3 B\cos(C-A)+\sin^3 C\cos(A-B)$=

$3 \sin A \sin B \sin C$

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

$\cot A + \cot B + \cot C - \cos ec A \cos ec B \cos ec C = \cot A \cot B \cot C$.

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

$\frac{\tan A}{\tan B \tan C} + \frac{\tan B}{\tan A \tan C} + \frac{\tan C}{\tan A \tan B} \tan A + \tan B + \tan C - 2 \cot A$

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87. In triangle ABC, if $\cot A \cot C = \frac{1}{2} and \cot B \cot C = \frac{1}{18}$, then the value of $\tan C$ is

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88. If $\cos(A+B+C)=\cos A\cos B\cos C$, then find the value of $\frac{8\sin(B+C)\sin(C+A)\sin(A+B)}{\sin 2A\sin 2B\sin 2C}$

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89. If $x+y+z=\frac{\pi}{2}$, then prove that $\left|\sin x\sin y\sin z\cos x\cos y\cos z\cos^3 x\cos^y y\cos^3 z\right|=0$

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90. The product of the sines of the angles of a triangle is p and the product of their cosines is q. Show that the tangents of the angles are the roots of the equation $qx^3-px^2+(1+q)x-p=0.$

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91. If $x^2+yx^2=4$ then find the xamimum value of $\frac{x^3+y^3}{x+y}$

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92. If $\frac{x^2}{4}+\frac{y^2}{9}=1,$ then find the range of $2x+y$

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93. If $x^2+y^2=x^2y^2$ then find the range of $\frac{5x+12y+7xy}{xy}$.

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94. For all, $x, y \in R \cdot$ find the range of $\frac{(x+y)(1-xy)}{(1+x^2)(1+y^2)}$.

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95. If $x, y \in R$ and $x^2+y^2+xy=1,$ then find the minimum value of $x^3y+xy^3+4.$

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96. Prove that in a ABC, $\sin^3 A + \sin^2 B + \sin^2 C \leq \frac{9}{4}$.

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97. Prove that in $\triangle ABC$, $2\cos A \cos B \cos C \leq \frac{1}{4}$.

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98. In $\triangle ABC$, prove that $\cos^2 A + \cos^2 B + \cos^2 C \geq \frac{3}{4}$.

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99. In triangle ABC, prove that $\frac{\sin A}{2} + \frac{\sin B}{2} + \frac{\sin C}{2} \leq \frac{3}{2}$. Hence, deduce that $\frac{\cos(\pi + A)}{4} \frac{\cos(\pi + B)}{4} \frac{\cos(\pi_C)}{4} \leq \frac{1}{8}$

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100. Find the least value of $\sec A + \sec B + \sec C$ in an acute angled triangle.

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101. 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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Solved example

1. In a ABC, if $\frac{\tan A}{2}, \frac{\tan B}{2}, \frac{\tan C}{2} are \in A\dot{P};$ then show that $\cos A, \cos B, \cos C$ are in $A\dot{P}.$

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2. if ABC is a triangle and $\tan\left(\frac{A}{2}\right), \tan\left(\frac{B}{2}\right), \tan\left(\frac{C}{2}\right)$ are in H.P. Then find the minimum value of $\cot\left(\frac{A}{2}\right)\cdot\cot\left(\frac{C}{2}\right)$

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3. In ABC, if $\sin^3\theta = \sin(A-\theta)\sin(B-\theta)\sin(C-\theta)$, then prove that $\cot\theta = \cot A + \cot B + \cot C$.

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4. Find the sum of series $\cos ec\theta + \cos ec2\theta + \cos ec4\theta + \ldots\ldots$ to n terms .

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

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6. If $\tan 6\theta = \frac{p}{q}$ find the value of $\frac{1}{2}(p \cos ec2\theta - q \sec 2\theta)$ terms of p and q.

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7. If $0 < \alpha < \frac{\pi}{2}$ and $\sin \alpha + \cos \alpha + \tan \alpha + \cot \alpha + \sec \alpha + \cos ec\alpha = 7,$ then prove that $\sin 2\alpha$ is a root of the equation $x^2 - 44x - 36 = 0.$

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8. Let A,B,C, be three angles such that $A = \frac{\pi}{4}$ and $\tan B, \tan C = p\cdot$ Find all possible values of p such that A, B, C are the angles of a triangle.

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9. If `s in A=(12)/(13)a n dsinB=4/5,\ w h e r e\ pi/2

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10. Prove that :

$$\frac{2\cos 2^n\theta + 1}{2\cos\theta + 1} = (2\cos\theta - 1)(2\cos 2\theta - 1)\left(2\cos 2^2\theta - 1\right)\ldots\left(2\cos 2^{n-1}\theta - \right.$$

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11. If $\tan\left(\frac{\pi}{4} + \frac{y}{2}\right) = \tan^3\left(\frac{\pi}{4} + \frac{x}{2}\right)$. Prove that $(\sin y) = (\sin x)\frac{3 + \sin^2 x}{1 + 3\sin^2 x}$.

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12. If $(1 + \sin t)(1 + \cos t) = \frac{5}{4}$. Find the value $(1 - \sin t)(1 - \cos t)$

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13. For all θ in $\left[0, \frac{\pi}{2}\right]$ show that the $\cos(\sin\theta) \geq \sin(\cos\theta)$

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14. Prove that $\frac{\tan x}{\tan 3x}$ never lies between $\frac{1}{3}$ and 3.

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15. Prove that

$$\sum_{k=1}^{n-1}(n-k)\frac{\cos(2k\pi)}{n} = -\frac{n}{2}, wheren \geq 3isan \in te \geq r$$

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Concept App. 3.1

1. In $\triangle ABC$, if $\cos A + \sin A - \frac{2}{\cos B + \sin B} = 0$ then prove that triangle is isosceles right angled.

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2. If X is $A.M.$ of $\tan\left(\frac{\pi}{9}\right)$ and $\tan\left(\frac{5\pi}{18}\right)$ and y is $A.M.$ of $\tan\left(\frac{\pi}{9}\right)$ and $\tan\left(\frac{7\pi}{18}\right)$, then

A. x > y

B. x = y

C. y = 2x

D. x = 2y

Answer: y=2x

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3. Find the value of

$$\cos\frac{\pi}{12}\left(\sin\frac{5\pi}{12}+\cos\frac{\pi}{4}\right)+\sin\frac{\pi}{12}\left(\cos\frac{5\pi}{12}-\sin\frac{\pi}{4}\right).$$

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4. If $\cos(\alpha + \beta) + \sin(\alpha - \beta) = 0$ and $\tan\beta \neq 1$, then find the value of $\tan\alpha$.

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5. If $\sin A + \cos 2A = 1/2$ and $\cos A + \sin 2A = 1/3$. Then find the value of $\sin 3A$.

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6. If $\sin x + \sin y + \sin z = 0 = \cos x + \cos y + \cos z$, then find the value of $\cos(\theta - x) + \cos(\theta - y) + \cos(\theta - z)$

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7. In a triangle ABC, if $\sin A \sin(B - C) = \sin C \sin(A - B)$, then prove that $\cot A$, $\cot B$, $\cot C are \in A\dot{P}$.

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8. Find the value of $\frac{(\cos 1^\circ + \sin 1^\circ)(\cos 2^\circ + \sin 2^\circ)(\cos 3^\circ + \sin 3^\circ)...(\cos 45^\circ \sin 45^\circ)}{\cos 1^\circ \cos 2^\circ \cos 3^\circ ...\cos 45^\circ}$

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9. Find the maximum value of $\sqrt{3}\sin x + \cos x and x$ for which a maximum value occurs.

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10. The maximum value of $1 + \sin\left(\frac{\pi}{4} + \theta\right) + 2\cos\left(\frac{\pi}{4} - \theta\right)$ for real values of θ is

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11. show that $2^{\sin x}+2^{\cos x}\geq 2^{1-\frac{1}{\sqrt{2}}}$

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Concept App. 3.2

1. If $A+B=225^{\circ}$, then find the value of $\dfrac{\cot A}{1+\cot A}\times\dfrac{\cot B}{1+\cot B}$

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2. If $\tan A-\tan B=x$, and $\cot B-\cot A=y$, then find the value of $\cot(A-B)$.

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3. Prove that $\dfrac{\tan^2 2\theta-\tan^2\theta}{1-\tan^2 2\theta\tan^2\theta}=\tan 3\theta\tan\theta.$

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4. If $A+B=45^\circ$, then $(1+\tan A)(1+\tan B)$=________

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5. If $\tan A=1/2, \tan B=1/3$, then prove that $\cos 2A=\sin 2B$.

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6. If $P+Q=\frac{7\pi}{6}$, then find the value of $\left(\sqrt{3}+\tan P\right)\times\left(\sqrt{3}+\tan Q\right)$.

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

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Concept App. 3.3

1. (a) Prove that $\sin 65^\circ + \cos 65^\circ = \sqrt{2}\cos 20^\circ$

(b) Prove that $\sin 47^\circ + \cos 77^\circ = \cos 17^\circ$

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

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3. Prove that sin 10Âº + sin 20Âº + sin 40Âº + sin 50Âº=sin 70Âº + sin 80

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4. $\frac{\cos \pi}{5} + \frac{\cos(2\pi)}{5} + \frac{\cos(6\pi)}{5} + \frac{\cos(7\pi)}{5} = 0$

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5. If $\sin\alpha - \sin\beta = \frac{1}{3}$ and $\cos\beta - \cos\alpha = \frac{1}{2}$, show that $\frac{\cot(\alpha+\beta)}{2} = \frac{2}{3}$

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6. If $\cos ecA + \sec A = \cos ecB + secB$, prove that: $\text{tanAtanB} = \frac{\cot(A+B)}{2}$

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

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8. 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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9. If $y \sin \phi = x \sin(2\theta + \phi)$ show that $(x+y)\cot(\theta+\phi) = (y-x)\cot\theta$.

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10. If $\cos(A+B)\sin(C+D) = \cos(A-B)\sin(C-D)$, prove that $\cot A \cot B \cot C = \cot D$.

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11. If $\tan(A+B) = 3\tan A$, prove that $\sin(2A+B) = 2\sin B$

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12. if $\frac{x}{y} = \frac{\cos A}{\cos B}$ then prove that $\frac{x \tan A + y \tan B}{x+y} = \tan\frac{A+B}{2}$

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13. If $\dfrac{\cos 6x + 6\cos 4x + 15\cos 2x + 10}{\cos 5x + 5\cos 3x + 10\cos x} = 1$, then find the smallest positive value of x.

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Concept App. 3.4

1. $\dfrac{1 + \sin 2A - \cos 2A}{1 + \sin 2A + \cos 2A} = \tan A$

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2. Prove that $\dfrac{1 + \sin 2A}{\cos 2A} = \dfrac{\cos A + \sin A}{\cos A - \sin A} = \tan\left(\dfrac{\pi}{4} + A\right)$

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3. Prove that $\cot\theta - \tan\theta = 2\cot 2\theta$.

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4. Prove that $\dfrac{\cos\theta - \sin\theta}{\cos\theta + \sin\theta} = \sec 2\theta - \tan 2\theta$.

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5. $\tan\left(\dfrac{\pi}{4} + \theta\right) - \tan\left(\dfrac{\pi}{4} - \theta\right) = 2\tan 2\theta$

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6. Prove that $\cos ecA - 2\cot 2A\cos A = 2\sin A$.

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7. Prove that $\cos^3\theta\sin 3\theta + \sin^3\theta\cos 3\theta = \dfrac{3}{4}\sin 4\theta$.

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8. $\frac{\sin^2 3A}{\sin^2 A} - \frac{\cos^2 3A}{\cos^2 A} =$

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9. Prove that $(1 + \sec 2\theta)(1 + \sec 4\theta)(1 + \sec 8\theta) = \frac{\tan 8\theta}{\tan \theta}$

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10. If in an isosceles triangle with base 'a', vertical angle 20° and lateral side each of length 'b' is given then value of $a^3 + b^3$ equals

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11. In $\Delta ABC, a = 3, b = 4$ and $c = 5,$ then value of $\sin A + \sin 2B + \sin 3C$ is

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12. If cosA=3/4, then 32 sin (A/2) sin ((5A) /2)= ------------ (A) √11 (B) -√11 (C) 11 (D) -11

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13. Find the value of $\left(4\cos^2 9^\circ - 1\right)\left(4\cos^2 27^\circ - 1\right)\left(4\cos^2 81^\circ - 1\right)\left(4\cos^2 243^\circ - 1\right)$.

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14. If θ is an acute angle and $\sin\left(\frac{\theta}{2}\right) = \sqrt{\frac{x-1}{2x}}$,then $\tan\theta$ is equal to

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15. In a triangle ABC, if $\sin A \sin(B - C) = \sin C \sin(A - B)$, then prove that $\cos 2A$, $\cos 2B$ and $\cos 2C$ are in AP.

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16. Let $a = \frac{\pi}{7}$, then show that $\sin^2 3a - \sin^2 a = \sin 2a \sin 3a$.

