MATHS

BOOKS - ARIHANT MATHS (HINGLISH)

TRIGONOMETRIC FUNCTIONS AND IDENTITIES

Example

1. Convert $40^\circ 21'$ into radian measure.

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2. Express the following angle in degrees.

(i) $\left(\frac{5\pi}{12}\right)^c$ (ii) - $\left(\frac{7\pi}{12}\right)^c$

(iii) $\frac{1^c}{3}$ (iv) - $\frac{2\pi^c}{9}$

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3. Express the following angle in degrees, minutes and seconds form

$(321.9)^{\circ}$

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4. In ΔABC, $\angle A = \frac{2\pi^c}{3}$ and $\angle B = 45^{\circ}$. Find $\angle C$ in both the systems.

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5. The sum of two angles is $5\pi^c$ and their difference is 60°. Find the angles in degrees.

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6. One angle of a quadrilateral has measure $\frac{2\pi^c}{5}$ and the measures of other three angles are in the ratio $2:3:4$. Find their measures in radians and in degrees.

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7. Express the following angles in radians.

(i) 120° (ii) - 600°

(iii) -144°

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8. The angles of a quadrilateral are $x^{\circ}, 60^{\circ}, 60^{\circ}$ and $\frac{5\pi^{c}}{6}$, Find x.

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9. एक वृत्त, जिसका व्यास 40 सेमी है, कि एक जीवा 20 सेमी लंबाई की है तो इसके संगत छोटे चाप की लंबाई ज्ञात कीजिए |

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10. In the circle of 5cm.radius, what is the length of the are which subtends and angle of $33\,^{\circ}\,15'$ at the centre.

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11. The minute hand a watch is 35cm long. How for does its tip move in 18minutes? $\left(use\pi=\frac{22}{7}\right)$

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12. The wheel of a railway carriage is 40cm in diameter and makes 6 revolutions in a second, how fast is the train going?

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13. Assuming that a person of normal sight can red print to such distance that the letters subtend and angle of 5 at his eye, find is the height of the letters that he can read at a distance of 12 metres.

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14. Show that $2\left(\sin^6 x + \cos^6 x\right) - 3\left(\sin^4 x + \cos^4 x\right) + 1 = 0$

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15. Show that

(i) $\sin^8 A - \cos^8 A = \left(\sin^2 A - \cos^2 A\right)\left(1 - 2\sin^2 A. \cos^2 A\right)$

(ii) $\dfrac{1}{\sec A - \tan A} - \dfrac{1}{\cos A} = \dfrac{1}{\cos A} - \dfrac{1}{\sec A + \tan A}$

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16. If $\tan\theta + \sec\theta = 1.5$, find $\sin\theta, \tan\theta and \sec\theta$

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17. If $\frac{\cos^4 A}{\cos^2 B} + \frac{\sin^4 A}{\sin^2 B} = 1$ Prove that :

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18. If $\tan^2\theta = 1 - e^2$, then prove that $\sec\theta + \tan^3\theta\text{cosec}\theta = \left(2 - e^2\right)^{\frac{3}{2}}$.

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19. Show that the equation $\sec^2\theta = \frac{4xy}{(x+y)^2}$ is only possible when x=y

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20. Show that the equation $\sin\theta = x + \frac{1}{x}$ is not possible if x is real.

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21. if $\text{cosec}\theta - \sin\theta = m$ and $\sec\theta - \cos\theta = n$, eliminate$\theta$

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22. If $3\sin\theta + 4\cos\theta = 5$, then find the value of $4\sin\theta - 3\cos\theta$.

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23. If $a\sec\alpha - c\tan\alpha = d$ and $b\sec\alpha + d\tan\alpha = c$, then eliminate α from above equations.

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24. Eliminate θ from the equations $a\sec\theta + b\tan\theta + c = 0$ and $p\sec\theta + q\tan\theta + r = 0$

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25. If $x = \sec\theta - \tan\theta$ and $y = \text{cosec}\theta + \cot\theta$, then prove that $xy + 1 = y - x$.

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26. If $x = rs\int h\eta\cos\varphi, y = rs\int h\eta\sin\varphi andz = r\cos\theta, thenx^2 + y^2 + z^2$ is independent of θ, φ (b) r, θ (c) r, φ (d) r

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27. If $0 < \theta < \frac{\pi}{2}, x = \sum_{n=0}^{\infty} \cos^{2n}\theta, y = \sum_{n=0}^{\infty} \sin^{2n}\theta$ and $z = \sum_{n=0}^{\infty} \cos^{2n}\theta \cdot \sin^{2n}\theta,$ then show $xyz = xy + z.$

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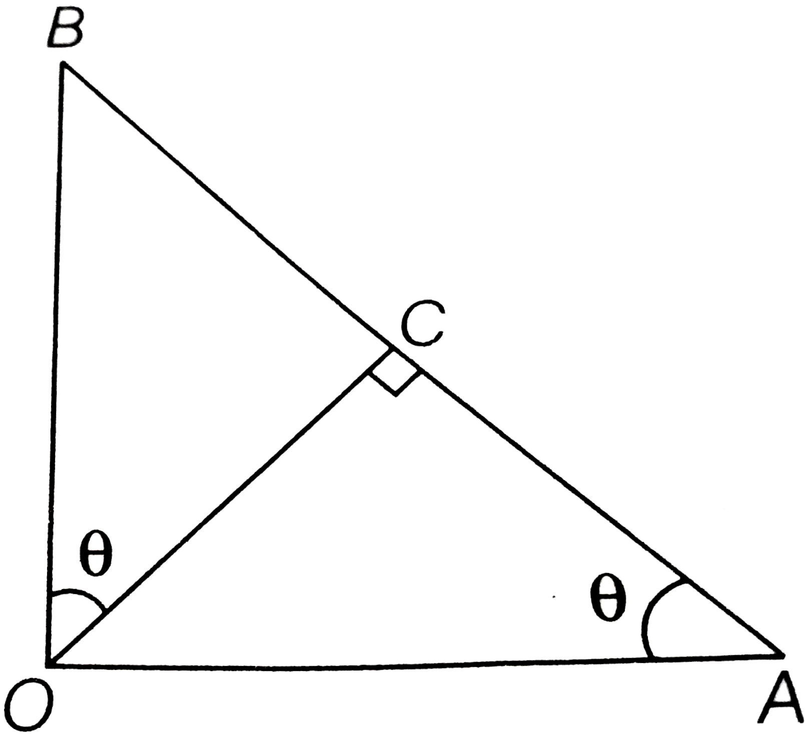
28. If in given fig, $\tan(\angle BAO) = 3$, then find the ratio $BC : CA$



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29. If angle C of triangle ABC is 90^0, then prove that $\tan A + \tan B = \frac{c^2}{ab}$

(where, $a, b, c,$ are sides opposite to angles $A, B, C,$ respectively).

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30. In triangle $ABC, BC = 8, CA = 6,$ and $AB = 10, A$ line dividing the triangle ABC into two regions of equal area is perpendicular to AB at point X. Find the value of $\frac{BX}{\sqrt{2}}$

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31. Let PQ and RS be tangents at the extremities of the diameter PR of a circle of radius r. If PS and RQ intersect at a point X on the circumference of the circle, then 2r equals

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32. Find the values of the other five trigonometric functions in each of the following questions

(i) $\tan\theta = \frac{5}{12}$, where θ is in third quadrant.

(ii) $\sin\theta = \frac{3}{5}$, where θ is in second quadrant.

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33. If $s\int h\eta = \frac{12}{13} and\ \theta$ lies in the second quadrant, find the values of $sec\theta + tan\theta^{.}$

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34. Draw the graph of $y = 3\sin 2x$

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35. Sketch the graph of $y = \cos\left(x - \frac{\pi}{4}\right)^{.}$

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36. Which of the following is the least? sin 3 (b) sin 2 (c) sin 1 (d) sin 7

A. $\sin 3$

B. $\sin 2$

C. $\sin 1$

D. $\sin 7$

Answer: a

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37. Find the value of x for which $f(x) = \sqrt{\sin x - \cos x}$ is defined, $x \in [0, 2\pi)$.

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38. Solve $\tan x > \cot x$, where $x \in [0, 2\pi]$.

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39. Prove that: $s \in^2 \frac{\pi}{6} + \frac{\cos^2 \pi}{3} - tan^2 \frac{\pi}{4} = -\frac{1}{2}$

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40. $2\sin^2\frac{\pi}{6} + \operatorname{cos}ec^2\frac{7\pi}{6}\cos^2\frac{\pi}{3} = \frac{3}{2}$

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

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42. Prove that: $2s \in^2\frac{3\pi}{4} + 2\frac{\cos^2\pi}{4} + sec^2\frac{\pi}{3} = 10$

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43. Prove that

$$\frac{\cos\left(90^\circ + \theta\right)\sec(-\theta)\tan\left(180^\circ - \theta\right)}{\sec\left(360^\circ - \theta\right)\sin\left(180^\circ + \theta\right)\cot\left(90^\circ - \theta\right)} = -1$$

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44. Fing the value of $\tan 1^{\circ} \tan 2^{\circ} \tan^{\circ} \ldots\ldots\ldots\ldots\ldots \tan 89^{\circ}$.

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45. Show that $\sin^2 5^0 + \sin^2 10^0 + \sin^2 15^0 + \; + \sin^2 90^0 = 9\frac{1}{2}\cdot$

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46. Find the value of $\frac{\cos^2 \pi}{16} + \frac{\cos^2(3\pi)}{16} + \frac{\cos^2(5\pi)}{16} + \frac{\cos^2(7\pi)}{16}\cdot$

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47. Find the values of the following: $\tan 105^0$ ii. $\frac{\tan(13\pi)}{12}$

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

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

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50. Find the value of $\dfrac{\tan 495^\circ}{\cot 855^\circ}$

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

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

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

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54. If $s \in \alpha s \in \beta - \cos\alpha\cos\beta + 1 = 0$, then prove that $1 + \cot\alpha\tan\beta = 0$

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55. 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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56. Show that $\tan 75^\circ + \cot 75^\circ = 4$.

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57. if $\tan\beta = \dfrac{n\sin\alpha\cos\beta}{1 - n\sin^2\alpha}$ then prove that $\tan(\alpha - \beta) = (1 - n)\tan\alpha$.

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58. Show that $\cos^2\theta + \cos^2\theta(\alpha + \theta) - 2\cos\alpha\cos\theta\cos(\alpha + \theta)$ is independent of $\dot{\theta}$

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59. If $3\tan\theta\tan\phi = 1$, then prove that $2\cos(\theta + \phi)^{\cdot}$

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

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61. $\frac{\cos 10^0+s\in 10^0}{\cos 10^0-s\in 10^0}$ is equal to $\tan 55^0$ b. $\cos 55^0$ c.- $\tan 35^0$ d. - $\cot 35^0$

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62. If

$\sin(A-B)=\frac{1}{\sqrt{10,}}\cos(A+B)=\frac{2}{\sqrt{29}}, f\in dthevalueof2AwhereAandBliebetween0$

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63. Prove that $\left(1+\tan 1^\circ\right)\left(1+\tan 2^\circ\right)...(1+\tan 45^o)=2^{23}$

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

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65. Find the value of $\frac{\cot 25^{\circ} + \cot 55^{\circ}}{\tan 25^{\circ} + \tan 55^{\circ}} + \frac{\cot 55^{\circ} + \cot 100^{\circ}}{\tan 55^{\circ} + \tan 100^{\circ}} + \frac{\cot 100^{\circ} + \cot 25^{\circ}}{\tan 100^{\circ} + \tan 25^{\circ}}$

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66. Prove that

$$\sum_{k=1}^{100} \sin(kx)\cos(101 - k)x = 50\sin(101x)$$

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67. If $A = \frac{\pi}{5}$, then find the value of $\sum_{r=1}^{8} \tan(rA) \cdot \tan(r + 1)A$.

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68. prove that $\sin\theta\sec 3\theta + \sin 3\theta, \sec 3^2\theta + \sin 3^2\theta\sec 3^3\theta + up \to n$ terms

$= \frac{1}{2}\left[\tan 3^n\theta - \tan\theta\right]$

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69. 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 AP.

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70. If $0 < \beta < \alpha < \pi/4$, $\cos(\alpha + \beta) = 3/5$ and $\cos(\alpha - \beta) = 4/5$, then evaluate $\sin 2\alpha$.

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71. If $\cos\alpha = \frac{1}{2}\left(x + \frac{1}{x}\right)\cos\beta = \frac{1}{2}\left(y + \frac{1}{y}\right)$ then $\cos(\alpha - \beta)$ is equal to

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72. If $2\sin\alpha\cos\beta\sin\gamma = \sin\beta\sin(\alpha + \gamma), then\tan\alpha, \tan\beta$ and γ are in

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73. Prove that $\cos 55^0 + \cos 65^0 + \cos 175^0 = 0$

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74. Prove that $\frac{\sin A + \sin 2A + \sin 4A + \sin 5A}{\cos A + \cos 2A + \cos 4A + \cos 5A} = \tan 3A.$

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

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76. If $\sin A = \sin B$ and $\cos A = \cos B$, then prove that $\sin.\frac{A - B}{2} = 0.$

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77. Prove that: $\sin 20^0 \sin 40^0 \sin 80^0 = \frac{\sqrt{3}}{8}$

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78. Prove that: $s\ i\ n\ A\ s\ i\ n(60 - A)\sin(60 + A) = \frac{1}{4}\sin 3A^{\cdot}$

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

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80. 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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81. 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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82. Prove that: $\frac{\sec 8\theta - 1}{\sec 4\theta - 1} = \frac{\tan 8\theta}{\tan 2\theta}$

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83. Show that $\sqrt{2+\sqrt{2+\sqrt{2+2\cos 8\theta}}} = 2\cos\theta$

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84. Show that $\sqrt{3}\,\mathrm{cos}ec\ 20^0$ - $\sec 20^0 = 4.$

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85. $\left(1+\cos.\ \frac{\pi}{8}\right)\left(1+\cos.\ \frac{3\pi}{8}\right)\left(1+\cos.\ \frac{5\pi}{8}\right)\left(1+\cos.\ \frac{7\pi}{8}\right)$ is equal to

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

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87. prove that : $\tan(\alpha) + 2\tan(2\alpha) + 4(\tan 4\alpha) + 8\cot(8\alpha) = \cot(\alpha)$

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88. The smallest positive value of x (in degrees) for which $\tan\left(x + 100^\circ\right) = \tan\left(x + 50^\circ\right).\tan x.\tan\left(x - 50^\circ\right)$ is

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

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90. Show that $\dfrac{1 + \tan.\frac{\theta}{2}}{1 - \tan.\frac{\theta}{2}} = \dfrac{1 + \sin\theta}{\cos\theta} = \tan\left(\dfrac{\pi}{4} + \dfrac{\theta}{2}\right)$

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91. Prove that, $(\cos A + \cos B)^2 + (\sin A + \sin B)^2 = 4\cos^2\left(\frac{A - B}{2}\right)$

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92. Prove that: $\frac{\cos^4\pi}{8} + \frac{\cos^4(3\pi)}{8} + \frac{\cos^4(5\pi)}{8} + \frac{\cos^4(7\pi)}{8} = \frac{3}{2}$

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93. find the value of $\tan\left(\frac{\pi}{8}\right)$

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94. If $\tan x = -\frac{4}{3}, \frac{\pi}{2} < x < \pi$, then find the value of $\sin\left(\frac{x}{2}\right), \cos\left(\frac{x}{2}\right)$ and $\tan\left(\frac{x}{2}\right)$.

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95. Find the value of $\sin.\ \frac{23\pi}{24}$.

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96. If $\alpha = 112^\circ 30'$, find the value of $\sin\alpha$ and $\cos\alpha$

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97. 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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98. If $\cos\theta = \frac{\cos\alpha - \cos\beta}{1 - \cos\alpha\cos\beta}$, prove that $\frac{\tan\theta}{2} = \pm\frac{\tan\alpha}{2}\frac{\cot\beta}{2}$.

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99. Prove that $\cos 6^\circ \cos 42^\circ \cos 66^\circ \cos 78^\circ = \frac{1}{16}$

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100. Prove that: $s \in \frac{\pi}{5} s \in \frac{2\pi}{5} s \in \frac{3\pi}{5} s \in \frac{4\pi}{5} = \frac{5}{16}$

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101. Find the value of

$(i)\sin 22^\circ 30'$ (ii) $\cos 22^\circ 30'$ (iii) $\tan 22^\circ 30'$

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102. If $0 < x < \pi$ and $\cos x + \sin x = \frac{1}{2}$, then tan x is

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103. If $\tan\theta_1, \tan\theta_2, \tan\theta_3, \tan\theta_4$ are the roots of the equation $x^4 - x^3\sin 2\beta + x^2\cos 2\beta - x\cos\beta - \sin\beta = 0$ then prove that $\tan\left(\theta_1 + \theta_2 + \theta_3 + \theta_4\right) = \cot\beta$

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104. Express $\sin^5\theta$ in term of $\sin(n\theta), n \in N$.

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105. Let n be an odd integer. In $\sin n\theta = \sum_{r=0}^{n} b_r \sin^r\theta,$ for all real θ. Then, find b_0 and b_1.

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106. If $\cos 5\theta - a\cos^5\theta + b\cos^3\theta + c\cos\theta$ then c is equal to-

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107. If $\sin^3 x \sin 3x = \sum_{m=0}^{n} c_m . \cos mx$ is an identity in x, where c_m 's are constants, then find the value of n.

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108. Evaluate $\sum_{r=1}^{n-1} \cos^2\left(\frac{r\pi}{n}\right)$.

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109. The value of $\frac{\sin\pi}{n} + \frac{\sin(3\pi)}{n} + \frac{\sin(5\pi)}{n} + \ldots$ to n terms is equal to

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

$\sin 2A + \sin 2B + \sin 2C = 4\sin A \sin B \sin C.$

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111. If $A + B + C = \pi$, then, find $\tan A + \tan B + \tan C$

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112. Find the maximum and minimum value of $3\sin 2x + 4\cos 2x + 3$.

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113. Find the maximum and minimum value of $6\sin x\cos + 4\cos 2x$.

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114. Prove that: $-4 \leq 5\cos\theta + 3\cos\left(\theta + \frac{\pi}{3}\right) + 3 \leq 10$, for all values of θ,

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115. 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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116. Find the maximum and minimum value of $\cos^2\theta - 6\sin\theta\cos\theta + 3\sin^2\theta + 2$.

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117. Minimum value of $\cos 2\theta + \cos\theta$ for all real value of θ is

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118. If $f(x) = \frac{\sin(3x)}{\sin x}, x \neq n\pi$, then the range of values of f(x) for real values of x is

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119. If $\tan\left(\frac{\alpha}{2}\right)$ and $\frac{\tan\beta}{2}$ are the roots of the equation $8x^2 - 26x + 15 = 0$ then the $\cos(\alpha + \beta)$ is equal to

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120. If the solutions for θ from the equation $\sin^2\theta - 2\sin\theta + \lambda = 0$ lie in $\cup_{n \in z}\left(2n\pi - \frac{\pi}{6}, (2n+1)\pi + \frac{\pi}{6}\right)$. Then, find the possible set values of λ .

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121. If ABCD is a convex quadrilateral such that $4\sec A + 5 = 0$ then the quadratic equation whose roots are tan A and cosec A is

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122. If sec $\alpha and \alpha$ are the roots of $x^2 - px + q + 0,$ then $p^2 = q(q - 2)$ (b) $p^2 = q(q + 2)$ $p^2q^2 = 2q$ (d) none of these

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123. Find the number of values of x in the internal $[0, 5\pi]$ satisfying the equation

$3\sin^2x - 7\sin x + 2 = 0$

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124. $0 \leq a \leq 3, 0 \leq b \leq 3$ and the equation, $x^2 + 4 + 3\cos(ax + b) = 2x$ has atleast one solution, then find the value of (a+b) .

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125. Find the values of p if it satisfy, $\cos\theta = x + \frac{p}{x}, x \in R$ for all real values of θ.

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126. The set of values of $\lambda \in R$ such that $\tan^2\theta + \sec\theta = \lambda$ holds for some θ is

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127. If $A, B, C, \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$. Then prove that $\cos A + \cos B + \cos C \leq \frac{3}{2}$.

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128. In the inequality below, the value of the angle is expressed in radian measure. Which one of the inequalities below is true?

A. $\sin 1 < \sin 2 < \sin 3$

B. $\sin 3 < \sin 2 < \sin 1$

C. $\sin 2 < \sin 1 < \sin 3$

D. $\sin 3 < \sin 1 < \sin 2$

Answer: D

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129. In a triangle ABC, angle A is greater than angle B. If the measures of angles A and B satisfy the equation $2\tan x - k\left(1 + \tan^2 x\right) = 0$, where k E (0, 1), then the measure of the angle Cis

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

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

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

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

Answer: C

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130. If M and m are maximum and minimum value of the function $f(x) = \dfrac{\tan^2 x + 4\tan x + 9}{1 + \tan^2 x}$, then (M + m) equals

A. 20

B. 14

C. 10

D. 8

Answer: C

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131. The value of $4\cos\left(\frac{\pi}{10}\right) - 3\sec\left(\frac{\pi}{10}\right) - 2\tan\left(\frac{\pi}{10}\right)$ is equal to

A. 1

B. $\sqrt{5}$ - 1

C. $\sqrt{5} + 1$

D. zero

Answer: D

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132. For $0 < A < \frac{\pi}{2}$, the value of

$\log_{\frac{1}{2}}\left(\frac{1}{1 + 2\cos^2 A} + \frac{2}{\sec^2 A + 2}\right)$ is equal to

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133. The sum

$$\frac{1}{\sin 45^\circ \sin 46^\circ} + \frac{1}{\sin 47^\circ \sin 48^\circ} + \frac{1}{\sin 49^\circ \sin 50^\circ} + \ldots + \frac{1}{\sin 133^\circ \sin 134^\circ}$$

is equal to

A. $\sec(1^\circ)$

B. $\operatorname{cos}ec(1^\circ)$

C. $\cot(1^\circ)$

D. None of these

Answer: B

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134. Th range of k for which the inequaliity $k\cos^2 x - k\cos x + 1 \geq 0 \forall x \in (-\infty, \infty) is$

A. $k < \frac{-1}{2}$

B. $k < 4$

C. $\frac{-1}{2} \leq k \leq 4$

D. $\frac{1}{2} \leq k \leq 5$

Answer: C

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

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

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

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

D. 1

Answer: A

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136. The variable x satisfying the equation $|\sin x \cos x| + \sqrt{2 + \tan^2 + \cot^2 x} = \sqrt{3}$ belongs to the interval $\left[0, \dfrac{\pi}{3}\right]$ (b) $\left(\dfrac{\pi}{3}, \dfrac{\pi}{3}\right)$ (c) $\left[\dfrac{3\pi}{4}, \pi\right]$ (d) none-existent

A. $\left[0, \frac{\pi}{3}\right]$

B. $\left[\frac{\pi}{3}, \frac{\pi}{2}\right]$

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

D. Non-existent

Answer: D

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137. Let α be a real number such that $0 \leq \alpha \leq \pi$. If $f(x) = \cos x + \cos(x + \alpha) + \cos(x + 2\alpha)$ takes some constant number c for any $x \in R$, then the value of $[c + \alpha]$ is equal to (Note : [y] denotes greatest integer less than or equal to y.)