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17. Show that $\frac{1}{\sin 10^\circ} - \frac{\sqrt{3}}{\cos 10^\circ} = 4$

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18. Prove that

$2\sin^2\beta + 4\cos(\alpha + \beta)\sin\alpha\sin\beta + \cos 2(\alpha + \beta) = \cos 2\alpha$

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19. If $\tan x = \frac{a}{b}$ and $\tan 2x = \frac{b}{a+b}$ find the smallest positive value of x.

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20. $\tan\theta + \tan\left(60^0 + \theta\right) + \tan\left(120^0 + \theta\right) = 3\tan 3\theta$

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21. If $A = 110^\circ$, then prove that $\frac{1 + \sqrt{1 + \tan^2 2A}}{\tan 2A} = -\tan A.$

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22. If α and β are the two different roots of equations $a\cos\theta + b\sin\theta = c$, prove that

(a) $\tan(\alpha + \beta) = \frac{2ab}{a^2 - b^2}$ (b) $\cos(\alpha + \beta) = \frac{a^2 - b^2}{a^2 + b^2}$

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23. If $\tan\beta = \cos\theta\tan\alpha$, then prove that $\tan^2\frac{\theta}{2} = \frac{\sin(\alpha-\beta)}{\sin(\alpha+\beta)}$.

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24. If $\cos\theta = \frac{a}{b+c}, \cos\phi = \frac{b}{a+c}$ and $\cos\psi = \frac{c}{a+b}$ where $\theta, \phi, \psi \in (0, \pi)$ and a, b, c are sides of triangle ABC then $\tan^2\left(\frac{\theta}{2}\right) + \tan^2\left(\frac{\phi}{2}\right) + \tan^2\left(\frac{\psi}{2}\right) =$

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25. If $\cos\theta = \frac{\cos\alpha - \cos\beta}{1-\cos\alpha\cos\beta}$, then prove that one of the values of $\tan.\frac{\theta}{2}$ is $\tan.\frac{\alpha}{2}\cot.\frac{\beta}{2}$

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26. If $\tan\theta\tan\phi = \sqrt{\frac{a-b}{a+b}}$, prove that

$a - b\cos 2\theta)(a - b\cos 2\phi)$ is independent of θ and ϕ.

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Concept App. 3.5

1. Find the value of $\left(\cos^2 66^\circ - \sin^2 6^\circ\right)\left(\cos^2 48^\circ - \sin^2 12^\circ\right)$.

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2. $4\left(\sin 24^0 + \cos 6^0\right) = \sqrt{3} + \sqrt{15}$

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3. $\sin 47^\circ + \sin 61^\circ - \sin 11^\circ - \sin 25^\circ =$

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4. Find the value of $\dfrac{\tan^2 37\frac{1}{(2)}^\circ + 1}{\tan^2 37\frac{1}{(2)}^\circ - 1}$.

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5. If

$$\tan^{-1}\left(\frac{1}{1+1.2}\right)+\tan^{-1}\left(\frac{1}{1+2.3}\right)+\;+\tan^{-1}\left(\frac{1}{1+n.(n+1)}\right)=t$$

then find the value of θ.

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6. Find the value of $\dfrac{\tan 9^\circ + \cot 9^\circ}{\tan 27^\circ + \cot 27^\circ}$.

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Concept App. 3.6

1. Prove that: $\sin 20^0 \sin 40^0 \sin 60^0 \sin 80^0 = \frac{3}{16}$

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

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3. Prove that $\sin 12^\circ \sin 18^\circ \sin 42^\circ \sin 48^\circ \sin 72^\circ \sin 78^\circ = \frac{\cos 18^\circ}{32}$.

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4. $\frac{\sin(9\pi)}{14} \frac{\sin(11\pi)}{14} \frac{\sin(13\pi)}{14}$ is equal to

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5. The value of $\sin\left(\frac{\pi}{14}\right)\sin\left(3\frac{\pi}{14}\right)\sin\left(5\frac{\pi}{14}\right)\sin\left(7\frac{\pi}{14}\right)\sin\left(9\frac{\pi}{14}\right)\sin\left(11\frac{\pi}{14}\right)\sin\left(13\frac{\pi}{14}\right)$ is equal to__________

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Concept App. 3.7

1. The value of $\cos\frac{\pi}{11}+\cos\frac{3\pi}{11}+\cos\frac{5\pi}{11}+\cos\frac{7\pi}{11}+\cos\frac{9\pi}{11}$, is

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2. The average value of $\sin 2^\circ, \sin 4^\circ, \sin 6^\circ ....\sin 180^\circ$ is $(i)\frac{1}{90}\cos 1^0 (ii)\frac{1}{90}\sin 1^0 (iii)\frac{1}{90}\cot 1^0$ (iv) none of these

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3. $\sum_{r=0}^{n} \sin^2 \frac{r\pi}{n}$ is equal to

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4. Sum the series: $\sqrt{1+\cos\alpha}+\sqrt{1+\cos 2\alpha}+\sqrt{1+\cos 3\alpha}$ +.......to n terms, where $0<\alpha<\pi$

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5. The value of $\left(\cos^4 1^\circ+\cos^4 2^\circ+\ldots.+\cos^4 179^\circ\right)-\left(\sin^4 1^\circ+\sin^4 2^\circ+\ldots..+\sin^4 1$ equals

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Concept App. 3.8

1. 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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2. 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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3. If $A+B+C=180^\circ$, then prove that $\cos^2 A+\cos^2 B+\cos^2 C=1-2\cos A\cos B\cos C$.

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4. Prove that : $\cos^2(\beta-\gamma)+\cos^2(\gamma-\alpha)+\cos^2(\alpha-\beta)=1+2\cos(\beta-\gamma)\cos(\gamma-\alpha)\cos$

.

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

$\cot, \frac{A}{2}+\cot, \frac{B}{2}+\cot, \frac{C}{2}=\cot, \frac{A}{2}\cot, \frac{B}{2}\cot, \frac{C}{2}$

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

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

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8. In a triangle ABC, $\cos 3A + \cos 3B + \cos 3C = 1$ and $\angle A + \angle B < \angle C$, then find possible measure of $\angle C$.

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9. In $\triangle ABC$ if $2\sin^2 C = 2 + \cos 2A + \cos 2B$, then prove that triangle is right angled.

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Concept App. 3.9

1. Let $x, y \in R$, then find the maximum and minimum values of expression $\dfrac{x^2 + y^2}{x^2 + xy + 4y^2}$.

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2. Let $a^2 + b^2 = \alpha^2 + \beta^2 = 2$. Then show that the maximum value of $S = (1-a)(1-b) + (1-\alpha)(1-\beta)$ is 8.

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3. Find the maxium distance of any point on the curve $x^2 + 2y^2 + 2xy = 1$ form the origin.

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4. If $\frac{x^2}{144} - \frac{y^2}{25} = 1$. Find the range of $\frac{144}{x} + \frac{25}{y}$.

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5. If $x^2 + y^2 + 6x - 4y - 12 = 0$ then find the ragne of 2x+y

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Concept App. 3.10

1. In ABC Prove that $\frac{\cos^2 A}{2}+\frac{\cos^2 B}{2}+\frac{\cos^2 C}{2}\leq\frac{9}{4}$. If $\frac{\cos^2 A}{2}+\frac{\cos^2 B}{2}+\frac{\cos^2 C}{2}=y\left(x^2+\frac{1}{x^2}\right)$ then find the maximum value of y.

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2. Let $\alpha,\beta,\gamma>0 and \alpha+\beta+\gamma=\frac{\pi}{2}$. Then prove that $\sqrt{\tan\alpha\tan\beta}+\sqrt{tan\beta\tan\gamma}+\sqrt{\tan\alpha\tan\gamma}\leq\sqrt{3}$

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3. In acute angled $\triangle ABC$ prove that $\tan^2 A+\tan^2 B+\tan^2 C\geq 9$.

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4. In a $\Delta ABC \sin A \sin B \sin C \leq \frac{3\sqrt{3}}{8}$

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5. In triangle ABC, prove that $\sin\frac{A}{2}\sin\frac{B}{2}\sin\frac{C}{2} \leq \frac{1}{8}$ and hence, prove that $co\sec\frac{A}{2} + co\sec\frac{B}{2} + co\sec\frac{C}{2} \geq 6.$

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Exercise (Single Correct Answer Type)

1. If $\cos(A-B) = \frac{3}{5}$ and $\tan A \tan B = 2$ then

A. $\cos A \cos B = \frac{1}{5}$

B. $\sin A \sin B = -\frac{2}{5}$

C. $\cos A \cos B = -\frac{1}{5}$

D. $\sin A \sin B = 1/5$

Answer: A

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2. If $A = \sin 45^0 + \cos 45^0 and B = \sin 44^0 + \cos 44^0,$ then

$(a) A > B (b) A = B$

A. $A > B$

B. $A < B$

C. $A = B$

D. none of these.

Answer: A

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3. $\tan 100^0 + \tan 125^0 + \tan 100^0 \tan 125^0$ is equal to

A. 0

B. $\frac{1}{2}$

C. -1

D. 1

Answer: D

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4. If $\cot(\alpha + \beta = 0,$ then $\sin(\alpha + 2\beta$ can be $-\sin \alpha$ (b) $\sin \beta$ (c) $\cos \alpha$ (d) $\cos \beta$

A. $-\sin \alpha$

B. $\sin \beta$

C. $\cos \alpha$

D. $\cos \beta$

Answer: D

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5. In triangle ABC, if $\sin A \cos B = \frac{1}{4}$ and $3tanA = tanB, then \cot^2 A$ is equal to

A. 2

B. 3

C. 4

D. 5

Answer: B

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6. Let $\frac{\sin(\theta - \alpha)}{\sin(\theta - \beta)} = \frac{a}{b} and \frac{\cos(\theta - \alpha)}{\cos(\theta - \beta)} = \frac{c}{d} then \frac{ac + bd}{ad + bc} =$

A. $\cos(\alpha - \beta)$

B. $\sin(\alpha - \beta)$

C. $\cos(\alpha+\beta)$

D. none of these.

Answer: A

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7. If A,B,C are angles of a triangle, then $2\frac{\sin A}{2}\cos ec\frac{B}{2}\frac{\sin C}{2}-\sin A\frac{\cos B}{2}-\cos A$ is

A. independent of A, B, C

B. function of A,B

C. function of C

D. none of these.

Answer: A

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8. If $a \leq 3\cos x + 5\sin\left(x - \frac{\pi}{6}\right) \leq b$ for all x then (a, b) is $\left(-\sqrt{19}, \sqrt{19}\right)$ (b) $(-17, 17)$ $\left(-\sqrt{21}, \sqrt{21}\right)$ (b) $none of these$

A. $\left(-\sqrt{19}\sqrt{19}\right)$

B. $(-17, 17)$

C. $\left(-\sqrt{21}, \sqrt{21}\right)$

D. none of these.

Answer: A

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9. If $\frac{x}{\cos\theta} = \frac{y}{\cos\left(\theta - \frac{2\pi}{3}\right)} = \frac{z}{\cos\left(\theta + \frac{2\pi}{3}\right)}$ 1 (b) 0 (c) -1 (d) none of these

A. 1

B. 0

C. -1

D. none of these.

Answer: B

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10. Let $x = \sin 1^{\circ}$ then find the value of the expression $\frac{1}{\cos 0^{\circ} \cos 1^{\circ}} + \frac{1}{\cos 1^{\circ} \cos 2^{\circ}} + ... + \frac{1}{\cos 44^{\circ} \cos 45^{\circ}}$

A. x

B. $1/x$

C. $\sqrt{2}/x$

D. $x/\sqrt{2}$

Answer: B

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11. If θ is eliminated from the equations $x = a\cos(\theta - \alpha)$ and $y = b\cos(\theta - \beta)$, then $\left(\frac{x^2}{a^2}\right) + \left(\frac{y^2}{b^2}\right) - \frac{2xy}{ab}\cos(\alpha - \beta)$ is equal to (a)$\sec^2(\alpha - \beta)$ (b) $\cos ec^2(\alpha - \beta)$ (c)$\cos^2(\alpha - \beta)$ (d) $\sin^2(\alpha - \beta)$

A. $\sec^2(\alpha - \beta)$

B. $co\sec^2(\alpha - \beta)$

C. $\cos^2(- \beta)$

D. $\sin^2(\alpha - \beta)$

Answer: D

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12. The minimum vertical distance between the graphs of $y = 2 + s \in xandy = \cos x$ is 2 (b) 1 (c) $\sqrt{2}$ (d) $2 - \sqrt{2}$

A. 2

B. 1

C. $\sqrt{2}$

D. $2-\sqrt{2}$

Answer: D

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13. If $\frac{\tan^2(\pi - A)}{4} + \frac{\tan^2(\pi - B)}{4} + \frac{\tan^2(\pi - C)}{4} = 1$, then ABC is equilateral (b) isosceles (c) scalene (d) none of these

A. equilateral

B. isosceles

C. scalene

D. none of these.

Answer: A

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14. if (1+tanα)(1+tan4α) =2 where $\alpha \in$ (0 , $\frac{\pi}{16}$) then α equal to