A. 0

B. 1

C. -1

D. 2

Answer: D

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138. In a ΔABC, if $4\cos A\cos B + \sin 2A + \sin 2B + \sin 2C = 4$, then ΔABC is

A. right angle but not issosceles

B. isosceles but not right angled

C. right angle isosceles

D. obtuse angled

Answer: C

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139. For $\theta_1, \theta_2, ..., \theta_n \in \left(0, \frac{\pi}{2}\right)$, if In $\left(\sec\theta_1 - \tan\theta_1\right) + \text{In}\left(\sec\theta_2 - \tan\theta_2\right) + ... + \text{In}\left(\sec\theta_n - \tan\theta_n\right) + \ln\pi = 0$, then the value of $\cos\left(\left(\sec\theta_1 + \tan\theta_1\right)\left(\sec\theta_2 + \tan\theta_2\right)....\left(\sec\theta_n + \tan\theta_n\right)\right)$ is equal to

A. $\cos\left(\frac{1}{\pi}\right)$

B. -1

C. 1

D. 0

Answer: B

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140. If A, B, C are interior angles of ΔABC such that $(\cos A + \cos B + \cos C)^2 + (\sin A + \sin B + \sin C)^2 = 9$, then number of possible triangles is

A. 0

B. 1

C. 3

D. infinite

Answer: D

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141. If $\operatorname{cosec}.\frac{\pi}{32}+\operatorname{cosec}.\frac{\pi}{16}+\operatorname{cosec}.\frac{\pi}{8}+\operatorname{cosec}.\frac{\pi}{4}+\operatorname{cosec}.\frac{\pi}{2}=\cot.\frac{\pi}{k}$, then the value of k is

A. 64

B. 96

C. 48

D. 32

Answer: A

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142. Let $S = \sum_{r=1}^{5} \cos(2r - 1)\frac{\pi}{11}$ and $P = \Pi_{r=1}^{4} \cos\left(2^r . \frac{\pi}{15}\right)$, then

A. $\log_S P = -4$

B. $P = 3S$

C. $\operatorname{cosec} S > \operatorname{cosec} P$

D. $\tan^{-1} P < \tan^{-1} S$

Answer: D

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143. Set of values of x lying in $[0, 2\pi]$ satisfying the inequality $|\sin x| > 2\sin^2 x$ contains

A. $\left(0, \frac{\pi}{6}\right) \cup \left(\pi, \frac{7\pi}{6}\right)$

B. $\left(0, \frac{7\pi}{6}\right)$

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

D. None of these

Answer: A

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144. The number of ordered pairs (x, y) , when $x, y \in [0, 10]$ satisfying $\left(\sqrt{\sin^2 x - \sin x + \frac{1}{2}}\right) \cdot 2^{\sec^2 y} \leq 1$ is

A. 0

B. 16

C. infinite

D. 12

Answer: B

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145. The least values of $cosec^2x + 25\sec^2x$ is

A. 0

B. 26

C. 28

D. 36

Answer: D

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146. 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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147. Let α and β be any two positve values of x for which $2\cos x, |\cos x|$ and $1 - 3\cos^2 x$ are in GP. The minium value of $|\alpha + \beta|$ is

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

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

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

D. None of these

Answer: D

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148. Let n be an odd integer. If $\sin n\theta = \sum_{r=0}^{n} b_r \sin^r\theta$ for all real θ, then

A. $b_0 = 1, b_1 = 3$

B. $b_0 = 0, b_1 = n$

C. $b_0 = -1, b_1 = n$

D. $b_0 = 0, b_1 = n^2 - 3n - 3$

Answer: B

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

A. $\{b - c, b + c\}$

B. $\{b + c, b - c\}$

C. $\{c - b, b + c\}$

D. None of these

Answer: C

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150. $\dfrac{\sin^3\theta - \cos^3\theta}{\sin\theta - \cos\theta} - \dfrac{\cos\theta}{\sqrt{1 + \cot^2\theta}} - 2\tan\theta\cot\theta = -1$ if

A. $\theta \in \left(0, \dfrac{\pi}{2}\right) - \left\{\dfrac{\pi}{4}\right\}$

B. $\theta \in \left(\dfrac{\pi}{2}, \pi\right) - \left\{\dfrac{3\pi}{4}\right\}$

C. $\theta \in \left(\pi, \dfrac{3\pi}{2}\right) - \left\{\dfrac{5\pi}{4}\right\}$

D. $\theta \in (0, \pi) - \left\{\dfrac{\pi}{4}, \dfrac{\pi}{2}\right\}$

Answer: D

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151. If $\cos x + \sin x = a\left(-\frac{\pi}{2} < x < -\frac{\pi}{4}\right)$, then $\cos 2x$ is equal to

A. a^2

B. $a\sqrt{(2 - a)}$

C. $a\sqrt{(2 + a)}$

D. $a\sqrt{\left(2 - a^2\right)}$

Answer: D

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152. If $S = \frac{\cos^2\pi}{2} + \frac{\cos^2(2\pi)}{n} + ... + \frac{\cos^2((n - 1)\pi)}{n}$, then S equals

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

B. $\frac{1}{2(n - 1)}$

C. $\frac{1}{2(n - 2)}$

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

Answer: C

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153. If $\cos 5\theta = a\cos\theta + b\cos^3\theta + c\cos^5\theta + d$, then

A. $a = 20$

B. $b = -30$

C. $a + b + c = 2$

D. $a + b + c + d = 1$

Answer: D

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154. If $A and B$ are acute positive angles satisfying the equations $3\sin^2 A + 2\sin^2 B = 1 and 3\sin 2A - 2\sin 2B = 0, then A + 2B$ is equal to π (b) $\frac{\pi}{2}$ (c) $\frac{\pi}{4}$ (d) $\frac{\pi}{6}$

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

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

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

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

Answer: B

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155. If $A = \begin{bmatrix} \cos^2\alpha & \cos\alpha\sin\alpha \\ \cos\alpha\sin\alpha & \sin^2\alpha \end{bmatrix}$ and $B = \begin{bmatrix} \cos^2\beta s & \cos\beta\sin\beta \\ \cos\beta\sin\beta & \sin^2\beta \end{bmatrix}$ are two matrices such that the product AB is null matrix, then $\alpha - \beta$ is

A. $\alpha = \beta$

B. $\cos(\alpha - \beta) = 0$

C. $\sin(\alpha - \beta) = 0$

D. None of these

Answer: B

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156. If $k_1 = \tan 27\theta - \tan\theta$ and $k_2 = \frac{\sin\theta}{\cos 3\theta} + \frac{\sin 3\theta}{\cos 9\theta} + \frac{\sin 9\theta}{\cos 27\theta}$ then,

A. $k_1 = k_2$

B. $k_1 = 2k_2$

C. $k_1 + k_2 = 2$

D. $k_2 = 2k_1$

Answer: B

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157. If $a^2 - 2a\cos x + 1 = 674$ and $\tan\left(\frac{x}{2}\right) = 7$ then the integral value of a is

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158. The maximum value of $(\cos\alpha_1)(\cos\alpha_2)...(\cos\alpha_n)$, under the restrications $0 \le \alpha_1, \alpha_2..., \alpha_n \le \frac{\pi}{2}$, and $(\cot\alpha_1)(\cot\alpha_2)...(\cot\alpha_n) = 1 is$

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

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

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

D. 1

Answer: A

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159. $\frac{\sin^3 x}{1 + \cos x} + \frac{\cos^3 x}{1 - \sin x} =$

A. $\sqrt{2}\cos\left[\frac{\pi}{4} - x\right]$

B. $\sqrt{2}\cos\left[\frac{\pi}{4} + x\right]$

C. $\sqrt{2}\sin\left[\frac{\pi}{4} - x\right]$

D. None of these

Answer: A

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160. Let $0 \le \theta \le \frac{\pi}{2}$ and $x = X\cos\theta + Y\sin\theta, y = X\sin\theta - Y\cos\theta$ such that $x^2 + 2xy + y^2 = aX^2 + bY^2$, where a and b are constant, then

A. $a = -1, b = -3$

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

C. $a = 2, b = 0$

D. $\theta = \frac{\pi}{3}$

Answer: C

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161. If $0 < x < \frac{\pi}{2}$ and $\sin^n x + \cos^n x \geq 1$, then

A. $n \in [2, \infty)$

B. $n \in (- \infty, 2]$

C. $n \in [- 1, 1]$

D. None of these

Answer: B

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162. If $a = \sin, \frac{\pi}{18} \frac{\sin(5\pi)}{18} si, \frac{7\pi}{18}$, and x is the solution of the equation $y = 2[x] + 2$ and $y = 3[x - 2], where[x]$ denotes the interal part of x then a=

(A) [x] (B) $\frac{1}{x}$ (C) 2[x] (D) $[x]^2$

A. $[x]$

B. $\frac{1}{[x]}$

C. $2[x]$

D. $[x]^2$

Answer: B

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163. If the mapping $f(x) = ax + b, a < 0$ and maps [-1, 1] onto [0, 2] , then for all values of $\theta, A = \cos^2\theta + \sin^4\theta$ is such that

A. $f\left(\frac{1}{4}\right) \le A \le f(0)$

B. $f(0) \le A \le f(-2)$

C. $f\left(\frac{1}{3}\right) \le A \le f(0)$

D. $f(-1) < A \le f(-2)$

Answer: A

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164. $\cos.\frac{2\pi}{7}+\cos.\frac{4\pi}{7}+\cos.\frac{6\pi}{7}$

A. 1

B. -1

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

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

Answer: D

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165. The number of integral values of k for which the equation $7\cos x+5\sin x=2k+1$ has a solution is (1) 4 (2) 8 (3) 10 (4) 12

A. 4

B. 8

C. 10

D. 12

Answer: B

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166. If $y = \frac{\sin^4 x - \cos^4 x + \sin^2 x\cos^2 x}{\sin^4 x + \cos^4 x + \sin^2 x\cos^2 x}, x \in \left(0, \frac{\pi}{2}\right)$, then

A. $-\frac{3}{2} \leq y \leq \frac{1}{2}$

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

C. $-\frac{5}{3} \leq y \leq 1$

D. None of these

Answer: D

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167. The distance between the two parallel lines is 1 unit. A point A is chosen to lie between the lines at a distance 'd' from one of them Triangle ABC is equilateral with B on one line and C on the other parallel line. The length of the side of the equilateral triangle is

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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168. If $a\sin x + b\cos(x + \theta) + b\cos(x - \theta) = d$, then the minimum value of $|\cos\theta|$ is equal to $\frac{1}{2|b|}\sqrt{d^2 - a^2}$ (b) $\frac{1}{2|a|}\sqrt{d^2 - a^2}$ $\frac{1}{2|d|}\sqrt{d^2 - a^2}$ (d) none of these

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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169. The set of values of $\lambda \in R$ such that $\tan^2\theta + \sec\theta = \lambda$ holds for some θ is

A. $(-\infty, 1]$

B. $(-\infty, -1]$

C. ϕ

D. $[1, \infty)$

Answer: D

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170. let $0 < \phi < \frac{\pi}{2}, x = \sum_{n=0}^{\infty} \cos^{2n}\phi, y = \sum_{n=0}^{\infty} \sin^{2n}\phi$ and $z = \sum_{n=0}^{\infty} \cos^{2n}\phi \sin^{2n}\phi$

A. $xyz = xz + y$

B. $xyz = xy + y$

C. $xyz = x + y + z$

D. $xyz = yz + x$

Answer: C

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171. If

$\frac{x}{a}\cos\alpha + \frac{y}{b}\sin\alpha = 1, \frac{x}{a}\cos\beta + \frac{y}{b}\sin\beta = 1$ and $\frac{\cos\alpha\cos\beta}{a^2} + \frac{\sin\alpha\sin\beta}{b^2} = 0,$ then

A. $\tan\alpha\tan\beta = \frac{b^2(x^2 + a^2)}{a^2(y^2 + b^2)}$

B. $x^2 + y^2 = a^2 + b^2$

C. $\tan\alpha\tan\beta = \frac{a^2}{b^2}$

D. None of these

Answer: B

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172. 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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173. 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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174. If $x_1 and x_2$ are two distinct roots of the equation $a\cos x + b\sin x = c$, then tan $\frac{x_{1+x^2}}{2}$ is equal to $\frac{a}{b}$ (b) $\frac{b}{a}$ (c) $\frac{c}{a}$ (d) $\frac{a}{c}$

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

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

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

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

Answer: B

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175. The minimum value of the function $f(x) = \frac{\sin x}{\sqrt{1 - \cos^2 x}} + \frac{\cos x}{\sqrt{1 - \sin^2 x}} + \frac{\tan x}{\sqrt{\sec^2 x - 1}} + \frac{\cot x}{\sqrt{cosec^2 x - 1}}$ whenever it is defined is

A. 4

B. -2

C. 0

D. 2

Answer: B

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176. If $0 < \alpha < \frac{\pi}{6}$, then the value of $(\alpha \operatorname{cosec} \alpha)$ is

A. less than $\frac{\pi}{6}$

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

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

D. greater than $\frac{\pi}{3}$

Answer: C

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177. In which of the following intervals the inequality, $\sin x < \cos x < \tan x < \cot x$ can hold good ?

A. $\left(\frac{7\pi}{4}, 2\pi\right)$

B. $\left(\frac{3\pi}{4}, \pi\right)$

C. $\left(\frac{5\pi}{4}, \frac{3\pi}{2}\right)$

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

Answer: D

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178. If $0 < x < \pi$ and $\cos x + \sin x = \frac{1}{2}$ then $\tan x =$

A. $\frac{4 - \sqrt{7}}{3}$

B. $\frac{4 + \sqrt{7}}{3}$

C. $\frac{-\left(4 + \sqrt{7}\right)}{3}$

D. $\frac{-4 + \sqrt{7}}{3}$

Answer: C::D

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179. The value of the expression $\tan.\frac{\pi}{7} + 2\tan.\frac{2\pi}{7} + 4\tan.\frac{4\pi}{7} + 8\cot.\frac{8\pi}{7}$ is equal to

A. $\operatorname{cos}ec.\frac{2\pi}{7} + \cot.\frac{2\pi}{7}$

B. $\tan.\frac{\pi}{14} - \cot.\frac{\pi}{14}$

C. $\dfrac{\sin.\frac{2\pi}{7}}{1 - \cos.\frac{2\pi}{7}}$

D. $\dfrac{1 + \cos.\frac{\pi}{7} + \cos.\frac{2\pi}{7}}{\sin.\frac{\pi}{7} + \sin.\frac{2\pi}{7}}$

Answer: A::C::D

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180. Two parallel chords are drawn on the same side of the centre of a circle of radius R. It is found that they subtend and angle of θ and 2θ at the centre of the circle. The perpendicular distance between the chords is

A. $2R\sin.\frac{3\theta}{2}\sin.\frac{\theta}{2}$

B. $\left(1-\cos.\frac{\theta}{2}\right)\left(1+2\cos.\frac{\theta}{2}\right)R$

C. $\left(1+\cos.\frac{\theta}{2}\right)\left(1-2\cos.\frac{\theta}{2}\right)R$

D. $2R\sin.\frac{3\theta}{4}\sin.\frac{\theta}{4}$

Answer: D

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181. If $2x$ and $2y$ are complementary angles and $\tan(x+2y)=2$, then which of the following is (are) correct ?

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

B. $\tan(x-y)=\frac{1}{7}$

C. $\cot x+\cot y=5$

D. $\tan x\tan y=6$

Answer: B::C

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182. If $2\cos\theta + 2\sqrt{2} = 3\sec\theta$ where $\theta \in (0, 2\pi)$ then which of the following can be correct ?

A. $\cos\theta = \frac{1}{\sqrt{2}}$

B. $\tan\theta = 1$

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

D. $\cot\theta = -1$

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

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183. The value of x in $\left(0, \frac{\pi}{2}\right)$ satisfying the equation, $\frac{\sqrt{3}-1}{\sin x} + \frac{\sqrt{3}+1}{\cos x} = 4\sqrt{2}$ is -

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

B. $\frac{5\pi}{12}$

C. $\frac{7\pi}{24}$

D. $\frac{11\pi}{36}$

Answer: A::D

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

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

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

Answer: A::B::C

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185. In ΔABC, $\tan B + \tan C = 5$ and $\tan A \tan C = 3$, then

A. ΔABC is an acute angled triangle

B. ΔABC is an obtuse angled triangle

C. sum of all possible values of $\tan A$ is 10

D. sum of all possible values of tan A is 9

Answer: A::C

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186. $(m + 2)\sin\theta + (2m - 1)\cos\theta = 2m + 1$ then $\tan\theta$ is

A. $\tan\theta = \frac{3}{4}$

B. $\tan\theta = \frac{4}{3}$

C. $\tan\theta = \frac{2m}{\left(m^2 - 1\right)}$

D. $\tan\theta = \frac{2m}{\left(m^2 + 1\right)}$

Answer: B::C

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187. If $x\cos\alpha + y\sin\alpha = x\cos\beta + y\sin\beta = 2a$ then $\cos\alpha\cos\beta =$

A. $\cos\alpha + \cos\beta = \frac{4ax}{x^2 + y^2}$

B. $\cos\alpha\cos\beta = \frac{4a^2 - y^2}{x^2 + y^2}$

C. $\sin\alpha + \sin\beta = \frac{4ay}{x^2 + y^2}$

D. $\sin\alpha\sin\beta = \frac{4a^2 - x^2}{x^2 + y^2}$

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

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188. Let $y = \sin^2 x + \cos^4 x$. Then, for all real x

(a) the maximum value of y is 2

(b) the minimum value of y is $\frac{3}{4}$

A. the maximum value of y is 2

B. the minimum value of y is $\frac{3}{4}$

C. $y \leq 1$

D. $y \geq \frac{1}{4}$

Answer: B::C

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189. If in $\Delta ABC, \tan A + \tan B + \tan C = 6$ and $\tan A \tan B = 2$, then $\sin^2 A : \sin^2 B : \sin^2 C$ is

A. $8:9:5$

B. $8:5:9$

C. $5:9:5$

D. $5:8:5$

Answer: B::C

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190. If $\sin(x - y) - \cos(x + y) = \frac{1}{2}$ then the values of $x \& y$ lying between 0 and π are given by

A. $x = 45^\circ, y = 15^\circ$

B. $x = 45^\circ, y = 135^\circ$

C. $x = 165^\circ, y = 15^\circ$

D. $x = 165^\circ, y = 135^\circ$

Answer: A::D

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191. If $\sin\alpha + \sin\beta = l$, $\cos\alpha\cos\beta = m$ and $\tan\left(\frac{\alpha}{2}\right)\tan\left(\frac{\beta}{2}\right) = n(\neq 1)$, then

A. $\cos(\alpha - \beta) = \frac{l^2 + m^2 - 2}{2}$

B. $\cos(\alpha + \beta) = \frac{m^2 - l^2}{m^2 + l^2}$

C. $\frac{1 + n}{1 - n} = \frac{l^2 + m^2}{2n}$

D. $\alpha + \beta = \frac{\pi}{2}$ if $l = m$

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

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

A. maximum value of $f(x)$ if b is $c = 0$

B. difference of maximum and minimum values of $f(x)$ is $2b$

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

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

Answer: A::B::C

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193. If $\tan\theta = \dfrac{x\sin\phi}{1 - x\cos\phi}$ and $\tan\phi = \dfrac{y\sin\theta}{1 - y\cos\theta}$, then $\dfrac{x}{y} =$ (A) $\dfrac{\sin\phi}{\sin\theta}$ (B) $\dfrac{\sin\theta}{\sin\phi}$ (C) $\dfrac{\sin\phi}{1 - \cos\theta}$ (D) $\dfrac{\sin\theta}{1 - \cos\phi}$

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

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

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

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

Answer: A::B

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

A. $\Sigma\cos\alpha = 0$

B. $\Sigma\sin\alpha = 0$

C. $\Sigma\cos\alpha\sin\alpha = 0$

D. $\Sigma(\cos\alpha + \sin\alpha) = 0$

Answer: A::B::D

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195. Statement I $\tan 5\theta - \tan 3\theta - \tan 2\theta = \tan 5\theta \tan 3\theta \tan 2\theta$.

Statement II $x = y + z \Rightarrow \tan x - \tan y - \tan z = \tan x \tan y \tan z$

A. Statement 1 is correct, Statement 2 is correct and Statement 2 is the correct explanation for Statement 1

B. Statement 1 is correct, Statement 2 is correct and Statement 2 is not the correct explanation for Statement 1

C. Statement 1 is correct, Statement 2 is not correct

D. Statement 1 is not correct, Statement 2 is correct

Answer: A

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196. Statement I The maximum value of $\sin\theta + \cos\theta$ is 2.

Statement II The maximum value of $\sin\theta$ is 1 and that of $\cos\theta$ is also 1.

A. A

B. B

C. C

D. D

Answer: D

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197. Statement I If $a, b, c, \in R$ and not all equal, then $\sec\theta = \dfrac{(bc + ca + ab)}{\left(a^2 + b^2 + c^2\right)}$,

Statement II $\sec\theta \leq -1$ and $\sec\theta \geq 1$

A. A

B. B

C. C

D. D

Answer: D

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198. Statement I $\Pi_{r=1}^{n}\left(1 + \sec 2^r\theta\right) = \tan 2^n\theta \cot\theta$

Statement II $\Pi_{r=1}^{n}\cos\left(2^{r-1}\theta\right) = \dfrac{\sin\left(2^n\theta\right)}{2^n\sin\theta}$

A. A

B. B

C. C

D. D

Answer: A

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199. Statement-1: $\cos 36^\circ > \tan 36^\circ$

Statement-2: $\cos 36^\circ > \sin 36^\circ$

A. A

B. B

C. C

D. D

Answer: B

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200. statement-I- $\cos^3\alpha + \cos^3\left(\alpha + 2\frac{\pi}{3}\right) + \cos^3\left(\alpha + 4\frac{\pi}{3}\right) = 3\cos\alpha\cos\left(\alpha + 2\frac{\pi}{3}\right)\cos\left(\alpha + 4\frac{\pi}{3}\right) Because$ Statement-II -

if $a + b + c = 0 \Leftrightarrow a^3 + b^3 + c^3 = 3abc$

A. A

B. B

C. C

D. D

Answer: A

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201. STATEMENT-1: $\sin 2 > \sin 3$ STATEMENT-2: If $x, y \in \left(\frac{\pi}{2}, \pi\right), x < y,$ then $\sin x > \sin y$

A.

B.

C.

D.

Answer: A

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202. Let $\alpha, \beta, \gamma > 0$ and $\alpha + \beta + \gamma = \frac{\pi}{2}$. Statement-1: $\left|\tan\alpha\tan\beta - \frac{a!}{6}\right| + \left|\tan\beta\tan\gamma - \frac{b!}{2}\right| + \left|\tan\gamma\tan\alpha - \frac{c!}{3}\right| \leq 0$, where $n \neq 1.2.........n$, then $\tan\alpha\tan\beta, \tan\beta\tan\gamma, \tan\gamma\tan\alpha = 1$

A.

B.

C.

D.

Answer: A::C::D

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203. Statement I The triangle so obtained is an equilateral triangle.

Statement II If roots of the equations be $\tan A, \tan B$ and $\tan C$ then $\tan A + \tan B + \tan C = 3\sqrt{3}$

A.

B.

C.

D.

Answer: B

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204. Let us define the function $f(x) = x^2 + x + 1$

Statement I The equation $\sin x = f(x)$ has no solution.

Statement II The curve $y = \sin x$ and $y = f(x)$ do not intersect each other when graph is oberved.

A.

B.

C.

D.

Answer: A

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205. Consider, $f(x) = (x + 2a)(x + a - 4)(a \in R)$,

$g(x) = k\left(x^2 + x\right) + 3k + x(k \in R)$ and

$h(x) = (1 - \sin\theta)x^2 + 2(1 - \sin\theta)x - 3\sin\theta$

$\left(\theta \in R - (4n + 1)\frac{\pi}{2}, n \in I\right)$

If $f(x) < 0$ for $-1 \leq x \leq 1$, then 'a' satisfies

A. $\frac{1}{2} < a < 3$

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

C. $-3 < a < -\frac{1}{2}$

D. $-3 < a < \frac{1}{2}$

Answer: A

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206. Consider, $f(x) = (x + 2a)(x + a - 4)(a \in R)$,

$g(x) = k\left(x^2 + x\right) + 3k + x(k \in R)$ and

$h(x) = (1 - \sin\theta)x^2 + 2(1 - \sin\theta)x - 3\sin\theta$

$\left(\theta \in R - (4n + 1)\frac{\pi}{2}, n \in I\right)$

If $g(x) > -3$ for all real x, then the values of k are given by

A. $-1 < k < \frac{1}{11}$

B. $-1 < k < 0$

C. $0 < k < \frac{1}{22}$

D. $k < \frac{1}{11}$

Answer: D

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207. Consider, $f(x) = (x + 2a)(x + a - 4)(a \in R)$,

$g(x) = k\left(x^2 + x\right) + 3k + x(k \in R)$ and

$h(x) = (1 - \sin\theta)x^2 + 2(1 - \sin\theta)x - 3\sin\theta$

$\left(\theta \in R - (4n + 1)\frac{\pi}{2}, n \in I\right)$

If the quadratic equation $h(x) = 0$ has both roots complex, then θ belongs to

A. $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$

B. $\left(0, \frac{3\pi}{2}\right)$

C. $\left(\frac{\pi}{6}, \frac{7\pi}{6}\right)$

D. $\left(\frac{7\pi}{6}, \frac{11\pi}{6}\right)$

Answer: D

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208. Let $f(\theta) = \sin\theta - \cos^2\theta - 1$, where $\theta \in R$ and $m \leq f(\theta) \leq M$.