A. $\frac{\pi}{20}$

B. $\frac{\pi}{30}$

C. $\frac{\pi}{40}$

D. $\frac{\pi}{60}$

Answer: A

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15. If $\cos 28^0 + \sin 28^0 = k^3, then \cos 17^0$ is equal to $\frac{k^3}{\sqrt{2}}$ (b) $-\frac{k^3}{\sqrt{2}}$ (c) $\pm\frac{k^3}{\sqrt{2}}$ (d) none of these

A. $\frac{k^3}{\sqrt{2}}$

B. $-\frac{k^3}{\sqrt{2}}$

C. $\pm\frac{k^3}{\sqrt{2}}$

D. none of these.

Answer: A

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16. Let $f(\theta) = \dfrac{\cot\theta}{1+\cot\theta}$ and $\alpha+\beta = \dfrac{5\pi}{4}$ then the value $f(\alpha)f(\beta)$ is

A. $\dfrac{1}{2}$

B. $-\dfrac{1}{2}$

C. 2

D. none of these.

Answer: A

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17. If y = (1 + tan A) (1 - tan B), where $A - B = \dfrac{\pi}{4}$ then $(y+1)^{y+1}$ is equal to

A. 9

B. 4

C. 27

D. 81

Answer: C

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18. If $\frac{\sin x}{\sin y} = \frac{1}{2}, \frac{\cos x}{\cos y} = \frac{3}{2}$, where $x, y, \in \left(0, \frac{\pi}{2}\right)$, then the value of $\tan(x + y)$ is equal to $\sqrt{13}$ (b) $\sqrt{14}$ (c) $\sqrt{17}$ (d) $\sqrt{15}$

A. $\sqrt{13}$

B. $\sqrt{14}$

C. $\sqrt{17}$

D. $\sqrt{15}$

Answer: D

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19. If $\cot^2 x = \cot(x-y)(x-z), then \cot 2x$ is equal to $\left(where x \neq \frac{\pi}{4}\right)$. $\frac{1}{2}(\tan y + \tan z)$ (b) $\frac{1}{2}(\cot y + \cot z)$ $\frac{1}{2}(\sin y + \sin z)$ (d) none of these

A. $\frac{1}{2}(\tan y + \tan x)$

B. $\frac{1}{2}(\cot y + \cot z)$

C. $\frac{1}{2}(\sin y + \sin z)$

D. none of these.

Answer: B

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20. In a ABC, if $\tan A : \tan B : \tan C = 3 : 4 : 5$, then the value of $\sin A \sin B \sin C$ is equal to (a) $\frac{2}{\sqrt{5}}$ (b) $\frac{2\sqrt{5}}{7}$ (c) $\frac{2\sqrt{5}}{9}$ (d) $\frac{2}{3\sqrt{5}}$

A. $\frac{2}{\sqrt{5}}$

B. $\frac{2\sqrt{5}}{7}$

C. $\frac{2\sqrt{5}}{9}$

D. $\frac{2}{3\sqrt{5}}$

Answer: B

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21. Find the value of $\sin 27^\circ - \cos 27^\circ$?

A. $-\frac{\sqrt{3-\sqrt{3}}}{2}$

B. $-\frac{\sqrt{5-\sqrt{5}}}{2}$

C. $-\frac{\sqrt{5}-1}{2\sqrt{2}}$

D. none of these.

Answer: B

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22. If $\cos\theta_1 2\cos\theta_2$, then $\frac{\tan(\theta_{1-\theta_2})}{2}\frac{\tan(\theta_1+\theta_2)}{2}$ is equal to $\frac{1}{3}$ (b) $-\frac{1}{3}$ 1 (d) -1

A. $\frac{1}{3}$

B. $-\frac{1}{3}$

C. 1

D. -1

Answer: B

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23. Let α and β be such that $\pi<\alpha-\beta<3\pi$, If $\sin\alpha+\sin\beta=-\frac{21}{65}$ and $\cos\alpha+\cos\beta=-\frac{27}{65}$, then the value of $\frac{\cos(\alpha-\beta)}{2} is$ (a) $-\frac{3}{\sqrt{130}}$ (b) $\frac{3}{\sqrt{130}}$ (c) $\frac{6}{25}$ (d) $\frac{6}{65}$

A. $-\frac{3}{\sqrt{130}}$

B. $\frac{3}{\sqrt{130}}$

C. $\frac{6}{65}$

D. $-\frac{6}{65}$

Answer: A

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24. If $n = \frac{\pi}{4\alpha}$, then $\tan\alpha\tan2\alpha\tan3\alpha...\tan(2n-1)\alpha$ is equal to (a) 1 (b) 1/2 (c) 2 (d) 1/3

A. 1

B. $1/2$

C. 2

D. $1/3$

Answer: A

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

A. $\tan 3\theta$

B. $\cot 3\theta$

C. $\tan 6\theta$

D. $\cot 6\theta$

Answer: C

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26. If x, y, z are in A.P., then $\dfrac{\sin x-\sin z}{\cos z-\cos x}$ is equal to (a)$\tan y$ (b) $\cot y$ (c) $\sin y$ (d) $\cos y$

A. (a) $\tan y$

B. (b) $\cot y$

C. (c) $\sin y$

D. (d) $\cos y$

Answer: B

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27. If $\frac{\cos x}{a} = \frac{\cos(x+\theta)}{b} = \frac{\cos(x+2\theta)}{c} = \frac{\cos(x+3\theta)}{d}$ then $\frac{a+c}{b+d}$ is equal to $(A)\frac{a}{d}(B)\frac{c}{d}(C)\frac{b}{c}(D)\frac{d}{a}$

A. $\frac{a}{d}$

B. $\frac{C}{b}$

C. $\frac{b}{c}$

D. $\frac{d}{a}$

Answer: C

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28. If $\cos\alpha + \cos\beta = 0 = \sin\alpha + \sin\beta$, then $\cos 2\alpha + \cos 2\beta$ is equal to $-2\sin(\alpha+\beta)$ (b) $-2\cos(\alpha+\beta)$ $2\sin(\alpha+\beta)$ (d) $2\cos(\alpha+\beta)$

A. $-2\sin(\alpha+\beta)$

B. $-2\cos(\alpha+\beta)$

C. $2\sin(\alpha+\beta)$

D. $2\cos(\alpha+\beta)$

Answer: B

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29. Value of $\dfrac{3+\cot 80^0 \cot 20^0}{\cot 80^0 + \cot 20^0}$ is equal to $\cot 20^0$ (b) $\tan 50^0$ $\cot 50^0$ (d) $\cot\sqrt{20^0}$

A. $\cot 20^\circ$

B. $\tan 50^\circ$

C. $\cot 50^\circ$

D. $\cot\sqrt{20^{\circ}}$

Answer: B

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30. If $\tan\alpha$ is equal to the integral solution of the inequality $4x^2-16x+15<0$ and $\cos\beta$ is equal to the slope of the bisector of the first quadrant, then $\sin(\alpha+\beta)\sin(\alpha-\beta)$ is equal to $\frac{3}{5}$ (b) $\frac{3}{5}$ (c) $\frac{2}{\sqrt{5}}$ (d) $\frac{4}{5}$

A. $\frac{3}{5}$

B. $\frac{3}{5}$

C. $\frac{2}{\sqrt{5}}$

D. $\frac{4}{5}$

Answer: D

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31. Let $f(n) = 2\cos nx \, \forall n \in N$, then $f(1)f(n+1) - f(n)$ is equal to $f(n+3)$ (b) $f(n+2)$ $f(n+1)f(2)$ (d) $f(n+2)f(2)$

A. $f(n+3)$

B. $f(n+2)$

C. $f(n+1)f(2)$

D. $f(n+2)f(2)$

Answer: B

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32. If $\sin\theta_1 \sin\theta_2 - \cos\theta_1 \cos\theta_2 + 1 = 0$, then the value of $\tan\left(\frac{\theta_1}{2}\right)\cot\left(\frac{\theta_2}{2}\right)$ is equal to -1 (b) 1 (c) 2 (d) -2

A. $a^2 + b^2 \geq 4$

B. $a^2 + b^2 \leq 4$

C. $a^2 + b^2 \geq 3$

D. $a^2 + b^2 \leq 2$

Answer: B

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33. $\frac{\sqrt{2} - \sin\alpha}{\sin\alpha\pi - \cos\alpha\pi}$ is equal to $\sec\left(\frac{\alpha}{2} - \frac{\pi}{8}\right)$ (b) $\cos\left(\frac{\pi}{8} - \frac{\alpha}{2}\right)$ $\tan\left(\frac{\alpha}{2} - \frac{\pi}{8}\right)$ (d) $\cot\left(\frac{\alpha}{2} - \frac{\pi}{2}\right)$

A. $\sec\left(\frac{\alpha}{2} - \frac{\pi}{8}\right)$

B. $\cos\left(\frac{\pi}{8} - \frac{\alpha}{2}\right)$

C. $\tan\left(\frac{\alpha}{2} - \frac{\pi}{8}\right)$

D. $\cot\left(\frac{\alpha}{2} - \frac{\pi}{2}\right)$

Answer: C

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34. If x_1 and x_2 are two distind roots of the equation $a\cos x+b\sin x=c$, then $\tan\frac{x_1+x_2}{2}$ is equal to

A. $\frac{a}{b}$

B. $\frac{b}{a}$

C. $\frac{c}{a}$

D. $\frac{a}{c}$

Answer: B

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

A. AP

B. GP

C. HP

D. none of these.

Answer: A

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36. If $\frac{\tan(\alpha+\beta+\gamma)}{\tan(\alpha-\beta-\gamma)}=\frac{\tan\gamma}{\tan\beta},(\beta\neq\gamma)$ then $\sin 2\alpha+s\in 2\beta+s\in 2\gamma=$ 0 (b) 1 (c) 2 (d)

A. 0

B. 1

C. 2

D. $1/2$

Answer: A

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37. If $\sin\theta_1 - \sin\theta_2 = a$ and $\cos\theta_1 + \cos\theta_2 = b$, then

A. -1

B. 1

C. 2

D. -2

Answer: A

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38. The value of expression $\left(2\frac{\sin 1^0 + \sin 2^0 + \sin 3^0 + \quad + \sin 89^0}{2\left(\cos 1^0 + \cos 2^0 + \quad + \cos 44^0\right) + 1}\right.$ $\sqrt{2}$

(b) $\frac{1}{\sqrt{2}}$ (c) $\frac{1}{2}$ (d) 0

A. $\sqrt{2}$

B. $\frac{1}{\sqrt{2}}$

C. $\frac{1}{2}$

D. 0

Answer: A

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39. If A,B,C, are the angles of a triangle such that $\frac{\cot A}{2} = 3\frac{\tan C}{2}$, then $\sin A, \sin B, \sin C$ are in $A\dot{P}.$ (b) $G\dot{P}.$ (c) $H\dot{P}.$ (d) none of these

A. AP

B. GP

C. HP

D. none of these.

Answer: A

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40. If $2\sec 2\theta = \tan\phi + \cot\phi$, then one of the values of $\theta + \phi$ is

A. $\frac{\pi}{2}$

B. $\frac{\pi}{4}$

C. $\frac{\pi}{3}$

D. none of these

Answer: B

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41. The roots of the equation $4x^2 - 2\sqrt{5}x + 1 = 0$ are .

A. $\sin 36^\circ$, $\sin 18^\circ$

B. $\sin 18^\circ$, $\cos 36^\circ$

C. $\sin 36^\circ$, $\cos 18^\circ$

D. $\cos 18^\circ$, $\cos 36^\circ$

Answer: B

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42. If A and B are acute positive angles satisfying the equations $3\sin^2 A + 2\sin^2 B = 1$ and $3\sin 2A - 2\sin 3B = 0$, then $A + 2B$ is equal to

A. π

B. $\frac{\pi}{2}$

C. $\frac{\pi}{4}$

D. $\frac{\pi}{6}$

Answer: B

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43. If $\cos 25^0 + \sin 25^0 = K$, then $\cos 50^0$ is equal to

A. $\sqrt{2-p^2}$

B. $-\sqrt{2-p^2}$

C. $p\sqrt{2-p^2}$

D. $-p\sqrt{2-p^2}$

Answer: C

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44. The value of $\frac{\cot(7\pi)}{16} + 2\frac{\cot(3\pi)}{8} + \frac{\cot(15\pi)}{16}$ is 4 (b) 2 (c) -2 (d) -4

A. 4

B. 2

C. -2

D. -4

Answer: D

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45. If $\alpha, \beta, \gamma, \delta$ are the smallest positive angles in ascending order of magnitude which have their sines equal to the positive quantity k, then the value of $4\frac{\sin\alpha}{2} + 3\frac{\sin\beta}{2} + 2\frac{\sin\gamma}{2} + \frac{\sin\delta}{2}$ is equal to $2\sqrt{1-k}$ (b) $2\sqrt{1+k}$ $\frac{\sqrt{1-k}}{2}$ (d) none of these

A. $2\sqrt{1-k}$

B. $2\sqrt{1+k}$

C. $\frac{\sqrt{1+k}}{2}$

D. none of these.

Answer: B

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46. $\frac{\sin^2 A - \sin^2 B}{\sin A \cos A - \sin B \cos B}$ is equal to