Let N denotes the number of solution of the equation $f(\theta) = 0$ in $[0, 4\pi]$

then the value of $\log_{\sqrt{m^2}}(N) + \log_{\sqrt{m^2}}\left(\frac{1}{N+1}\right)$ is equal to

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

B. 1

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

D. -1

Answer: C

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209. Let $f(\theta) = \sin\theta - \cos^2\theta - 1$, where $\theta \in R$ and $m \leq f(\theta) \leq M$.

The value of $(4m + 13)$ is equal to

A. 0

B. 4

C. 5

D. 6

Answer: B

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210. Let $f(\theta) = \sin\theta - \cos^2\theta - 1$, where $\theta \in R$ and $m \leq f(\theta) \leq M$.

Find all values satisfying the equation

$\sqrt{\frac{1}{|m|} + \sqrt{\frac{1}{|m|} + \sqrt{\frac{1}{|m|} + \ldots\ldots\ldots\ldots\infty}}}$, is

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

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

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

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

Answer: D

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211. The method of eliminating $'\theta'$ from two given equations involving trigonometrical functions of $'\theta'$. By using given equations involving $'\theta'$ and trigonometrical identities, we shall obtain an equation not involving $'\theta'$.

On the basis of above information answer the following questions.

If $x\sin^3\theta + y\cos^3\theta = \sin\theta\cos\theta$ and $x\sin\theta$ - $y\cos\theta = 0$then (x, y) lie one

A. a circle

B. a parabola

C. an ellipse

D. a hyperbola

Answer: A

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212. The method of eliminating $'\theta'$ from two given equations involving trigonometrical functions of $'\theta'$. By using given equations involving $'\theta'$ and trigonometrical identities, we shall obtain an equation not involving $'\theta'$.

On the basis of above information answer the following questions.

If $\frac{x}{a\cos\theta} = \frac{y}{b\sin\theta}$ ...(i)

and $\frac{ax}{\cos\theta} - \frac{by}{\sin\theta} = a^2 - b^2$, then (x, y) lie on

A. a circle

B. a parabola

C. an ellipse

D. a hyperbola

Answer: C

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213. The method of eliminating $'\theta'$ from two given equations involving trigonometrical functions of $'\theta'$. By using given equations involving $'\theta'$ and trigonometrical identities, we shall obtain an equation not involving $'\theta'$.

On the basis of above information answer the following questions.

If $\tan\theta + \sin\theta = m$ and $\tan\theta - \sin\theta = n$, then $\left(m^2 - n^2\right)^2$ is

A. $4\sqrt{mn}$

B. 4mn

C. $16\sqrt{mn}$

D. $16mn$

Answer: D

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214. The method of eliminating $'\theta'$ from two given equations involving trigonometrical functions of $'\theta'$. By using given equations involving $'\theta'$ and trigonometrical identities, we shall obtain an equation not involving $'\theta'$.

On the basis of above information answer the following questions.

If $\sin\theta + \cos\theta = a$ and $\sin^3\theta + \cos^2\theta = b$, then we get $\lambda a^3 + \mu b + va = 0$ when λ, μ, v are independent of θ, then the value of $\lambda^3 + \mu^3 + v^3$ is

A. -6

B. -18

C. -36

D. -98

Answer: B

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215. The method of eliminating $'\theta'$ from two given equations involving trigonometrical functions of $'\theta'$. By using given equations involving $'\theta'$ and trigonometrical identities, we shall obtain an equation not involving $'\theta'$.

On the basis of above information answer the following questions.

After eliminating $'\theta'$ from equations $\frac{x\cos\theta}{a} + \frac{y\sin\theta}{b} = 1$ and $x\sin\theta - y\cos\theta = \sqrt{\left(a^2\sin^2\theta + b^2\cos^2\theta\right)}$, we get

A. $x^2 + y^2 = a^2 + b^2$

B. $\frac{x^2}{a^2}\frac{y^2}{b^2} = 1$

C. $\frac{x^2}{a(a+b)} + \frac{y^2}{b(a+b)} = 1$

D. $x^2 + y^2 = (a+b)^2$

Answer: C

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216. Match the statement of Column I with values of Column II.

	Column-I		Column-II
(A)	The number of real roots of the equation $\cos^7 x + \sin^4 x = 1$ in $(-\pi, \pi)$ is	(p)	1
(B)	The value of $\sqrt{3}$ cosec $20° - \sec 20°$ is	(q)	4
(C)	$4 \cos 36° - 4 \cos 72° + 4 \sin 18° \cos 36°$ equals	(r)	3
(D)	The number of values of x where $x \in [-2\pi, 2\pi]$, which satisfy $\text{cosec } x = 1 + \cot x$	(s)	2

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217. Match the statement of Column I with values of Column II.

	Column-I		Column-II
(A)	The tangents of two acute angles are 3 and 2. The sine of twice their difference is	(p)	1
(B)	If $n = \frac{\pi}{4\alpha}$, then $\tan \alpha \tan 2\alpha \tan 3\alpha \ldots \tan(2n-1)\alpha$ is equal to	(q)	0
(C)	If $x = y \cos \frac{2\pi}{3} = z \cos \frac{4\pi}{3}$, then $xy + yz + zx =$	(r)	$\frac{1}{2}$
(D)	The ratio of the greatest value of $2 - \cos x + \sin^2 x$ to its least value is	(s)	$\frac{7}{25}$
		(t)	$\frac{13}{4}$

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218. $\tan 46^\circ \tan 14^\circ - \tan 74^\circ \tan 14^\circ + \tan 74^\circ \tan 46^\circ$ is equal to

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219. Maximum value of the expression

$\log_3\left(9 - 2\cos^2\theta - 4\sec^2\theta\right)$ is equal to

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220. Let $x \in \left(0, \frac{\pi}{2}\right)$ and $\log_{24\sin x}(24\cos x) = \frac{3}{2}$, then find the value of $\operatorname{cosec}^2 x$.

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221. If $x, y \in R$ and satisfy the equation $xy\left(x^2 - y^2\right) = x^2 + y^2$ where $x \neq 0$ then the minimum possible value of $x^2 + y^2$ is

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222. Using the identity $\sin^4 x = \frac{3}{8} - \frac{1}{2}\cos 2x + \frac{1}{8}\cos 4x$ or otherwise, if the value of $\sin^4\left(\frac{\pi}{7}\right) + \sin^4\left(\frac{3\pi}{7}\right) + \sin^4\left(\frac{5\pi}{7}\right) = \frac{a}{b}$, where a and b are coprime, find the value of $(a - b)$.

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

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224. The value of the expression $\frac{\sin 40^\circ}{\sin 80^\circ} + \frac{\sin 80^\circ}{\sin 20^\circ} - \frac{\sin 20^\circ}{\sin 40^\circ}$ is

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225. If $\cot(\theta - \alpha), 3\cot\theta, \cot(\theta + \alpha)$ are in AP (where, $\theta \neq \frac{n\pi}{2}, \alpha \neq k\pi, n, k \in I$), then $\frac{2\sin^2\theta}{\sin^2\alpha}$ is equal to

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226. If $4\sin^2 x + \cos ec^2 x, a, \sin^2 y + 4\cos ec^2 y$ are in AP, then minimum value of (2a) is

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227. If $\sin\alpha, \sin\beta, \sin\gamma$ are in AP and $\cos\alpha, \cos\beta, \cos\gamma$ are in GP, then the value of

$\frac{\cos^2\alpha + \cos^2\gamma + 4\cos\alpha\cos\gamma - 2\sin\alpha\sin\gamma - 2}{1 - 2\sin^2\beta}$, where $\beta \neq \frac{\pi}{4}$, is equal to

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228. Let $\prod_{r=1}^{51}\tan\left(\frac{\pi}{3}\left(1+\frac{3^r}{3^{50}-1}\right)\right)=\prod_{r=1}^{51}\cot\left(\frac{\pi}{3}\left(1+\frac{3^r}{3^{50}-1}\right)\right]\right)$ On solving equation we get, $1-3\tan^2\left(1+\frac{3^r}{3^{50}-1}\right)=\frac{a}{bk-1},(a,b\in I)$ then value of $(a-b)$ is equal

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229. If $\sec A\tan B+\tan A\sec B91$, then the value of $(\sec A\sec B+\tan A\tan B)^2$ is equal to....

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230. If $(25)^2+a^2+50a\cos\theta$

$=(31)^2+b^2+62b\cos\theta=1$ and $775+ab+(31a+25b)\cos\theta=0$, then the value of $\cos ec^2\theta$ is

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231. If $\sin x_1 + \sin x_2 + \sin x_3 + \ldots + \sin x_{2008} = 2008$ then find the value of $\sin^{2008} x_1 + \sin^{2008} x_2 + \sin^{2008} x_3 + \ldots + \sin^{2008} x_{2008}$.

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232. If $4\sin 27^\circ = \sqrt{\alpha} - \sqrt{\beta}$, then the value of $(\alpha + \beta - \alpha\beta + 2)^4$ must be

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233. If $0 < A < \pi/2$ and sinA + cosA + tan A + cotA + secA + cosec A=7 and sinA and cosA are roots of equation $4x^2 - 3x + a = 0$. Then value of 25a is:

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234. 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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235. If $\frac{1}{\cos 290^\circ} + \frac{1}{\sqrt{3}\sin 250^\circ} = \lambda$, then the value of $9\lambda^4 + 81\lambda^2 + 97$ must be

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236. If $(\log)_{10}\sin x + (\log)_{10}\cos x = -1 and (\log)_{10}(\sin x + \cos x) = \frac{\left((\log)_{10}n\right) - 1}{2}$, then the value of $'n/3'$ is______

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237. If $498[16\cos x + 12\sin x] = 2k + 60$, then the maximum value of k is

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238. If $a\tan\alpha + \sqrt{a^2 - 1}\tan\beta + \sqrt{a^2 + 1}\tan\gamma = 2a$ where a is a constant and α, β and γ are variable angles. Then the least value of $\tan^2\alpha + \tan^2\beta + \tan^2\gamma$ is equal to

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

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240. Prove that $\tan.\frac{3\pi}{11} + 4\sin.\frac{2\pi}{11} = \sqrt{11}.$

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241. For all θ in $[0, \pi/2]$, show that $\cos(\sin\theta) > \sin(\cos\theta)$.

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242. The inequality $2^{\sin\theta} + 2^{\cos\theta} \geq 2^{1 - \frac{1}{\sqrt{2}}}$,holds for all real values of θ

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243. If $a\sin^2\theta + b\cos^2\theta = m$, $b\sin^2\phi + a\cos^2\phi = n$, $a\tan\theta = b\tan\phi$, then which of the following is true?

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244. Let $\cos A + \cos B + \cos C = \frac{3}{2}$ in a triangle then the type of the triangle is

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245. If $\frac{\tan 3A}{\tan A} = k$, show that $\frac{\sin 3A}{\sin A} = \frac{2k}{k - 1}$ and hence or otherwise prove that either $k > 3$ or $k < \frac{1}{3}$.

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

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

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248. (i) If $\tan A - \tan B = x$ and $\cot B - \cot A = y$. Prove that $\cot(A - B) = \frac{1}{x} + \frac{1}{y}$.

(ii) If $2\cos A = x + \frac{1}{x}$, $2\cos B = y + \frac{1}{y}$, then show that $2\cos(A - B) = \frac{x}{y} + \frac{y}{x}$.

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249. 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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250. Find all possible real values of x and y satisfying.

$\sin^2 x + 4\sin^2 y - \sin x - 2\sin y - 2\sin x\sin y + 1 = 0, \ \forall x, y \in [0, \pi/2]$

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251. Find the roots of the following cubic equations

$2x^3 - 3x^2\cos(A - B) - 2x\cos^2(A + B) + \sin 2A$

$\sin 2B\cos(A - B) = 0$.