(a) $\tan(A - B)$

(b) $\tan(A + B)$

(c) $\cot(A - B)$

(d) $\cot(A + B)$

A. $\tan(A - B)$

B. $\tan(A + B)$

C. $\cot(A - B)$

D. $\cot(A + B)$

Answer: B

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47. If $\cos(\alpha - \beta) = 3\sin(\alpha + \beta), then \frac{1}{1 - 3\sin 2\alpha} + \frac{1}{1 - 3\sin 2\beta} =$ $\frac{1}{2}$ (b) $\frac{-1}{2}$ (c) $\frac{1}{4}$ (d) $\frac{-1}{4}$

A. $\frac{1}{2}$

B. $\frac{-1}{2}$

C. $\frac{1}{4}$

D. (-1)/(4)`

Answer: D

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48. The value of $\cos^2 10^0 - \cos 10^0 \cos 50^0 + \cos^2 50^0$ is equal to $\frac{4}{3}$ (b) $\frac{1}{3}$ (c) $\frac{3}{4}$ (d) 3

A. $\frac{4}{3}$

B. $\frac{1}{3}$

C. $\frac{3}{4}$

D. 3

Answer: C

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49. If $tan^2\theta = 2tan^2\varphi + 1$, prove that $\cos 2\theta + s \in^2 \varphi = 0.$

A. -1

B. 0

C. 1

D. none of these.

Answer: B

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50. If $\sin x + \cos ecx + \tan y + \cot y = 4$ where $xandy \in \left[0, \frac{\pi}{2}\right], then \frac{\tan y}{2}$ is a root of the equation $\alpha^2 + 2\alpha + 1 = 0$ (b) $2\alpha^2 - 2\alpha - 1 = 0$ $2\alpha^2 - 2\alpha - 1 = 0$ (d) $\alpha^2 - \alpha - 1 = 0$

A. $a^2 + 2\alpha + 1 = 0$

B. $a^2 + 2a = 0$

C. $2a^2 - 2a - 1 = 0$

D. $a^2 - \alpha - 1 = 0$

Answer: D

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51. If $2\sin 2\alpha = |\tan\beta + \cot\beta|\alpha, \beta, \in \left(\frac{\pi}{2}, \pi\right)$, then the value of $\alpha + \beta$ is

A. $\frac{3\pi}{4}$

B. π

C. $\frac{3\pi}{2}$

D. $\frac{5\pi}{4}$

Answer: C

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52. If $2|\sin 2\alpha| = |\tan\beta + \cot\beta|, \alpha, \beta \in \left(\frac{\pi}{2}, \pi\right)$, then the value of $\alpha + \beta$ is (a)$\frac{3\pi}{4}$ (b) π (c) $\frac{3\pi}{2}$ (d) $\frac{5\pi}{4}$

A. $\frac{3\pi}{4}$

B. π

C. $\frac{3\pi}{2}$

D. $\frac{5\pi}{4}$

Answer: C

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53. The value of $\sin^3 10^0 + \sin^3 50^0 - \sin^3 70^0$ is equal to $-\frac{3}{2}$ (b) $\frac{3}{4}$ (c) $-\frac{3}{4}$ (d) $-\frac{3}{8}$

A. $-\frac{3}{2}$

B. $\frac{3}{4}$

C. $-\frac{3}{4}$

D. $-\frac{3}{8}$

Answer: D

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54. Let $P(x)=\left(\frac{1-\cos 2x+\sin 2x}{1+\cos 2x+s\in 2x}\right)^2+\left(\frac{1+\cot x+\cot^2 x}{1+\tan x+\tan^2 x}\right),$ then the minimum value of $P(x)$ equal 1 (b) 2 (c) 4 (d) 16

A. 1

B. 2

C. 4

D. 16

Answer: B

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55. If $\dfrac{3-\tan^2\frac{\pi}{7}}{1-\tan^2\frac{\pi}{7}} = k\cos\dfrac{\pi}{7}$ then the value of k is

A. 1

B. 2

C. 3

D. 4

Answer: D

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56. $\cos ec\dfrac{360^0}{7} + \cos ec\dfrac{540^0}{7} =$ $\cos ec\dfrac{180^0}{7}$ (b) $\cos ec\dfrac{90^0}{7}$ $\dfrac{\sec(180^0)}{7}$
(d) $\dfrac{\sec(90^0)}{7}$

A. $co\sec\left(\dfrac{180^\circ}{7}\right)$

B. $co\sec\left(\dfrac{90^\circ}{7}\right)$

C. $\sec\left(\dfrac{180^\circ}{7}\right)$

D. $\sec\left(\frac{90^\circ}{7}\right)$

Answer: A

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57. If $\theta_1 andth\eta_2$ are two values lying in $[2, 2\pi]$ for which $tan\theta = \lambda$, then $\frac{\tan(\theta_1)}{2}\frac{\tan(\theta_2)}{2}$ is equal to 0 (b) -1 (c) 2 (d) 1

A. 0

B. -1

C. 2

D. 1

Answer: B

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58. If $\tan\theta = \sqrt{n}$, where $n \in N$, $\geq 2, then \sec 2\theta$ is always a rational number (b) an irrational number a positive integer (d) a negative integer

A. a rational number

B. an irrational number

C. a positive integer

D. a negative integer.

Answer: A

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59. If $\sin 2\theta = \cos 3\theta and th\eta$ is an acute angle, then $\sin\theta$ equal $\frac{\sqrt{5}-1}{4}$ (b) $-\left(\frac{\sqrt{5}-1}{4}\right)$ $\frac{\sqrt{5}+1}{4}$ (d) $\frac{-\sqrt{5}-1}{4}$

A. $\frac{\sqrt{5}-1}{4}$

B. $-\left(\frac{\sqrt{5}-1}{4}\right)$

C. $\frac{\sqrt{5}+1}{4}$

D. $\frac{-\sqrt{5}-1}{4}$

Answer: A

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60. If $\cos x = \tan y, \cos y = \tan z \text{ and } \cos z = \tan x,$ prove that $\sin x = \sin y = \sin z = \sin 18^\circ$

A. $2\cos 18^\circ$

B. $\cos 18^\circ$

C. $\sin 18^\circ$

D. $2\sin 18^\circ$

Answer: D

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61. The value of $70^0 + 4\cos 70^0$ is $\frac{1}{\sqrt{3}}$ (b) $\sqrt{3}$ (c) $2\sqrt{3}$ (d) $\frac{1}{2}$

A. $\frac{1}{\sqrt{3}}$

B. $\sqrt{3}$

C. $2\sqrt{3}$

D. $\frac{1}{2}$

Answer: B

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62. If $\sin x + \cos x = \frac{\sqrt{7}}{2}$ where x $\in \left[0, \frac{\pi}{4}\right]$ then $\tan\left(\frac{x}{2}\right)$ is equal to

A. (a) $\frac{3-\sqrt{7}}{3}$

B. (b) $\frac{\sqrt{7}-2}{3}$

C. (c) $\frac{4-\sqrt{7}}{4}$

D. (d) none of these.

Answer: B

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63. If $\frac{\tan 3A}{\tan A}=k(k\neq 1)$ then which of the following is not true? $\frac{\cos A}{\cos 3A}=\frac{k-1}{2}$ (b) $\frac{\sin 3A}{\sin A}=\frac{2k}{k-1}$ $\frac{\cot 3A}{\cot A}=\frac{1}{k}$ (d) none of these

A. $\frac{\cos A}{\cos 3A}=\frac{k-1}{2}$

B. $\frac{\sin 2A}{\sin A}=\frac{2k}{k-1}$

C. $\frac{\cos 3A}{\cot A}=\frac{1}{k}$

D. none of these.

Answer: D

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64. If $x\in\left(\pi,\frac{3\pi}{2}\right), then 4\cos^2\left(\frac{\pi}{4}-\frac{x}{2}\right)+\sqrt{4\sin^4 x+\sin^2 2x}$ is always equal to 1 (b) 2 (c) -2 (d) none of these

A. 1

B. 2

C. -2

D. none of these.

Answer: B

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65. If $\cos x = \dfrac{2\cos y - 1}{2 - \cos y}$, where $x, y \in (0, \pi)$ then $\tan\left(\dfrac{x}{2}\right) \times \cot\left(\dfrac{y}{2}\right)$ is equal to

(a) $\sqrt{2}$

(b) $\sqrt{3}$

(c) $\dfrac{1}{\sqrt{2}}$

(d) $\dfrac{1}{\sqrt{3}}$

A. $\sqrt{2}$

B. $\sqrt{3}$

C. $\frac{1}{\sqrt{2}}$

D. $\frac{1}{\sqrt{3}}$

Answer: B

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66. $\cot 16^0 \cot 44^0 + \cot 44^0 \cot 76^0 - \cot 76^0 \cot 16^0 =$ 1 (b) 2 (c) 3 (d) 4

A. 1

B. 2

C. 3

D. 4

Answer: C

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67. If $\tan x = \frac{b}{a}$, then $\sqrt{\frac{a+b}{a-b}} + \sqrt{\frac{1-b}{a+b}}$ is equal to $2s \in x / \sqrt{\sin 2x}$ (b) $2\cos x / \sqrt{\cos 2x}$ $2\cos x / \sqrt{\sin 2x}$ (d) $2s \in x / \sqrt{\cos 2x}$

A. $2\sin x / \sqrt{2\sin 2x}$

B. $2\cos x / \sqrt{\cos 2x}$

C. $2\cos x / \sqrt{\sin 2x}$

D. $2\sin x / \sqrt{\cos 2x}$

Answer: B

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68. Given that $(1+\sqrt{1+x})\tan y = 1+\sqrt{1-x}$. Then $\sin 4y$ is equal to $4x$ (b) $2x$ (c) x (d) none of these

A. 4x

B. 2x

C. x

D. none of these.

Answer: C

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69. If $\cos 2B = \frac{\cos(A+C)}{\cos(A-C)}$, then $\tan A, tanB, \tan C$ are in A.P. (b) G.P. (c) H.P. (d) none of these

A. AP

B. GP

C. HP

D. none of these.

Answer: B

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70. If $\frac{\cos(x-y)}{\cos(+y)}+\frac{\cos(z+t)}{\cos(z-t)}=0$, then the value of expression $\tan x \tan y \tan z \tan t$ is equal to 1 (b) -1 (c) 2 (d) -2

A. 1

B. -1

C. 2

D. -2

Answer: B

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71. If $\tan\beta = 2\sin\alpha\sin\gamma co\sec(\alpha+\gamma)$, then $\cot\alpha$, $\cot\beta$, $\cot\gamma$ are in

A. AP

B. GP

C. HP

D. none of these.

Answer: A

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72. The value of $\tan 9^\circ - \tan 27^\circ - \tan 63^\circ + \tan 81^\circ$ is equal to

A. 2

B. 3

C. 4

D. none of these.

Answer: C

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73. If $\cos^3 x \sin 2x = \sum_{r=0}^{n} a_x \sin(rx), \ \forall x \in R$ then

A. $n = 5, a_1 = 1/2$

B. $n = 5, \alpha_1 = 1/4$

C. $n = 5, a_2 = 1/8$

D. $n = 5, a_2 = 1/4$

Answer: B

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74. $\frac{\tan^6 \pi}{9} - 33\frac{\tan^4 \pi}{9} + 27\frac{\tan^2 \pi}{9}$ is equal to (a) 0 (b) $\sqrt{3}$ (c) 3 (d) 9

A. 0

B. $\sqrt{3}$

C. 3

D. 9

Answer: C

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75. Given that $a, b, c,$ are the side of a ABC which is right angled at C, then the minimum value of $\left(\frac{c}{a} + \frac{c}{b}\right)^2$ is 0 (b) 4 (c) 6 (d) 8

A. 0

B. 4

C. 6

D. 8

Answer: D

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76. If $\theta = 3\alpha$ and $\sin\theta = \frac{a}{\sqrt{a^2 + b^2}}$, the value of the expression $a co\sec\alpha - b\sec\alpha$ is

A. (a) $\frac{a}{\sqrt{a^2 + b^2}}$

B. (b) $2\sqrt{a^2 + b^2}$

C. (c) 'a+b'

D. (d) none of these.

Answer: B

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77. $\tan 6^\circ \tan 42^\circ \tan 66^\circ \tan 78^\circ = 1$

A. 1

B. $1/2$

C. $1/4$

D. $1/8$

Answer: A

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78. In triangle ABC, if angle is 90^0 and the area of triangle is $30 sq.$ units, then the minimum possible value of the hypotenuse c is equal to (a) $30\sqrt{2}$ (b) $60\sqrt{2}$ (c) $120\sqrt{2}$ (d) $2\sqrt{30}$

A. $30\sqrt{2}$

B. $60\sqrt{2}$

C. $120\sqrt{2}$

D. $2\sqrt{30}$

Answer: D

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79. If $\sqrt{2}\cos A = \cos B + \cos^3 B, and \sqrt{2}\sin A = \sin B - \sin^3 B then \sin(A - B)$ ± 1 (b) $\pm\frac{1}{2}$ (c) $\pm\frac{1}{3}$ (d) $\pm\frac{1}{4}$

A. ± 1

B. $\pm\frac{1}{2}$

C. $\pm\frac{1}{3}$

D. $\pm\frac{1}{4}$

Answer: C

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80. In a right angled triangle the hypotenuse is $2\sqrt{2}$ times the perpendicular drawn from the opposite vertex. Then the other acute angles of the triangle are $\frac{\pi}{3} and \frac{\pi}{6}$ (b) $\frac{\pi}{8} and \frac{3\pi}{8}$ (c) $\frac{\pi}{4} and \frac{\pi}{4}$ (d) $\frac{\pi}{5} and \frac{3\pi}{10}$

A. $\frac{\pi}{3}$ and $\frac{\pi}{6}$

B. $\frac{\pi}{8}$ and $\frac{3\pi}{8}$

C. $\frac{\pi}{4}$ and $\frac{\pi}{4}$

D. $\frac{\pi}{5}$ and $\frac{3\pi}{10}$

Answer: B

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81. A circular ring of radius 3 cm hangs horizontally from a point 4 cm vertically above its centre by 4 strings attached at equal intervals to its circumference . If the angle between two consecutive strings is$theta$,then find the value of cos$theta$

A. $\frac{4}{5}$

B. $\frac{4}{25}$

C. $\frac{16}{25}$

D. none of these.

Answer: C

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82. The distance between two parallel lines is unity. A point P lies between the lines at a distance a from one of them. Find the length of a side of an equilateral triangle PQR, vertex Q of which lies on one of the parallel lines and vertex R lies on the other line.

A. $\frac{2}{3}\sqrt{d^2+d+1}$

B. $2\sqrt{\frac{d^2-d+1}{3}}$

C. $2\sqrt{d^2-d+1}$

D. $\sqrt{d^2-d+1}$

Answer: B

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83. If $\sin^{-1}a+\sin^{-1}b+\sin^{-1}c=\pi$, then the value of $a\sqrt{(1-a^2)}+b\sqrt{(1-b^2)}+c\sqrt{(1-c^2)}$ will be (A) $2abc$ (B) abc (C) $\frac{1}{2}abc$ (D) $\frac{1}{3}abc$

A. a+b+c

B. $a^2b^2c^2$

C. 2abc

D. 4abc

Answer: C

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84. If $A+B+C=\frac{3\pi}{2}, then \cos 2A+\cos 2B+\cos 2C$ is equal to

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

$1-4\sin A\sin B\sin C$

A. $1-4\cos A\cos B\cos C$

B. $4\sin A\sin B\sin C$

C. $1+2\cos A\cos B\cos C$

D. $1-4\sin A\sin B\sin C$

Answer: D

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85. If $\tan(\alpha - \beta) = \frac{\sin 2\beta}{3 - \cos 2\beta}$, then

A. $\tan\alpha = 2\tan\beta$

B. $\tan\beta = 2\tan\alpha$

C. $2\tan\alpha = 3\tan\beta$

D. $3\tan\alpha = 2\tan\beta$

Answer: A

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86. In any triangle ABC, $\sin^2 A - \sin^2 B + \sin^2 C$ is always equal to $2\sin A\sin B\cos C$ (b) $2\sin A\cos B\sin C$ $2\sin A\cos B\cos C$ (d) $2\sin A\sin B\sin C$

A. $2\sin A\sin B\cos C$

B. $2\sin A\cos B\sin C$

C. $2\sin A\cos B\cos C$

D. $2\sin A\sin B\sin C$

Answer: B

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87. The value of $\sum_{r=0}^{10}\frac{\cos^3(r\pi)}{3}$ is equal to $\frac{1}{4}$ (b) $\frac{1}{8}$ (c) $-\frac{1}{4}$ (d) $-\frac{1}{8}$

A. $1/4$

B. $1/8$

C. $-1/4$

D. $-1/8$

Answer: D

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88. In triangle ABC, $\frac{\sin A + \sin B + \sin C}{\sin A + \sin B - \sin C}$ is equal to

A. $\tan\left(\frac{A}{2}\right)\cot\left(\frac{B}{2}\right)$

B. $\cot\left(\frac{A}{2}\right)\tan\left(\frac{B}{2}\right)$

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

D. $\tan\left(\frac{A}{2}\right)\tan\left(\frac{B}{2}\right)$

Answer: C

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89. $\frac{\sin 2A + \sin 2B + \sin 2C}{\sin A + \sin B + \sin C}$ is equal to

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

B. $8\cos\left(\frac{A}{2}\right)\cos\left(\frac{B}{2}\right)\cos\left(\frac{C}{2}\right)$

C. $8\tan\left(\frac{A}{2}\right)\tan\left(\frac{B}{2}\right)\tan\left(\frac{C}{2}\right)$

D. $8\cot\left(\frac{A}{2}\right)\cot\left(\frac{B}{2}\right)\cot\left(\frac{C}{2}\right)$

Answer: A

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90. If $\cos^2 A + \cos^2 B + \cos^2 C = 1$, then $\triangle ABC$ is

A. equilateral

B. isosceles

C. right angled

D. none of these.

Answer: C

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91. In a triangle $\tan A + \tan B + \tan C = 6$ and $\tan A \tan B = 2,$ then the values of $\tan A$, $\tan B$ and $\tan C$ are

A. 1,2,3

B. $3,\ 2/3,\ 7/3$

C. $4,\ 1/2,\ 3/2$

D. none of these.

Answer: A

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92. If $\cos x + \cos y - \cos(x + y) = \frac{3}{2}$, then

A. $x + y = 0$

B. x=2y

C. x=y

D. 2x=y

Answer: C

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93. If $a \sin x + b \cos(x+\theta) + b \cos(x-\theta) = d$, then the minimum value of $|\cos\theta|$ is equal to

A. $\frac{1}{2|b|}\sqrt{d^2 - a^2}$

B. $\frac{1}{2|a|}\sqrt{d^2 - a^2}$

C. $\frac{1}{2|d|}\sqrt{d^2 - a^2}$

D. none of these.

Answer: A

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94. If $u = \sqrt{a^2 \cos^2\theta + b^2 \sin^2\theta} + \sqrt{a^2 \sin^2\theta + b^2 \cos^2\theta}$, then the difference between the maximum and minimum values of u^2 is given by :

(a) $(a-b)^2$ (b) $2\sqrt{a^2+b^2}$ (c) $(a+b)^2$ (d) $2(a^2+b^2)$

A. $2(a^2+b^2)$

B. $2\sqrt{a^2+b^2}$

C. $(a+b)^2$

D. $(a-b)^2$

Answer: D

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95. If $\tan x = n \tan y, n \in R^+$ then the maximum value of $\sec^2(x-y)$ is

A. $\dfrac{(n+1)^2}{2n}$

B. $\dfrac{(n+1)^2}{n}$

C. $\dfrac{(n+1)^2}{2}$

D. $\dfrac{(n+1)^2}{4n}$

Answer: D

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96. Consider a system of linear equation in three variables x,y,z

$a_1x + b_1y + c_1z = d_1, a_2x + b_2y + c_2z = d_2, a_3x + b_3y + c_3z = d_3$

The systems can be expressed by matrix equation

$$\begin{bmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{bmatrix}\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} d_1 \\ d_2 \\ d_3 \end{bmatrix}$$

if A is non-singular matrix then the solution of above system can be found by X $=A^{-1}B$, the solution in this case is unique.

if A is a singular matrix i.e. then the system will have

no solution (i.e. it is inconsistent) if

Where Adj A is the adjoint of the matrix A, which is obtained by taking transpose of the matrix obtained by replacing each element of matrix A with corresponding cofactors.

Now consider the following matrix.

$$A=\begin{bmatrix} a & 1 & 0 \\ 1 & b & d \\ 1 & b & c \end{bmatrix}, B=\begin{bmatrix} a & 1 & 1 \\ 0 & d & c \\ f & g & h \end{bmatrix}, U=\begin{bmatrix} f \\ g \\ h \end{bmatrix}, V=\begin{bmatrix} a^2 \\ 0 \\ 0 \end{bmatrix}, X=\begin{bmatrix} x \\ y \\ z \end{bmatrix}$$

The system AX=U has infinitely many solutions if :

A. $\left(\frac{4}{\sqrt{3}}, \infty\right)$

B. $\left[\frac{4}{\sqrt{3}}, \infty\right]$

C. $\left[0, \frac{4}{\sqrt{3}}\right]$

D. $\left(0, \frac{4}{\sqrt{3}}\right)$

Answer: B

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97. The maximum value of $\cos x \sin x+\sqrt{\sin^2 x+\sin^2\left(\frac{\pi}{6}\right)}$ is

A. $\frac{\sqrt{5}}{3}$

B. $\sqrt{\frac{3}{2}}$

C. $\sqrt{\frac{5}{2}}$

D. $\frac{\sqrt{5}}{2}$

Answer: D

View Text Solution

98. If α, β, γ are ccute angles and $\cos\theta = \sin\beta / \sin\alpha, \cos\varphi = \sin\gamma \sin\alpha and \cos(\theta - \varphi) = \sin\beta \sin\gamma$, then the value of $\tan^2\alpha - \tan^2\beta - \tan^2\gamma$ is equal to -1 (b) 0 (c) 1 (d) 2

A. -1

B. 0

C. 1

D. 2

Answer: B

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99. $\sum_{n=1}^{\infty} \frac{\tan\left(\frac{\theta}{2^n}\right)}{2^{n-1}\cos\left(\frac{\theta}{2^{n-1}}\right)}$ is

A. $\frac{2}{\sin 2\theta} - \frac{1}{\theta}$

B. $\frac{2}{\sin 2\theta} + \frac{1}{\theta}$

C. $\frac{1}{\sin 2\theta} - \frac{1}{\theta}$

D. $\frac{1}{\sin \theta} - \frac{1}{\theta}$

Answer: A

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100. If $x\sin a + y\sin 2a + z\sin 3a = \sin 4a$ $x\sin b + y\sin 2b + z\sin 3b = \sin 4b$ $x\sin c + y\sin 2c + z\sin 3c = \sin 4c$ then the roots of the equation $t^3 - \left(\frac{z}{2}\right)t^2 - \left(\frac{y+2}{4}\right)t + \left(\frac{z-x}{8}\right) = 0, a, b, c, \neq n\pi,$ are $\sin a, \sin b, \sin c$ (b) $\cos a, \cos b, \cos c$ $\sin 2a, \sin 2b, \sin 2c$ (d) $\cos 2a, \cos 2b \cos 2c$

A. $\sin a, \sin b, \sin c$

B. $\cos a, \cos b, \cos c$

C. $\sin 2a, \sin 2b, \sin 2c$

D. $\cos 2a, \cos 2b \cos 2c$

Answer: B

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Exercise (Multiple Correct Answer Type)

1. If $\cos \beta$ is the geometric mean between $\sin \alpha and \cos \alpha$, where `0

A. $-2\sin^2\left(\frac{\pi}{4}-\alpha\right)$

B. $-2\cos^2\left(\frac{\pi}{4}+\alpha\right)$

C. $2\sin^2\left(\frac{\pi}{4}+\alpha\right)$

D. $2\cos^2\left(\frac{\pi}{4}-\alpha\right)$

Answer: A::B

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2. Which of the following statements are always correct (where Q denotes the set of rationals)? $\cos 2\theta \in Qand \sin 2\theta \in Q \tan \theta \in Q$ $(\text{ if } def \in ed)$ $\tan \theta \in Q \sin 2\theta, \cos 2\theta andtan2\theta \in Q(\text{ if } def \in ed)$ $\text{if } s \int h\eta \in Qand \cos \theta \in Q \tan 3\theta \in Q(\text{ if } def \in ed)$ fi sin $\theta \in Q \cos 3\theta \in Q$

A. $\cos 2\theta \in Q$ and $\sin 2\theta \in Q \Rightarrow \tan \theta \in Q$ (if defined)

B. $\tan \theta \in Q \Rightarrow \sin 2\theta, \cos 2\theta$ and $\tan 2\theta \in Q$ (if denied)

C. if $\sin \theta \in Q$ and $\cos \theta \in Q \Rightarrow \tan 3\theta \in Q$(if denied)

D. if $\sin \theta \in Q \Rightarrow \cos 3\theta \in Q$

Answer: A::B::C

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3. Which of the following quantities are rational? (a)$\sin\left(\frac{11\pi}{12}\right)\sin\left(\frac{5\pi}{12}\right)$ (b) $\cos ec\left(\frac{9\pi}{10}\right)\sec\left(\frac{4\pi}{5}\right)$ (c)$\sin^4\left(\frac{\pi}{8}\right)+\cos^4\left(\frac{\pi}{8}\right)$ (d) $\left(1+\cos\left(\frac{2\pi}{9}\right)\right)\left(1+\cos\left(\frac{4\pi}{9}\right)\right)\left(1+\cos\left(\frac{8\pi}{9}\right)\right)$

A. $\sin\left(\frac{11\pi}{12}\right)\sin\left(\frac{5\pi}{12}\right)$

B. $co\sec\left(\frac{9\pi}{10}\right)\sec\left(\frac{4\pi}{5}\right)$

C. $\sin^4\left(\frac{\pi}{8}\right)+\cos^4\left(\frac{\pi}{8}\right)$

D. $\left(1+\cos\left(\frac{2\pi}{9}\right)\right)\left(1+\cos\left(\frac{4\pi}{9}\right)\right)\left(1+\cos\left(\frac{8\pi}{9}\right)\right)$

Answer: A::B::C::D

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4. In which of the following sets the inequality $\sin^6 x+\cos^6 x>\frac{5}{8}$ holds good? $\left(-\frac{\pi}{3},\frac{\pi}{8}\right)$ (b) $\left(\frac{3\pi}{8},\frac{5\pi}{8}\right)$ (c) $\left(\frac{\pi}{4},\frac{3\pi}{4}\right)$ (d) $\left(\frac{7\pi}{8},\frac{9\pi}{8}\right)$

A. $(-\pi/8,\pi/8)$

B. $(3\pi/8,5\pi/8)$

C. $(\pi / 4, 3\pi / 4)$

D. $(7\pi / 8, 9\pi / 8)$

Answer: A::B::D

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5. Let $f(x) = x^2 - 2\sqrt{(\sin\sqrt{3} - \sin\sqrt{2})x} - (\cos\sqrt{3} - \cos\sqrt{2})$ then $f(x) is positive \forall x \in R$ $f(x)$ assumes both positive and negative values $f(x) = 0$ has no real roots $y = f(x)$ touches the line $y = 0$

A. f(x) is positive $\forall x \in R$

B. f(x) assumes both positive and negative values

C. f(x)=0 has no real roots

D. y=f(x) touches the line y=0.

Answer: A::C

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6. For $\alpha = \frac{\pi}{7}$ which of the following hold (s) good?