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252. If $m^2 + m'^2 + 2mm'\cos\theta = 1$ and $n^2 + n'^2 + 2nn'\cos\theta = 1$, $(mn + m'n' + (mn' + m'n)\cos\theta = 0$ prove that $m^2 + n^2 = cosec^2\theta$

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253. If $\frac{s \in^4\theta}{a} + \frac{\cos^4\theta}{b} = \frac{1}{a + b}$, prove that $\frac{s \in^8\theta}{a^3} + \frac{\cos^4\theta}{b^3} = \frac{1}{(a + b)^3}$ $\frac{s \in^{4n}\theta}{a^{2n-1}} + \frac{\cos^{4n}\theta}{b^{2n-1}} = \frac{1}{(a + b)^{2n-1}}, n \in N$

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254. if $a_{r+1} = \sqrt{\frac{1}{2}\left(1 + a_r\right)}$,prove that $\cos\left(\frac{\sqrt{1 - a_0^2}}{a_1 \cdot a_2 \cdot a_3 .... . \infty}\right) = a_0$

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255. Find sum of $\sin 2\alpha + \sin 3\alpha + \ldots\ldots + \sin n\alpha$ where $(n+2)\alpha = 2\pi$

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256. 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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257. If $A+B+C=\pi$, prove that $\cot A + \cot B + \cot C - \operatorname{cosec} A \operatorname{cosec} B \operatorname{cosec} C = \cot A \cot B \cot C$

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258. Consider a triangle ABC such that $\cot A + \cot B + \cot C = \cot\theta$. Now answer the following :

Q. $\sin(A - \theta)\sin(B - \theta)\sin(C - \theta) =$:

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259. If A,B,C and D are angles of quadrilateral and $\frac{\sin(A)}{2}\frac{\sin(B)}{2}\frac{\sin(C)}{2}\frac{\sin(D)}{2} = \frac{1}{4}$, prove that A=B=C=D=$\pi/2$

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260. If α, β are two different values of θ which satisfy is bc $\cos\theta\cos\phi + ac\sin\theta\sin\phi = ab$, then prove that $\left(b^2 + c^2 - a^2\right)\cos\alpha\cos\beta + ac\sin\alpha\sin\beta = a^2 + b^2 - c^2$.

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261. Find all number of pairs x,y that satisfy the equation $\tan^4)x + \tan^4 y + 2\cos^2 x \cdot \cot^2 y = 3 + \sin^2(x + y)$.

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262. Prove that $\tan.\frac{3\pi}{11} + 4\sin.\frac{2\pi}{11} = \sqrt{11}.$

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263. The value of $\sin\frac{2\pi}{7} + \sin\frac{4\pi}{7} + \sin\frac{8\pi}{7}$, is

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264. In a ΔABC, $\tan A + \tan B + \tan C = k$, then find the interval in which k should lie so that

(A) there exists exactly one isosceles triangle ABC

(B) there exists exactly two isosceles triangle ABC

(C) can there exist three non-similar isosceles triangles for any real value of k.

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Exercise For Session 1

1. The difference between two acute angles of a right angle triangle $\frac{3\pi}{10}$ rad. Find the angles in degree.

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2. Find the length of an arc of circle of radius 6cm subtending an angle of 15° at the centre.

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3. A horse is tied to a post by a rope. If the horse moves along a circular path always keeping the rope tight, and describes 88 metres when it traces 72° at the centre, find the length of the rope.

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4. Find the angle between the minute hand and hour hand of a clock, when the time is 7:30 pm.

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5. if OP makes 4 revolutions in one second, the angular velocity in radians per second is?

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6. A railway train is travelling on a circular curve of 1500 metres radius at the rate of 66km/hr. Through what angle has it turned in 10 seconds?

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7. If the angular diameter of the moon be 30, how far from the eye a coin of diameter $2.2cm$ be kept to hide the moon?

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8. The wheel of a railway carriage is 40 cm in diameter and makes 7 revolutions in a second, find the speed of train.

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9. Assuming that a person of normal sight can red print to such distance that the letters subtend and angle of 5 at his eye, find is the height of the letters that he can read at a distance of 12 metres.

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10. For each natural number k, let C_k denotes the circle radius k centimeters in the counter-clockwise direction.After completing its motion on C_k, the particle moves to C_{k+1} in the radial direction. The motion of the particle continues in this manner. The particle starts at (1,0).If the particle crosses the the positive direction of the x-axis for first time on the circle C_n,then n equal to

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Exercise For Session 2

1. Prove that

$(\sin\theta - \text{cosec}\theta)(\cos\theta - \sec\theta) = \dfrac{1}{\tan\theta + \cot\theta}$.

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2. If $\cos^2\alpha - \sin^2\alpha = \tan^2\alpha$, then show that $\tan^2\alpha = \cos^2\beta - \sin^2\beta$.

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3. If $\sin^6\theta + \cos^6\theta - 1 = \lambda\sin^2\theta\cos^2\theta$, find the value of λ.

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4. If $a\cos\theta - b\sin\theta = c$, then find the value of $a\sin\theta + b\cos\theta$.

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5. $3(\sin x - \cos x)^4 + 6(\sin x + \cos x)^2 + 4\left(\sin^6 x + \cos^6 x\right) =$

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6. If $\sin\theta + \mathrm{cosec}\theta = 2$, then find the value of $\sin^{20}\theta + \mathrm{cosec}^{20}\theta$.

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7. Let $f_k(x) = \frac{1}{k}\left(\sin^k x + \cos^k x\right)$ where $x \in \mathbb{R}$ and $k \geq 1$. Then $f_4(x) - f_6(x)$ equals

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8. If $\frac{\sin^4 x}{2} + \frac{\cos^4 x}{3} = \frac{1}{5} then \ \tan^2 x = \frac{2}{3}$ (b) $\frac{\sin^8 x}{8} + \frac{\cos^8 x}{27} = \frac{1}{125} \ \tan^2 x = \frac{1}{3}$ (d) $\frac{\sin^8 x}{8} + \frac{\cos^8 x}{27} = \frac{2}{125}$

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9. If $\cot\theta + \tan\theta = x$ and $\sec\theta - \cos\theta = y$ then (i) $\sin\theta\cos\theta = -x$ (ii) $\sin\theta\tan\theta = -y$ (iii) $\left(x^2 y\right)^{\frac{2}{3}} - \left(xy^2\right)^{\frac{2}{3}} = 1$ (iv) $\left(x^2 y\right)^{\frac{1}{3}} + \left(xy^2\right)^{\frac{1}{3}} = 1$

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10. If $\sin A + \sin^2 A + \sin^3 A = 1$, then find the value of $\cos^6 A - 4\cos^4 A + 8\cos^2 A$.

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Exercise For Session 3

1. If $\sec\theta + \tan\theta = k$ find the value of $\cos\theta$

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2. If $x\sin^3\theta + y\cos^3\theta = \sin\theta\cos\theta$ and $x\sin\theta = y\cos\theta$ Find the value of $x^2 + y^2$

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3. If sin A + cos A = m and $\sin^3 A + \cos^3 A = n$, then (1) $m^3 - 3m + n = 0$ (2) $n^3 - 3n + 2m = 0$ (3) $m^3 - 3m + 2n = 0$ (4) $m3 + 3m + 2n = 0$

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4. If $\sin^2\theta = \dfrac{x^2 + y^2 + 1}{2x}$. Find the value of x and y.

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5. If $\sin\theta - \sqrt{6}\cos\theta = \sqrt{7}\cos\theta$. Prove that $\cos\theta + \sqrt{6}\sin\theta - \sqrt{7}\sin\theta = 0$.

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6. If $\sin x + \sin y + \sin z = 3$. Find the value of $\cos x + \cos y + \cos z$.

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7. $\frac{x}{a}\cos\theta + \frac{y}{b}\sin\theta = 1, \frac{x}{a}\sin\theta - \frac{y}{b}\cos\theta = 1$ then $\frac{x^2}{a^2} + \frac{y^2}{b^2} =$

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8. If $a\sin^2 x + b\cos^2 x = c, b\sin^2 y + a\cos^2 y = d$ and $a\tan x = b\tan y$ then $\frac{a^2}{b^2} = \ldots\ldots.\left(0 < x, y < \frac{\pi}{2}\right)$

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9. If $a + b\tan\theta = \sec\theta$ and $b - a\tan\theta = 3\sec\theta$ then find the value of $a^2 + b^2$

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10. Two circles of radii 4cm and 1cm touch each other externally and θ is the angle contained by their direct common tangents. Find $\frac{\sin\theta}{2} + \frac{\cos\theta}{2}\cdot$

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Exercise For Session 4

1. If $\tan x = -\frac{4}{3}, \frac{3\pi}{2} < x < 2\pi$, find the value of $9\sec^2 x - 4\cot x$.

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2. Show that $\sin^2 x = p + \frac{1}{p}$ is impossible if x is real.

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3. If $\cos x = \frac{3}{5}$ and x lies in the fourth quadrant find the values of $\operatorname{cosec} x + \cot x$.

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4. Draw the graph of $y = \sin x$ and $y = \sin. \frac{x}{2}$.

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5. Draw the graph of $y = \sec^2 x - \tan^2 x$. Is $f(x)$ periodic? If yes, what is its fundamental period?

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6. Prove that $\sin\theta < \theta < \tan\theta$ for $\theta \in \left(0, \frac{\pi}{2}\right)$.

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7. Find the value of x for which $f(x) = \sqrt{\sin x - \cos x}$ is defined, $x \in [0, 2\pi)$

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8. Draw the graph of $y = \sin x$ and $y = \cos x$, $0 \leq x \leq 2\pi$

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9. Draw the graph of $y = \tan(3x)$.

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10. if $\cos x = \frac{-\sqrt{15}}{4}$ and $\frac{\pi}{2} < x < \pi$ find the value of sin x .

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Exercise For Session 5

1. $\tan\frac{19\pi}{3}$

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2. FInd the sign of $\sec 2000^\circ$

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3. $\cos 1^\circ + \cos 2^\circ + \cos 3^\circ + \dots + \cos 180^\circ$ is equal to

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4. The value of $\cos\left(270^\circ + \theta\right)\cos\left(90^\circ - \theta\right) - \sin\left(270^\circ - \theta\right)\cos\theta$ is

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5. If $S_n = \cos^n\theta + \sin^n tehta$ then find teh value of $3S_4 - 2S_6$

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6. $\sin^2\theta = \dfrac{x^2 + y^2 + 1}{2x}$, then x must be.

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7. If $\sin\theta + \operatorname{cosec}\theta = 2$, then the volume of $\sin^{10}\theta + \operatorname{cosec}^{10}\theta$, *is*

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8. Show that the equation $e^{\sin x} - e^{-\sin x} - 4 = 0$ has no real solution.

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9. If $\pi < \alpha < \frac{3\pi}{2}$ then find the value of expression $\sqrt{4\sin^4\alpha + \sin^2 2\alpha} + 4\cos^2\left(\frac{\pi}{4} - \frac{\alpha}{2}\right)$

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10. If $\sum_{i=1}^{1} \cos\theta_1 = n$, then the value of $\sum_{i=1}^{n} \sin\theta_1$.

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Exercise For Session 6

1. If α lies in II quadrant, β lies in III quadrant and $\tan(\alpha + \beta) > 0$, then $(\alpha + \beta)$ lies in... quadrants.

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2. If $3tanAtanB = 1$, prove that $2\cos(A + B) = \cos(A - B)$

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3. If $\tan\alpha = \frac{m}{m+1} and tan\beta = \frac{1}{2m+1}$. Find the possible values of $(\alpha + \beta)$

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4. If $\cos(\alpha + \beta) = \frac{4}{5}; \sin(\alpha - \beta) = \frac{5}{13}$ and α, β lie between $0 \& \frac{\pi}{4}$ then find the value of $\tan 2\alpha$

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5. If $\alpha + \beta = \frac{\pi}{2}$ and $\beta + \gamma = \alpha$, then find the value of $\tan\alpha$.

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6. If $\cos(\theta - \alpha) = a$ and $\cos(\theta - \beta) = b$ then the value of $\sin^2(\alpha - \beta) + 2ab\cos(\alpha - \beta)$

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7. If $2\cos A = x + \frac{1}{x}, 2\cos B = y + \frac{1}{y}$ then show that $2\cos(A - B) = \frac{x}{y} + \frac{y}{x}$.

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8. If $y = (1 + tanA)(1 - tanB)$, where $A - B = \frac{\pi}{4}$, then $(y + 1)^{y-1}$ is equal to 9 (b) 4 (c) 27 (d) 81

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Exercise For Session 7

1. show that $\sin x + \sin 3x + \sin 5x + \sin 7x = 4\sin 4x\cos 2x\cos x$.