A. $\tan\alpha \tan 2\alpha \tan 3\alpha = \tan 3\alpha - \tan 2\alpha - \tan\alpha$

B. $co\sec\alpha = co\sec 2\alpha + co\sec 4\alpha.$

C. $\cos\alpha - \cos 2\alpha + \cos 3\alpha = 1/2$

D. $8\cos\alpha\cos 2\alpha\cos 4\alpha = 1$

Answer: A::B::C

View Text Solution

7. Which of the following identieis, wherever defined, hold(s) good?

A. $\cot\alpha - \tan\alpha = 2\cot 2\alpha$

B. $\tan(45^\circ + \alpha) - \tan(45^\circ - \alpha) = 2co\sec 2\alpha$

C. $\tan(45^\circ + \alpha) + \tan(45^\circ - \alpha) = 2\sec 2\alpha$

D. $\tan\alpha + \cot\alpha = 2\tan 2\alpha.$

Answer: A::C

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8. The expression $\left(\tan^4 x + 2\tan^2 x + 1\right)\cos^2 x, when x = \frac{\pi}{12}$, can be equal to $4\left(2-\sqrt{3}\right)$ (b) $4\left(\sqrt{2}+1\right)$ $16\frac{\cos^2\pi}{12}$ (d) $16\frac{\sin^2\pi}{12}$

A. $4\left(2-\sqrt{3}\right)$

B. $4\left(\sqrt{2}+1\right)$

C. $16\cos^2\pi/12$

D. $16\sin^2\pi/12$

Answer: A::D

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9. Let $\alpha, \beta and \gamma$ be some angles in the first quadrant satisfying $\tan(\alpha+\beta) = \frac{15}{8} and \cos ec\gamma = \frac{17}{8}$, then which of the following hold(s) good? (a) $\alpha+\beta+\gamma=\pi$ (b) $\cot\alpha+\cot\beta+\cot\gamma=\cot\alpha\cot\beta\cot\gamma$ (c) $\tan\alpha+\tan\beta+\tan\gamma=\tan\alpha\tan\beta\tan\gamma$ (d) $\tan\alpha\tan\beta+\tan\beta\tan\gamma+\tan\gamma\tan\alpha=1$

A. $\alpha+\beta+\gamma=\pi$

B. $\cot\alpha\cot\beta\cot\gamma=\cot\alpha+\cot\beta+\cot\gamma$

C. $\tan\alpha+\tan\beta+\beta\gamma=\tan\alpha\tan\beta\tan\gamma$

D. $\tan\alpha\tan\beta+\tan\beta\tan\gamma+\tan\gamma\tan\alpha=1$

Answer: B::D

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10. Let $f_n(\theta)=\dfrac{\frac{\cos\theta}{2}+\cos 2\theta+\frac{\cos(7\theta)}{2}+\ldots+\cos(3n-2)\left(\frac{\theta}{2}\right)}{\frac{\sin\theta}{2}+\sin 2\theta+\frac{\sin(7\theta)}{2}+\ldots.+\sin(3n-2)\left(\frac{\theta}{2}\right)}$ then $f_3\left(\frac{3\pi}{16}\right)$

A. $f_3\left(\frac{3\pi}{16}\right)=\sqrt{2}-1$

B. $f_5\left(\frac{\pi}{28}\right) = \sqrt{2} + 1$

C. $f_7\left(\frac{\pi}{60}\right) = (2 + \sqrt{3})$

D. none of these.

Answer: A::B::C

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11. If $\sin\left(x + 20^0\right) = 2\sin x\cos 40^0, whrex \in \left(0, \frac{\pi}{2}\right),$ then which of the following hold(s) good? $\cos 2x = \frac{1}{2}$ (b) $\cos ec4x = 2\ \frac{\sec x}{2} = \sqrt{6} - \sqrt{2}$ (d) $\frac{\tan x}{2} = (2 - \sqrt{3})$

A. $\cos 2x = 1/2$

B. $co\sec 4x = 2$

C. $\sec\left(\frac{x}{2}\right) = \sqrt{6} - \sqrt{2}$

D. $\tan\left(\frac{x}{2}\right) = (2 - \sqrt{3})$

Answer: A::C::D

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12. The expression $\cos^2(\alpha+\beta)+\cos^2(\alpha-\beta)-\cos 2\alpha \cos 2\beta$ is

A. independent of α

B. independent of β

C. independent of α and β

D. dependent on α and β.

Answer: A::B::C

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13. If $\cot^3\alpha+\cot^2\alpha+\cot\alpha=1$ then which of the following is/are correct

A. $\cos 2\alpha.\tan\alpha=-1$

B. $\cos 2\alpha.\tan\alpha=1$

C. $\cos 2\alpha - \tan 2\alpha = 1$

D. $\cos 2\alpha - \tan 2\alpha = 1.$

Answer: A::C

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14. If

$p = \sin(A - B)\sin(C - D), q = \sin(B - C)\sin(A - D), r = \sin(C - A)$s

then $p + q - r = 0$ (b) $p + q + r = 0$ $p - q + r = 0$ (d) $p^3 + q^3 + r^3 = 3pqr$

A. $p + q - r = 0$

B. $p + q + r = 0$

C. $p - q + r = 0$

D. $p^3 + q^3 + r^3 = 3pqr$

Answer: B::D

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15. If $\cos x - \sin\alpha \cot\beta \sin x = \cos a$, then the value of $\tan\left(\frac{x}{2}\right)$ is $-\tan\left(\frac{\alpha}{2}\right)\cot\left(\frac{\beta}{2}\right)$ (b) $\tan\left(\frac{\alpha}{2}\right)\tan\left(\frac{\beta}{2}\right)$ $-\cot\left(\frac{\alpha\beta}{2}\right)\tan\left(\frac{\beta}{2}\right)$ (d) $\cot\left(\frac{\alpha}{2}\right)\cot\left(\frac{\beta}{2}\right)$

A. $-\tan(\alpha 2)\cot(\beta 2)$

B. $\tan(\alpha/2)\tan(\beta/2)$

C. $-\cot(\alpha/2)\tan(\beta/2)$

D. $\cot(\alpha/2)\cot(\beta/2)$

Answer: A::B

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16. Let $f(x) = ab\sin x + b\sqrt{1-a^2}\cos x + c$, where $|a| < 1, b > 0$ then

A. maximum value of $f(x) = -\cos^{-1} a$

B. $f(x) = c$ if $x = \cos^{-1}\alpha$

C. $f(x) = c$ if $x = -\cos^{-1}\alpha$

D. $f(x) = c$ if $x = \cos^{-1}\alpha.$

Answer: A::B::C

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17. Let $P(k) = \left(1 + \frac{\cos\pi}{4k}\right) \left(1 + \frac{\cos((2k-1)\pi)}{4k}\right) \left(1 + \frac{\cos((2k+1)\pi)}{4k}\right)\left(1 + \frac{\cos((4k-1)\pi)}{4k}\right)\dot{T}hen \quad P(3) = \frac{1}{16}$ (b) $P(4) = \frac{2-\sqrt{2}}{16}$ $P(5) = \frac{3-\sqrt{5}}{32}$ (d) $P(6)\frac{2-\sqrt{3}}{16}$

A. $P(3) = \frac{1}{16}$

B. $P(4) = \frac{2-\sqrt{2}}{16}$

C. $P(5) = \frac{3-\sqrt{5}}{32}$

D. $P(6) = \frac{2-\sqrt{3}}{16}$

Answer: A::B::C::D

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18. If $3\sin\beta = \sin(2\alpha + \beta)$ then $\tan(\alpha + \beta) - 2\tan\alpha$ is independent of α independent of β dependent of both $\alpha and \beta$ independent of both $\alpha and \beta$

A. independent of α

B. independent of β

C. dependent of both α and β.

D. independent of both α and β.

Answer: A::B::D

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19. $x = \sqrt{a^2\cos^2\alpha + b^2\sin^2\alpha} + \sqrt{a^2\sin^2\alpha + b^2\cos^2\alpha}$ then $x^2 = a^2 + b^2 + 2\sqrt{p(a^2 + b^2) - p^2}$, where p can be is equal to

A. $\alpha^2 \cos^2 \alpha + b^2 \sin^2 \alpha$

B. $\alpha^2 \sin^2 \alpha + b^2 \cos^2 \alpha$

C. $\frac{1}{2}\left[\alpha^2 + b^2 + \left(\alpha^2 - b^2\right)\cos 2\alpha\right[$

D. $\frac{1}{2}\left[a^2 + b^2 - \left(a^2 - b^2\right)\cos 2\alpha\right]$

Answer: A::B::C::D

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20. If

$(x - a)\cos\theta + y\sin\theta = (x - a)\cos\varphi + y\sin\theta = aandtan\left(\frac{\theta}{2}\right) - \tan\left(\frac{\varphi}{2}\right.$

$y^2 = 2ax - \left(1 - b^2\right)x^2 \quad \frac{\tan\theta}{2} = \frac{1}{x}(y + bx) \quad y^2 = 2bx - \left(1 - a^2\right)x^2$

$\frac{\tan\varphi}{2} = \frac{1}{x}(y - bx)$

A. $y^2 = 2ax - \left(1 - b^2\right)x^2$

B. $\tan\left(\frac{\theta}{2}\right) = \frac{1}{x}(y + bx)$

C. $y^2 = 2bx - \left(1 - a^2\right)x^2$

D. $\tan\left(\frac{\phi}{2}\right) = \frac{1}{x}(y - bx)$

Answer: A::B::D

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21. If $\cos(x-y),$, $\cos x$ and $\cos(x+y)$ are in H.P., are in H.P., then $\cos x \cdot \sec\left(\frac{y}{2}\right)$=

A. $-\sqrt{3}$

B. $-\sqrt{2}$

C. $\sqrt{2}$

D. $\sqrt{3}$

Answer: B::C

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22. Difference between maximum and minimum values of $(60\sin\alpha + p\cos\alpha)$ is 122 then p can be

A. 61

B. 11

C. -61

D. -11

Answer: B::D

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Exercise (Linked Comprehension Type)

1. If $\sin\alpha = A\sin(\alpha+\beta), A \ne 0$, then

The value of $\tan\alpha$ is

A. $\dfrac{A\sin\beta}{1-A\cos\beta}$

B. $\dfrac{A\sin\beta}{1+A\cos\beta}$

C. $\dfrac{A\cos\beta}{1-A\sin\beta}$

D. $\dfrac{A\sin\beta}{1+A\cos\beta}$

Answer: A

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2. If $\sin\alpha = A\sin(\alpha+\beta),\ A \neq 0$, then

The value of $\tan\beta$ is

A. $\dfrac{\sin\alpha(1 + A\cos\beta)}{A\cos\alpha\cos\beta}$

B. $\dfrac{\sin\alpha(1 - A\cos\beta)}{A\cos\alpha\cos\beta}$

C. $\dfrac{\cos(1 - A\sin\beta)}{A\cos\alpha\cos\beta}$

D. $\dfrac{\cos\alpha(1 + A\sin\beta)}{A\cos\alpha\cos\beta}$

Answer: B

View Text Solution

3. If $\sin\alpha = A\sin(\alpha+\beta),\ A \neq 0$, then

Which of the following is not the value of $\tan(\alpha+\beta)$?

A. $\dfrac{\sin\beta}{\cos\beta - A}$

B. $\dfrac{\sin\alpha\cos\alpha}{A\cos\beta - \sin^2\alpha}$

C. $\dfrac{\sin\alpha\cos\alpha}{A\cos\beta + \sin^2\alpha}$

D. none of these.

Answer: C

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4. If $\alpha, \beta, \gamma, \delta$ are the four solutions of the equation $\tan\left(\theta + \frac{\pi}{4}\right) = 3\tan 3\theta$. No two of which have equal tangents, then the value of $\tan\alpha + \tan\beta + \tan\gamma + \tan\delta =$

A. $1/3$

B. $8/3$

C. $-8/3$

D. 0

Answer: D

View Text Solution

5. If α, β, γ are the solutions of the equation $\tan\left(\theta + \frac{\pi}{4}\right) = 3\tan 3\theta$, no two of which have equal tangents.

The value of $\tan\alpha + \tan\beta + \tan\gamma + \tan\delta$ is

A. $-1/3$

B. -2

C. 0

D. none of these

Answer: A

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6. If $\alpha, \beta, \gamma, \delta$ are the solutions of the equation $\tan\left(\theta + \frac{\pi}{4}\right) = 3\tan 3\theta$, no two of which have equal tangents.

The value of $\frac{1}{\tan\alpha} + \frac{1}{\tan\beta} + \frac{1}{\tan\gamma} + \frac{1}{\tan\delta}$ is

A. -8

B. 8

C. $2/3$

D. $1/3$

Answer: B

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7. $\sin\alpha + \sin\beta = \frac{1}{4}$ and $\cos\alpha + \cos\beta = \frac{1}{3}$ the value of $\sin(\alpha + \beta)$

A. $\frac{24}{25}$

B. $\frac{13}{25}$

C. $\frac{12}{13}$

D. none of these.

Answer: A

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8. $\sin\alpha + \sin\beta = \frac{1}{4}$ and $\cos\alpha + \cos\beta = \frac{1}{3}$

The value of $\cos(\alpha + \beta)$ is

A. $\frac{12}{25}$

B. $\frac{7}{25}$

C. $\frac{12}{13}$

D. none of these.

Answer: B

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9. $\sin\alpha + \sin\beta = \dfrac{1}{4}$ and $\cos\alpha + \cos\beta = \dfrac{1}{3}$

The value of $\tan(\alpha + \beta)$ is

A. $\dfrac{25}{7}$

B. $\dfrac{25}{12}$

C. $\dfrac{25}{13}$

D. $\dfrac{24}{7}$

Answer: D

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10. To find the sum $\sin^2\dfrac{2\pi}{7} + \sin^2\dfrac{4\pi}{7} + \sin^2\dfrac{8\pi}{7}$, we follow the following method.

Put $7\theta = 2n\pi$, where n is any integer. Then

$$\sin 4\theta = \sin(2n\pi - 3\theta) = -\sin 3\theta$$

This means that $\sin\theta$ takes the values

$0, \ \pm\sin(2\pi/7), \ \pm\sin(2\pi/7), \ \pm\sin(4\pi/7), \ \text{and} \ \pm\sin(8\pi/7).$

From Eq. (i), we now get

$$2\sin 2\theta\cos 2\theta = 4\sin^3\theta - 3\sin\theta$$

or $4\sin\theta\cos\theta\left(1-2\sin^2\theta\right) = \sin\theta\left(4\sin^2\theta - 3\right)$

Rejecting the value $\sin\theta = 0$, we get

$$4\cos\theta\left(1-2\sin^2\theta\right) = 4\sin^2\theta - 3$$

or $16\cos^2\theta\left(1-2\sin^2\theta\right)^2 = \left(4\sin^2\theta - 3\right)^2$

or $16\left(1-\sin^2\theta\right)\left(1-4\sin^2\theta+4\sin^4\theta\right)$

$$= 16\sin^4\theta - 24\sin^2\theta + 9$$

or $$64\sin^6\theta - 112\sin^4\theta - 56\sin^2\theta - 7 = 0$$

This is cubic in $\sin^2\theta$ with the roots $\sin^2(2\pi/7), \sin^2(4\pi/7),\ \text{and}\ \sin^2(8\pi/7).$

The sum of these roots is

$$\sin^2\frac{2\pi}{7} + \sin^2\frac{4\pi}{7} + \sin^2\frac{8\pi}{7} = \frac{112}{64} = \frac{7}{4}.$$

The value of $\left(\tan^2\frac{\pi}{7} + \tan^2\frac{2\pi}{7} + \tan^2\frac{3\pi}{7}\right) \times \left(\cot^2\frac{\pi}{7} + \cot^2\frac{2\pi}{7} + \cot^2\frac{3\pi}{7}\right)$ is

A. 105

B. 35

C. 210

D. none of these.

Answer: A

View Text Solution

11. To find the sum $\sin^2\frac{2\pi}{7}+\sin^2\frac{4\pi}{7}+\sin^2\frac{8\pi}{7}$, we follow the following method.

Put $7\theta = 2n\pi$, where n is any integer. Then

$$\sin 4\theta = \sin(2n\pi - 3\theta) = -\sin 3\theta$$

This means that $\sin\theta$ takes the values $0, \pm\sin(2\pi/7), \pm\sin(2\pi/7), \pm\sin(4\pi/7),$ and $\pm\sin(8\pi/7)$.

From Eq. (i), we now get

$$2\sin 2\theta\cos 2\theta = 4\sin^3\theta - 3\sin\theta$$

or $4\sin\theta\cos\theta(1-2\sin^2\theta) = \sin\theta(4\sin^2\theta - 3)$

Rejecting the value $\sin\theta = 0$, we get

$$4\cos\theta(1-2\sin^2\theta) = 4\sin^2\theta - 3$$

or $16\cos^2\theta(1-2\sin^2\theta)^2 = (4\sin^2\theta - 3)^2$

or $16(1-\sin^2\theta)(1-4\sin^2\theta+4\sin^4\theta)$

$$= 16\sin^4\theta - 24\sin^2\theta + 9$$

or $$64\sin^6\theta - 112\sin^4\theta - 56\sin^2\theta - 7 = 0$$

This is cubic in $\sin^2\theta$ with the roots $\sin^2(2\pi/7), \sin^2(4\pi/7),$ and $\sin^2(8\pi/7)$.

The sum of these roots is

$$\sin^2\frac{2\pi}{7} + \sin^2\frac{4\pi}{7} + \sin^2\frac{8\pi}{7} = \frac{112}{64} = \frac{7}{4}.$$

The value of $\dfrac{\tan^2\frac{\pi}{7} + \tan^2\frac{2\pi}{7} + \tan^2\frac{3\pi}{7}}{\cot^2\frac{\pi}{7} + \cot^2\frac{2\pi}{7} + \cot^2\frac{3\pi}{7}}$ is

A. 7

B. $35/3$

C. $21/5$

D. none of these

Answer: C

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12. To find the sum $\sin^2\frac{2\pi}{7}+\sin^2\frac{4\pi}{7}+\sin^2\frac{8\pi}{7}$, we follow the following method.

Put $7\theta = 2n\pi$, where n is any integer. Then

$$\sin 4\theta = \sin(2n\pi - 3\theta) = -\sin 3\theta$$

This means that $\sin\theta$ takes the values $0,\ \pm\sin(2\pi/7),\ \pm\sin(2\pi/7),\ \pm\sin(4\pi/7),\ \text{and}\ \pm\sin(8\pi/7).$

From Eq. (i), we now get

$$2\sin 2\theta\cos 2\theta = 4\sin^3\theta - 3\sin\theta$$

or $4\sin\theta\cos\theta\left(1-2\sin^2\theta\right) = \sin\theta\left(4\sin^2\theta - 3\right)$

Rejecting the value $\sin\theta = 0$, we get

$$4\cos\theta\left(1-2\sin^2\theta\right) = 4\sin^2\theta - 3$$

or $16\cos^2\theta\left(1-2\sin^2\theta\right)^2 = \left(4\sin^2\theta - 3\right)^2$

or $16\left(1-\sin^2\theta\right)\left(1-4\sin^2\theta+4\sin^4\theta\right)$

$$= 16\sin^4\theta - 24\sin^2\theta + 9$$

or $$64\sin^6\theta - 112\sin^4\theta - 56\sin^2\theta - 7 = 0$$

This is cubic in $\sin^2\theta$ with the roots $\sin^2(2\pi/7), \sin^2(4\pi/7),\ \text{and}\ \sin^2(8\pi/7).$

The sum of these roots is

$$\sin^2\frac{2\pi}{7}+\sin^2\frac{4\pi}{7}+\sin^2\frac{8\pi}{7}=\frac{112}{64}=\frac{7}{4}.$$

The value of $\tan^2\frac{\pi}{7}\tan^2\frac{2\pi}{7}\tan^2\frac{3\pi}{7}$ is

A. -3

B. 7

C. -5

D. none of these

Answer: B

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13. In a ΔABC, if $\cos A\cos B\cos C=\frac{\sqrt{3}-1}{8}$ and $\sin A\sin B\sin C=\frac{3+\sqrt{3}}{8}$, then

The value of $\tan A+\tan B+\tan C$ is

A. $\frac{3+\sqrt{3}}{\sqrt{3}-1}$

B. $\frac{\sqrt{3}+4}{\sqrt{3}-1}$

C. $\dfrac{6-\sqrt{3}}{\sqrt{3}-1}$

D. $\dfrac{\sqrt{3}+\sqrt{2}}{\sqrt{3}-1}$

Answer: A

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14. In a $\Delta ABC,$ if $\cos A \cos B \cos C = \dfrac{\sqrt{3}-1}{8}$ and $\sin A \sin B \sin C = \dfrac{3+\sqrt{3}}{8},$ then The value of $\tan A \tan B \tan C$ is

A. $5-4\sqrt{3}$

B. $5+4\sqrt{3}$

C. $3+2\sqrt{3}$

D. $3-2\sqrt{3}$

Answer: C

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15. In a ΔABC, if $\cos A \cos B \cos C = \frac{\sqrt{3}-1}{8}$ and $\sin A \sin B \sin C = \frac{3+\sqrt{3}}{8}$, then the respective values of $\tan A$, $\tan B$ and $\tan C$ are

A. $1, \sqrt{3}, \sqrt{2}$

B. $1, \sqrt{3}, 2$

C. $1, 2, \sqrt{3}$

D. $1, \sqrt{3}, 2+\sqrt{3}$

Answer: D

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16. If the angles α, β, γ of a triangle satisfy the relation,

$\sin\left(\frac{\alpha-\beta}{2}\right) + \sin\left(\frac{\alpha-\gamma}{2}\right) + \sin\left(\frac{3\alpha}{2}\right) = \frac{3}{2}$, then

The measure of the smallest angle of the triangle is

A. 30°

B. 40°

C. 45°

D. 50°

Answer: B

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17. If the angles α, β, γ of a triangle satisfy the relation,

$\sin\left(\frac{\alpha-\beta}{2}\right)+\sin\left(\frac{\alpha-\gamma}{2}\right)+\sin\left(\frac{3\alpha}{2}\right)=\frac{3}{2}$, then

Triangle is

A. acute angled

B. right angled but not isosceles

C. isosceles

D. isosceles right angled

Answer: C

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18. A line OA of length r starts from its initial position OX and traces an angle AOB = α in the anitclockwise direction. It then traces back in the clockwise direction an angle BOC = 3θ (where $\alpha > 3\theta$). L is the foot of the perpendicular from C on OA. Also, $\frac{\sin^3\theta}{CL} = \frac{\cos^3\theta}{OL} = 1$

$\frac{2r\sin\alpha}{1+2r\cos\alpha}$ is equal to

A. $\tan 2\theta$

B. $\cot 2\theta$

C. $\sin 2\theta$

D. $\sin 2\theta$

Answer: A

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19. A line OA of length r starts from its initial position OX and traces an angle AOB = α in the anitclockwise direction. It then traces back in the clockwise direction an angle BOC = 3θ (where $\alpha > 3\theta$). L is the foot of the perpendicular from C on OA. Also, $\frac{\sin^3 \theta}{CL} = \frac{\cos^3 \theta}{OL} = 1$

$\frac{2r \sin \alpha}{1 + 2r \cos \alpha}$ is equal to

A. $\tan^2 \theta$

B. $\cot^2 \theta$

C. $\cot 2\theta$

D. $\tan 2\theta$

Answer: D

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20. A line OA of length r starts from its initial position OX and traces an angle AOB = α in the anitclockwise direction. It then traces back in the clockwise direction an angle BOC = 3θ (where $\alpha > 3\theta$). L is the foot of the perpendicular from C on OA. Also, $\frac{\sin^3\theta}{CL} = \frac{\cos^3\theta}{OL} = 1$

$\frac{2r^2 - 1}{r}$ is equal to

A. $\sin\alpha$

B. $\cos\alpha$

C. $\sin\theta$

D. $\cos\theta$

Answer: B

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Exercise (Matrix Match Type)

1. If $\cos\theta - \sin\theta = \frac{1}{5}$, where $0 < \theta < \frac{\pi}{4}$, then

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2. If $\cos\alpha + \cos\beta = 1/2$ and $\sin\alpha + \sin\beta = 1/3$, then

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3.

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4.

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5.

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6.

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7.

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8.

A. $\begin{array}{ccccc} & a & b & c & d \\ (1) & s & q & r & p \end{array}$

B. $\begin{array}{ccccc} & a & b & c & d \\ (2) & r & s & q & p \end{array}$

C. $\begin{array}{ccccc} & a & b & c & d \\ (3) & p & r & s & q \end{array}$

D. $\begin{array}{ccccc} & a & b & c & d \\ (4) & q & r & s & p \end{array}$

Answer: A

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9.