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2. Show that $\sin A \cdot \sin(B - C) + \sin B \cdot \sin(C - A) + \sin C \cdot \sin(A - B) = 0.$

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3. For all value of α, β, γ prove that ,

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

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4. if x and y are acute angles such that $\cos x + \cos y = \frac{3}{2}$ and $\sin x + \sin y = \frac{3}{4}$

then $\sin(x + y) =$

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

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6. Find the value of $\left(\frac{\cos A + \cos B}{\sin A - \sin B}\right)^n + \left(\frac{\sin A + \sin B}{\cos A - \cos B}\right)^n$ (where, n is an even)

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7. $\left(1 + \cos . \frac{\pi}{8}\right)\left(1 + \cos . \frac{3\pi}{8}\right)\left(1 + \cos . \frac{5\pi}{8}\right)\left(1 + \cos . \frac{7\pi}{8}\right)$ is equal to

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8. In a triangle ABC, $\cos 3A + \cos 3B + \cos 3C = 1$, then find any one angle.

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Exercise For Session 8

1. This question has statement which is true or false.5, If $\frac{\pi}{9} < \theta < \frac{\pi}{2}$, then the value of $\sqrt{1 - \sin 2\theta} = \cos\theta - \sin\theta$.

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2. If $\pi < \theta < \frac{3\pi}{2}$, then find the value of $\sqrt{\frac{1 - \cos 2\theta}{1 + \cos 2\theta}}$.

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3. if $\tan x = -\frac{4}{3}$, x lies in II quadrant, then find the value of $\frac{\sin x}{2}$

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4. Prove that: $s \in^4 \frac{\pi}{8} + s \in^4 \frac{3\pi}{8} + s \in^4 \frac{5\pi}{8} + s \in^4 \frac{7\pi}{8} = \frac{3}{2}$

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5. If $A = 2\sin^2\theta - \cos2\theta$ and $A \in [\alpha, \beta]$, then find the values of α and β.

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6. If $\sin x + \cos x = \frac{1}{5}$, then find the value of $\tan 2x$.

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7. If $\tan 3A = \frac{3\tan A + k\tan^3 A}{1 - 3\tan^2 A}$, then k is equal to

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8. If $\tan A + 2\tan 2A + 4\tan 4A + 8\cot 8A = k\cot A$, then find the value of k.

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9. If $m^2\cos.\frac{2\pi}{15}\cos.\frac{4\pi}{15}\cos.\frac{8\pi}{15}\cos.\frac{14\pi}{15} = n^2$, then find the value of $\frac{m^2 - n^2}{n^2}$.

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10. If $\left(2^n+1\right)\theta=\pi$ then $2^n\cos\theta\cos2\theta\cos2^2\theta\ldots\ldots\cos2^{n-1}\theta=$

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Exercise For Session 9

1. If $\tan\left(\frac{x}{2}\right)=\operatorname{cosec}x-\sin x$ then the value of $\tan^2\left(\frac{x}{2}\right)$ is

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2. Find the value of $\cos^4\left(\frac{\pi}{8}\right)$

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3. Find the value of expression $\frac{1}{\cos 290^\circ} + \frac{1}{\sqrt{3}\sin 250^\circ}$

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4. If $x + \frac{1}{x} = 2\cos\theta$, then the value of $x^n + \frac{1}{x^n}$

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

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6. If $\alpha and \beta$ are distict roots of $a\cos\theta + bs\int h\eta = c,$ prove that $\sin(\alpha + \beta) = \frac{2ab}{a^2 + b^2}$

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

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8. Show that $\cot\left(142\frac{1}{2}\right)^\circ = \sqrt{2} + \sqrt{3} - 2 - \sqrt{6}$

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9. If $\cos\theta = \frac{\cos\alpha + \cos\beta}{1 + \cos\alpha\cos\beta}$, prove that $\frac{\tan\theta}{2} = = -\frac{\tan\alpha}{2}\frac{\tan\beta}{2}$

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10. Find the value $\tan\left(\frac{\pi}{5}\right) + 2\tan\left(\frac{2\pi}{5}\right) + 4\cot\left(\frac{4\pi}{5}\right)$.

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Exercise For Session 10

1. If $A + B + C = 180^\circ$, then prove that $\sin 2A + \sin 2B + \sin 2C = 4\sin A \sin B \sin C$

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2. If $A + B + C = 180^\circ$, then prove that $\tan^2\left(\frac{\theta}{2}\right) = \tan\left(\frac{B}{2}\right)\tan\left(\frac{C}{2}\right)$. when $\cos\theta(\sin\theta + \sin\theta) = \sin A$.

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3. In ΔABC,prove that:

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

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

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

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

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5. if $A + B + C = \pi$ then $\frac{\cos A}{\sin B \sin C} + \frac{\cos B}{\sin C \sin A} + \frac{\cos C}{\sin A \sin B} =$

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6. In ΔABC, show that $\frac{1 - \cos A + \cos B + \cos C}{1 - \cos C + \cos A + \cos B} = \tan\left(\frac{A}{2}\right)\cot\left(\frac{C}{2}\right)$.

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7. In ΔABC if $\tan\left(\frac{B + C - A}{4}\right)\tan\left(\frac{C + A - B}{4}\right)\tan\left(\frac{A + B - C}{4}\right) = 1$ then find the value of $\cos A + \cos B + \cos C$

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8. 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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9. If $A+B+C=\frac{3\pi}{2},$ then show that

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

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10. If $\alpha+\beta+\gamma=2\pi,$ then show that

$\tan. \frac{\alpha}{2}+\tan. \frac{\beta}{2}+\tan. \frac{\gamma}{2}=\tan. \frac{\alpha}{2}\tan. \frac{\beta}{2}\tan. \frac{\gamma}{2}.$

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Exercise For Session 11

1. Prove that the minimum value of $3\cos x + 4\sin x + 5$ is 0.

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2. If $\sin\theta_1 + \sin\theta_2 + \sin\theta_3,$ then find the value of $\cos\theta_1 + \cos\theta_2 + \cos\theta_3.$

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3. If $x = rs\int h\eta\cos\varphi, y = rs\int h\eta\sin\varphi andz = r\cos\theta, thenx^2 + y^2 + z^2$ is independent of θ, φ (b) r, θ (c) r, φ (d) r

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4. Find the least value of $2\sin^2\theta + 3\cos^2\theta.$

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5. α, β, γ are real number satisfying $\alpha + \beta + \gamma = \pi$. The minimum value of the given expression $\sin\alpha + \sin\beta + \sin\gamma$ is

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6. If $A = \sin^2\theta + \cos^4\theta$, then for all real values of θ

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7. Find the minimum value of $\sec^2\theta + \operatorname{cosec}^2\theta - 4$.

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8. If $P = \cos(\cos x) + \sin(\cos x)$, then the least and greatest value of P respectively.

A. - 1 and 1

B. 0 and 2

C. $-\sqrt{2}$ and $\sqrt{2}$

D. 0 and $\sqrt{2}$

Answer: $-\sqrt{2}$ **and** $\sqrt{2}$

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9. Let

$\theta \in \left(0, \frac{\pi}{4}\right)$ and $t_1 = (\tan\theta)^{\tan\theta}, t_2 = (\tan\theta)6(\cot\theta), t_3 = (\cot\theta)^{\tan\theta}$ and $t_4 = (\cot\theta$

then

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10. The ratio of the greatest value of $2 - \cos x + s \in^2 x$ to its least value is

$\frac{7}{4}$ (2) $\frac{9}{4}$ (3) $\frac{13}{4}$ (4) $\frac{5}{4}$

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Exercise (Single Option Correct Type Questions)

1. The value of $\sum_{k=1}^{10}\left(\frac{\sin(2\pi k)}{11} - i\frac{\cos(2\pi k)}{11}\right)$ is

A. 2

B. 1

C. 0

D. -1

Answer: B

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2. Given $a^2 + 2a + cosec^2\left(\frac{\pi}{2}(a + x)\right) = 0$ then, which of the following holds good

A. $a = 1, \frac{x}{2} \in 1$

B. $a = -1, \frac{x}{2} \in I$

C. $a \in R, x \in \phi$

D. a, x are finite but not possible to find

Answer: B

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3. The minimum value of the function

$f(x) = (3\sin x - 4\cos x - 10)(3\sin x + 4\cos x - 10)$, is

A. 49

B. $\frac{195 - 60\sqrt{2}}{2}$

C. 84

D. 48

Answer: A

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4. The value of the expression $\sum_{\theta=0}^{8} \frac{1}{1 + \tan^3(10\theta)^\circ}$ equals

A. 5

B. $\frac{21}{4}$

C. $\frac{14}{3}$

D. $\frac{9}{2}$

Answer: A

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5. the value of $\sqrt{1 - \sin^2 110^\circ} \cdot \sec 110^\circ$

A. 2

B. -1

C. -2

D. 1

Answer: B

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6. If $\tan\alpha, \tan\beta$ are th roots of the eqution $x^2 + px + q = 0 (p \neq 0)$ Then $\sin^2(\alpha + \beta) + p\sin(\alpha + \beta)\cos(\alpha + \beta) + q\cos^2(\alpha + \beta) =$

A. independent of p but dependent on q

B. independent of q but dependent on p

C. independent of both p and q

D. dependent on both p and q

Answer: A

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7. $\sin\left(\frac{\pi}{2^{2009}}\right)\cos\left(\frac{\pi}{2^{2009}}\right)\cos\left(\frac{\pi}{2^{2008}}\right)\ldots.\ \cos\left(\frac{\pi}{2^{2}}\right)$ is

A. $\frac{1}{2^{2007}}$

B. $\frac{1}{2^{2008}}$

C. $\frac{1}{2^{2009}}$

D. $\frac{1}{2^{2010}}$

Answer: B

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8. If $\tan B = \frac{n\sin A\cos A}{1 - n\cos^2 A}$ then $\tan(A + B)$ equals

A. $\frac{\sin A}{(1 - n)\cos A}$

B. $\frac{(n - 1)\cos A}{\sin A}$

C. $\frac{\sin A}{(n - 1)\cos A}$

D. $\frac{\sin A}{(n + 1)\cos A}$

Answer: A

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9. If $P = \left(\tan\left(3^{n+1}\theta - \tan\theta\right)\right.$

A. $P = 2Q$

B. $P = 3Q$

C. $2P = Q$

D. $3P = Q$

Answer: A

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10. The value of

$$\left(\cos^4 1^\circ + \cos^4 2^\circ + \ldots. + \cos^4 179^\circ\right) - \left(\sin^4 1^\circ + \sin^4 2^\circ + \ldots. . + \sin^4 179^\circ\right)$$

equals

A. $2\cos 1^\circ$

B. -1

C. $2\sin 1^\circ$

D. 0

Answer: B

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11. Suppose that 'a' is a non-zero real number for which $\sin x + \sin y = a$ and $\cos x + \cos y = 2a$. The value of $\cos(x - y) is$

A. $\dfrac{3a^2 - 2}{2}$

B. $\dfrac{7a^2 - 2}{2}$

C. $\dfrac{9a^2 - 2}{2}$

D. $\dfrac{5a^2 - 2}{2}$

Answer: D

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12. Let $P(x) = \sqrt{(\cos x + \cos 2x + \cos 3x)^2 + (\sin x + \sin 2x + \sin 3x)^2}$ then P(x) is equal to

A. $1 + 2\cos x$

B. $1 + \sin x$

C. $1 - 2\cos x$

D. None of these

Answer: D

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13. If the maximum value of the expression $\dfrac{1}{5\sec^2\theta - \tan^2\theta + 4cosec^2\theta}$ is equal to $\dfrac{p}{q}$ (where p and q are coprime), then the value of $(p + q)$ is

A. 14

B. 15

C. 16

D. 18

Answer: D

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14. Let $f_n(a) = \dfrac{\sin\alpha + \sin3\alpha + \sin5\alpha + \ldots + \sin(2n - 1)\alpha}{\cos\alpha + \cos3\alpha + \cos5\alpha + \ldots + \cos(2n - 1)\alpha}$ Then, the value of $f_4\left(\dfrac{\pi}{32}\right)$ is equal to

A. $\sqrt{2} + 1$

B. $\sqrt{2} - 1$

C. $2 + \sqrt{3}$

D. $2 - \sqrt{3}$

Answer: B

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15. The minimum value of $\left|\sin x + \cos x + \frac{\cos x + \sin x}{\cos^4 x - \sin^4 x}\right|$ is

A. 2

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

C. $\sqrt{2}$

D. 1

Answer: A

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16. If $a = \cos(2012\pi)$, $b = \sec(2013\pi)$ and $c = \tan(2014\pi)$ then