A. $\begin{matrix} & a & b & c & d \\ (1) & s & q & r & p \end{matrix}$

B. $\begin{matrix} & a & b & c & d \\ (2) & r & s & q & p \end{matrix}$

C. $\begin{matrix} & a & b & c & d \\ (3) & q & s & p & r \end{matrix}$

D. $\begin{matrix} & a & b & c & d \\ (4) & q & r & s & p \end{matrix}$

Answer: C

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Exercise (Numerical Value Type)

1. If $f(\theta)=\dfrac{1-\sin 2\theta+\cos 2\theta}{2\sin 2\theta}$ then value of $f(11^o).\,f(34^o)$ is

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2. If $f(x) = 2(7\cos x + 24\sin x)(7\sin x - 24\cos x)$, for even $x \in R$ then maximum value of f(x) is ________

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3. In a triangle ABC, $\angle C = \frac{\pi}{2}$. If $\tan\left(\frac{A}{2}\right) and tan\left(\frac{B}{2}\right)$ are the roots of the equation $ax^2 + bx + c = 0$, $(a \neq 0)$, then the value of $\frac{a+b}{c}$ (where a, b, c, are sides of opposite to angles A, B, C, respectively) is

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4. If $x, y \in R$ satisfies $(x+5)^2 + (y-12)^2 = (14)^2$, then the minimum value of $\sqrt{x^2 = y^2}$ is________

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5. Suppose x and y real number such that $\tan x \tan y = 42$ and $\cot x + \cot = 49$ the value of $\tan(x+y)$ is

____

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6. Let $0 \leq a, b, c, d \leq \pi,$ where $b and c$ are not complementary, such that

$2\cos a + 6\cos b + 7\cos c + 9\cos d = 0 and 2\sin a - 6\sin b + 7\sin c - 9 and$

then the value of $3\dfrac{\cos(a+d)}{\cos(b+c)}$ is____

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7. Suppose A and B are two angles such that $A, B \in (0, \pi)$ and satisfy $\sin A + \sin B = 1$ and $\cos A + \cos B = 0.$ Then the value of $12\cos 2A + 4\cos 2B$ is___

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8. $\alpha and \beta$ are the positive acute angles and satisfying equation $5\sin 2\beta = 3s \in 2\alpha and tan\beta = 3\tan\alpha$ simultaneously. Then the value of

$\tan\alpha + \tan\beta$ is ________

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9. The absolute value of the expression $\frac{\tan\pi}{16} + \frac{\tan(5\pi)}{16} + \frac{\tan(9\pi)}{16} + \frac{\tan(13\pi)}{16}$ is ______

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10. The greatest integer less than or equal to $\frac{1}{\cos 290^0} + \frac{1}{\sqrt{3}\sin 250^0}$ is _____

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11. The maximum value of $y = \frac{1}{\sin^6 x + \cos^6 x}$ is ______

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12. The maximum value of $\cos^2(45^0 + x) + (\sin x - \cos x)^2$ is ______

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13. Find the exact value of coses 10° + coses50° − cosec70°

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14. Number of triangles ABC if $\tan A = x, \tan B = x + 1, andtanC = 1 - x$ is _______

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15. If $\log_{10}\sin x + \log_{10}\cos x = -1$ and $\log_{10}(\sin x + \cos x) = \frac{(\log_{10}n)n - 1}{2}$ then the value of n is __________

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16. The value of $\frac{\sin 1^{\circ} + \sin 3^{\circ} + \sin 5^{\circ} + \sin 7^{\circ}}{\cos 1^{\circ} \cdot \cos 2^{\circ} \sin 4^{\circ}}$ is ________

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17. In a triangle ABC, if $A - B = 120^{0} and \frac{\sin A}{2} \frac{\sin B}{2} \frac{\sin C}{2} = \frac{1}{32}$, then the value of $8 \cos C$ is______

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18. If $\frac{\tan x}{2} = \frac{\tan y}{3} = \frac{\tan z}{5}, x + y + z = \pi and tan^{2} x + \tan^{2} y + \tan^{2} z = \frac{38}{K}$

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19. If $\sin^{3} x \cos 3x + \cos^{3} x \sin 3x = 3/8$, then the value of $\sin 4x$ is __________

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20. The value of $\operatorname{cosec}.\frac{\pi}{18}-4\sin\frac{7\pi}{18}$ is __________

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21. If $\tan x+\tan 2x+\tan 3x=\tan x\tan 2x\tan 3x$ then value of $|\sin 3x+\cos 3x|$ is _________

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22.

$$16\left(\cos\theta-\frac{\cos\pi}{8}\right)\left(\cos\theta-\frac{\cos(3\pi)}{8}\right)\left(\cos\theta-\frac{\cos(5\pi)}{8}\right)\left(\cos\theta-\frac{\cos(7\pi)}{8}\right.$$

then the value of λ is ____.

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23. If $\frac{\tan(In6)\tan(In2)\tan(In3)}{\tan(In6)-\tan(In2)-\tan(In3)}=k,$ then the value of k is________

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24. If $\cot(\theta-\alpha), 3\cot\theta, \cot(\theta+\alpha)$ are in A.P. and θ is not an integral multiple of $\frac{\pi}{2}$, then the value of $\frac{4\sin^2\theta}{3\sin^2\alpha}=$ ________

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25. The value of $\frac{2\sin x}{\sin 3x}+\frac{\tan x}{\tan 3x}$ ___________

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26. If $\cot^2 A\cot^2 B=3,$ then the value of $(2-\cos 2A)(2-\cos 2B)$ is ____

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27. The value of $f(x) = x^4 + 4x^3 + 2x^2 - 4x + 7,$ when $x = \frac{\cot(11\pi)}{8}$ is ________

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28. The value of $\sin^2 12^0 + \sin^2 21^0 + \sin^2 39^0 + \sin^2 48^0 - \sin^2 9^0 - \sin^2 18^0$ is ______

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29. Given that $f(n\theta) = \frac{2\sin 2\theta}{\cos 2\theta - \cos 4n\theta},$ and $f(\theta) + f(2\theta) + f(3\theta) + \quad + f(n\theta) = \frac{\sin\lambda\theta}{\sin\theta\sin\mu\theta},$ then the value of $\mu - \lambda$ is _____

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30. Suppose $\sin^3 x \sin 3x = \sum_{m=0}^{n} C_m \cos mx$ is an idedntity in x , where $C_0, \dots C_n$ are constant and $C_n \neq 0$ then the value of n is __________

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31. If $\sec\alpha$ is the average of $\sec(\alpha - 2\beta)$ and $\sec(\alpha + 2\beta)$ then the value of $(2\sin^2\beta - \sin^2\alpha)$ where $\beta \neq n\pi$ is

A. (a) 3

B. (b) 2

C. (c) 1

D. (d) 0

Answer: (c)1

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32. If A, B and C are three values lying in $[0, 2\pi]$ for which $\tan\theta = K$ then $\tan\frac{A}{3}\tan\frac{B}{3} + \tan\frac{B}{3}\tan\frac{C}{3} + \tan\frac{C}{3}\tan\frac{A}{3}$ is equal to __________.

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33. The value of $\left[\left(\sin\frac{\pi}{9}\right)\left(4 + \sec\frac{\pi}{9}\right)\right]^2$ is ______.

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34. $\left(\frac{\sin 33^\circ}{\sin 11^\circ \sin 49^\circ \sin 71^\circ}\right)^2 + \left(\frac{\cos 33^\circ}{\cos 11^\circ \cos 49^\circ \cos 71^\circ}\right)^2$ is equal to ______.

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35. If $f(\theta) = \sin^3\theta + \sin^3\left(\theta + \frac{2\pi}{3}\right) + \sin^3\left(\theta + \frac{4\pi}{3}\right)$ then the value of $f\left(\frac{\pi}{18}\right) + f\left(\frac{7\pi}{18}\right)$ is __________.

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36. The expression $\dfrac{1+\sin 22^\circ \sin 33^\circ \sin 35^\circ}{\cos^2 22^\circ + \cos^2 33^\circ + \cos^2 35^\circ}$ simplifies to

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37. If A > 0, B > 0, and A + B = $\dfrac{\pi}{3}$ then the maximum value of tan A tan B is

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38. If $\dfrac{\sin^3\theta}{\sin(2\theta+\alpha)} = \dfrac{\cos^3\theta}{\cos(2\theta+\alpha)}$ and $\tan 2\theta = \lambda \tan(3\theta+\alpha)$ then the value of λ is __________.

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Single correct Answer Type (Archives) JEE Main

1. Let A and B denote the statements

$A: \cos\alpha + \cos\beta + \cos\gamma = 0$

$B: \sin\alpha + si \in \beta + \sin\gamma = 0$

If $\cos(\beta - \gamma) + \cos(\gamma - \alpha) + \cos(\alpha - \beta) = -\frac{3}{2}$,

then

A. A is true and B is false.

B. A is false and B is true.

C. Both A and B are true.

D. Both A and B are false.

Answer: C

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2. Let $\cos(\alpha + \beta) = \frac{4}{5}$ and $\sin(\alpha - \beta) = \frac{5}{13}$ where $0 \leq \alpha, \beta \leq \frac{\pi}{4}$

then find $\tan(2\alpha)$

A. $\frac{20}{7}$

B. $\frac{25}{16}$

C. $\frac{56}{33}$

D. $\frac{19}{12}$

Answer: C

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3. If $A = \sin^2 x + \cos^4 x$, then for all real x

A. $\frac{3}{4} \leq A \leq \frac{13}{16}$

B. $\frac{3}{4} \leq A \leq 1$

C. $\frac{13}{16} \leq A \leq 1$

D. $1 \leq A \leq 2$

Answer: B

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4. In a ΔPQR. if $3 \sin P + 4 \cos Q = 6$ and $4 \sin Q + 3 \cos P = 1$, then the angle R is equal to:

A. $\frac{5\pi}{6}$

B. $\frac{\pi}{6}$

C. $\frac{\pi}{4}$

D. $\frac{3\pi}{4}$

Answer: B

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5. If $5\left(\tan^2 x - \cos^2 x\right) = 2 \cos 2x + 9$, then the value of cos4x is

A. $-\frac{7}{9}$

B. $-\frac{3}{5}$

C. $\frac{1}{3}$

D. $\frac{2}{9}$

Answer: A

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Single correct Answer Type (Archives) JEE Advanced

1. The value of $\sum_{k=1}^{13} \frac{1}{\sin\left(\frac{\pi}{4} + \frac{(k-1)\pi}{6}\right)\sin\left(\frac{\pi}{4} + \frac{k\pi}{6}\right)}$ is equal to

A. $3 - \sqrt{3}$

B. $2(3 - \sqrt{3})$

C. $2(\sqrt{3} - 1)$

D. $2(2 + \sqrt{3})$

Answer: C

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Archives (Multiple correct Answers Type) (JEE Advanced)

1. Let $f:(-1, 1) \to R$ be such that $f(\cos 4\theta) = \frac{2}{2 - \sec^2 \theta}$ for $\theta \in \left(0, \frac{\pi}{4}\right) \cup \left(\frac{\pi}{4}, \frac{\pi}{2}\right)$. Then the value(s) of $f\left(\frac{1}{3}\right)$ is/are

A. $1 - \sqrt{\frac{3}{2}}$

B. $1 + \sqrt{\frac{3}{2}}$

C. $1 - \sqrt{\frac{2}{3}}$

D. $1 + \sqrt{\frac{2}{3}}$

Answer: A::B

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2. If α and β are non-zero real number such that $2(\cos \beta - \cos \alpha) + \cos \alpha \cos \beta = 1$. Then which of the following is treu?

A. $\tan\left(\frac{\alpha}{2}\right) + \sqrt{3} \tan\left(\frac{\beta}{2}\right) = 0$

B. $\sqrt{3}\tan\left(\frac{\alpha}{2}\right)+\tan\left(\frac{\beta}{2}\right)=0$

C. $\tan\left(\frac{\alpha}{2}\right)-\sqrt{3}\tan\left(\frac{\beta}{2}\right)=0$

D. $\sqrt{3}\tan\left(\frac{\alpha}{2}\right)-\tan\left(\frac{\beta}{2}\right)=0$

Answer: A::C

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Matrix Match Type

1. Match List I with List II and select the correct answer using the codes given below the lists :

A. $\begin{array}{cccc}(P) & (Q) & (R) & (S) \\ IV & III & I & II\end{array}$

B. $\begin{array}{cccc}(P) & (Q) & (R) & (S) \\ IV & III & II & I\end{array}$

C. $\begin{array}{cccc}(P) & (Q) & (R) & (S) \\ III & IV & II & I\end{array}$

D. $\begin{array}{cccc}(P) & (Q) & (R) & (S) \\ III & IV & I & II\end{array}$

Answer: 2

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Archives (Numerical Value Type)

1. The maximum value of the expression $\frac{1}{\sin^2\theta + 3\sin\theta\cos\theta + 5\cos^2\theta}$ is.........

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2. The positive integer value of $n > 3$ satisfying the equation $\frac{1}{\sin\left(\frac{\pi}{n}\right)} = \frac{1}{\sin\left(\frac{2\pi}{n}\right)} + \frac{1}{\sin\left(\frac{3\pi}{n}\right)} is$

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