A. $a < b < c$

B. $b < c < a$

C. $c < b < a$

D. $a = b < c$

Answer: B

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17. In a ΔABC, the minimum value of

$\sec^2. \frac{A}{2} + \sec^2. \frac{B}{2} + \sec^2. \frac{C}{2}$ is equal to

A. 3

B. 4

C. 5

D. 6

Answer: B

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18. The number of ordered pairs (x, y) of real number satisfying $4x^2 - 4x + 2 = \sin^2 y$ and $x^2 + y^2 \leq 3$ equal to

A. 0

B. 2

C. 4

D. 8

Answer: B

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19. In a ΔABC, $3\sin A + 4\cos B = 6$ and $3\cos A + 4\sin B = 1$, then $\angle C$ can be

A. 30°

B. 60°

C. 90°

D. 150°

Answer: A

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20. An equilateral triangle has side length 8. The area of the region containing all points outside the triangle but not more than 3 units from a point on the triangle is :

A. $9(8+\pi)$

B. $8(9+\pi)$

C. $9\left(8+\frac{\pi}{2}\right)$

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

Answer: A

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21. If $a\cos^3\alpha + 3a\cos\alpha \cdot \sin\alpha = m$ and $a\sin^3\alpha + 3a\cos^3\alpha\sin^3\alpha = n$ then

$(m + n)^{\frac{2}{3}} + (m - n)^{\frac{2}{3}}$

A. $2a^2$

B. $2a^{1/3}$

C. $2a^{2/3}$

D. $2a^3$

Answer: C

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22. As shown in the figure AD is the altitude on BC and AD produced meets the circumcircle of ΔABC at P where DP=x. Similarly EQ=y and FR=z. If a,b,c respectively denotes sides BC, CA and AB then $\frac{a}{2x} + \frac{b}{2y} + \frac{c}{2z}$ has the value equal to

A. $\tan A + \tan B + \tan C$

B. $\cot A + \cos B + \cot C$

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

D. $\operatorname{cosec} A + \operatorname{cosec} B + \operatorname{cosec} C$

Answer: A

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23. One side of a rectangular piece of paper is 6 cm, the adjacent sides being longer than 6 cms. One corner of the paper is folded so that it sets on the opposite longer side. If the length of the crease is l cms and it makes an angle θ with the long side as shown, then l is

A. $\dfrac{3}{\sin\theta\cos^2\theta}$

B. $\dfrac{6}{\sin^2\theta\cos\theta}$

C. $\dfrac{3}{\sin\theta\cos\theta}$

D. $\dfrac{3}{\sin^2\theta}$

Answer: A

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24. Provethat the average of the numbers $n\sin n^\circ$, n = 2,4,6...180 is $\cot 1^\circ$

A. 1

B. $\cot 1^\circ$

C. $\tan 1^\circ$

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

Answer: B

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25. A circle is inscribed inside a regular pentagon and another circle is circumscribed about this pentagon.Similarly a circle is inscribed in a regular heptagon and another circumscribed about the heptagon. The area of the regions between the two circles in two cases are A_1 and A_2, respectively. If each polygon has a side length of 2 units then which one of the following is true?

A. $A_1 = \frac{5}{7}A_2$

B. $A_1 = \frac{25}{49}A_2$

C. $A_1 = \frac{49}{25}A_2$

D. $A_1 = A_2$

Answer: D

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26. The value of $\sum_{r=1}^{18} \cos^2(5r)^\circ$, where x° denotes the x degree, is equal to

A. 0

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

C. $\frac{17}{2}$

D. $\frac{25}{2}$

Answer: C

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27. Minimum value of $4x^2 - 4x|\sin x| - \cos^2\theta$ is equal

A. -2

B. -1

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

D. 0

Answer: B

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28. In a triangle ABC, $\cos 3A + \cos 3B + \cos 3C = 1$, then find any one angle.

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

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

C. π

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

Answer: B

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29. $\frac{\sqrt{1+\sin 2A}+\sqrt{1-\sin 2A}}{\sqrt{1+\sin 2A}-\sqrt{1-\sin 2A}}$ If $|\tan A| < 1$, and $|AI$

A. tan A

B. $-\tan A$

C. cot A

D. $-\cot A$

Answer: C

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30. For any the real $\theta$the maximum value of$\cos^2(\cos\theta) + \sin^2(\sin\theta)$ is

A. 1

B. $1 + \sin^2 1$

C. $1 + \cos^2 1$

D. does not exist

Answer: B

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31. Find the ragne of the expression $27^{\cos 2x} 81^{\sin 2x}$

A. -5

B. $\frac{1}{5}$

C. $\frac{1}{243}$

D. $\frac{1}{27}$

Answer: C

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32. ABCD is a trapezium such that AB and CD are parallel and $BC \perp CD$. If $\angle ADB = \theta, BC = p$ and $CD = q$, then AB is equal to

A. $\frac{(p^2 + q^2)\sin\theta}{p\cos\theta + q\sin\theta}$

B. $\frac{p^2 + q^2\cos\theta}{p\cos\theta + q\sin\theta}$

C. $\frac{p^2 + q^2}{p^2\cos\theta + q^2\sin\theta}$

D. $\frac{(p^2 + q^2)\sin\theta}{(p\cos\theta + q\sin\theta)^2}$

Answer: A

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33. If $4n\alpha = \pi$ then $\cot\alpha\cot2\alpha\cot3\alpha...\cot(2n - 1)\alpha$ $n \in Z$ is equal to

A. 0

B. 1

C. n

D. None of these

Answer: B

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34. In ΔABC, if (Sin A + SinB + SinC) (SinA + SinB - SinC) = 3SinA SinB then C =

A. 30°

B. 45°

C. 60°

D. 75°

Answer: C

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35. If α, β, γ are acute angles and $\cos\theta = \sin\beta / \sin\alpha$, $\cos\phi = \sin\gamma / \sin\alpha$ and $\cos(\theta - \phi) = \sin\beta\sin\gamma$, then $\tan^2\alpha - \tan^2\beta - \tan^2\gamma$ is equal to

A. -1

B. 0

C. 1

D. None of these

Answer: B

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36. if $\tan\beta = \dfrac{n\sin\alpha\cos\beta}{1 - n\sin^2\alpha}$ then prove that $\tan(\alpha - \beta) = (1 - n)\tan\alpha$.

A. $n\tan\alpha$

B. $(1 - n)\tan\alpha$

C. $(1 + n)\tan\alpha$

D. None of these

Answer: B

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37. If $\frac{\cos\theta}{a} = \frac{\sin\theta}{b}, then \frac{a}{\sec 2\theta} + \frac{b}{\operatorname{cosec} 2\theta}$ is equal to

A. a

B. b

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

D. $a + b$

Answer: A

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38. The graph of the function, $\cos x \cos(x+2) - \cos^2(x+1)$ is

A. a straight line passing through $\left(0, -\sin^2\theta\right)$ with slope 2

B. a straight line passing through (0, 0)

C. a parabola with vertex $\left(1, -\sin^2 1\right)$

D. a straight line passing through the point $\left(\frac{\pi}{2}, -\sin^2 1\right)$ and parallel to the X-axis

Answer: D

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39. If $f(\theta) = |\sin\theta| + |\cos\theta|, \theta \in R$, then

A. $f(\theta) \in [0, 2]$

B. $f(\theta) \in \left[0, \sqrt{2}\right]$

C. $f(\theta) \in [0, 1]$

D. $f(\theta) \in \left[1, \sqrt{2}\right]$

Answer: D

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40. If $P = \cos(\cos x) + \sin(\cos x)$, then the least and greatest value of P respectively.

A. 0 and 2

B. - 1 and 1

C. - $\sqrt{2}$ and $\sqrt{2}$

D. 0 and $\sqrt{2}$

Answer: C

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41. If $u_n = \sin(n\theta)\sec^n\theta, v_n = \cos(n\theta)\sec^n\theta$ $n \in N n \neq 1$ then

$$\frac{v_n - v_{n-1}}{u_{n-1}} + \frac{1}{n}\left(\frac{u_n}{v_n}\right) =$$

A. 0

B. $\tan\theta$

C. $-\tan\theta + \frac{\tan n\theta}{n}$

D. $\tan\theta + \tan\theta + \frac{\tan n\theta}{n}$

Answer: C

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42. If $0 \le x \le \frac{\pi}{3}$ then range of $f(x) = \sec\left(\frac{\pi}{6} - x\right) + \sec\left(\frac{\pi}{6} + x\right)$ is $\left(\frac{4}{\sqrt{3}}, \infty\right)$

(b) $\left(\frac{4}{\sqrt{3}}, \infty\right)$ $\left(0, \frac{4}{\sqrt{3}}\right)$ (d) $\left(0, \frac{4}{\sqrt{3}}\right)$

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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43. If $A = \sin^8\theta + \cos^{14}\theta$, then for all values of θ,

A. $A \geq 1$

B. $0 < A \leq 1$

C. $1 < 2a \leq 3$

D. None of these

Answer: B

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44. Find the value of the expression

$$3\left[\sin^4\left(\frac{3\pi}{2} - \alpha\right) + \sin^4(3\pi + \alpha)\right] - 2\left[\sin^6\left(\frac{\pi}{2} + \alpha\right) + \sin^6(5\pi - \alpha)\right].$$

A. 0

B. -1

C. 1

D. 3

Answer: C

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45. The maximum value of $\sin\left(\theta + \frac{\pi}{6}\right) + \cos\left(\theta + \frac{\pi}{6}\right)$ is attained at $\theta \in \left(0, \frac{\pi}{2}\right)$

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

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

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

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

Answer: A

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46. If $\cot^2 x = \cot(x - y) \cdot \cot(x - z)$, then $\cot 2x$ is equal to $\left(x \neq \pm \frac{\pi}{4}\right)$

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

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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47. The minimum value of the expression $\sin\alpha + \sin\beta + \sin\gamma$, where α, β, γ are real numbers satisfying $\alpha + \beta + \gamma = \pi$ is

A. positive

B. zero

C. negative

D. None of these

Answer: C

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48. 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. $\cot.\ \frac{\alpha}{2}\tan.\ \frac{\beta}{2}$

B. $\cot.\ \frac{\beta}{2}\tan.\ \frac{\alpha}{2}$

C. $\tan.\frac{\alpha}{2}\tan.\frac{\beta}{2}$

D. None of these

Answer: B

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49. If $\cos^4\theta\sec^2\alpha, \frac{1}{2}$ and $\sin^4\theta\cos ec^2\alpha$ are in $A.P.$, then $\cos^8\theta\sec^6\alpha, \frac{1}{2}$ and $\sin^8\theta\cos ec^6\alpha$ are

A. AP

B. GP

C. HP

D. None of these

Answer: A

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50. The maximum value of $(\cos\alpha_1)(\cos\alpha_2)...(\cos\alpha_n)$, under the restrications $0 \le \alpha_1, \alpha_2..., \alpha_n \le \frac{\pi}{2}$, and $(\cot\alpha_1)(\cot\alpha_2)...(\cot\alpha_n) = 1 is$

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

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

C. $\frac{-1}{2^n}$

D. 1

Answer: A

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51. Find the set of values of x , which satisfy $\sin x \cdot \cos^3 x > \cos \cdot \sin^3 x, 0 \le x \le 2\pi$.

A. $x \in \left(0, \frac{\pi}{4}\right) \cup \left(\frac{\pi}{2}, \frac{3\pi}{4}\right)$

B. $x \in \left(\frac{\pi}{4}, \frac{\pi}{2}\right) \cup \left(\frac{3\pi}{4}, \pi\right)$

C. $x \in \left(\frac{\pi}{4}, \frac{\pi}{2}\right)$

D. None of these

Answer: A

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52. 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 maximum and minimum values of u^2 is

A. $2\left(a^2 + b^2\right)$

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

C. $(a + b)^2$

D. $(a - b)^2$

Answer: D

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53. For a positive integer n, $f_n(\theta) = \left(\frac{\tan\theta}{2}\right)(1 + \sec\theta)(1 + \sec 2\theta)(1 + \sec 4\theta)....\left(1 + \sec 2^n\theta.\right)$, then

A. $f_2\left(\frac{\pi}{16}\right) = 0$

B. $f_3\left(\frac{\pi}{32}\right) = -1$

C. $f_4\left(\frac{\pi}{64}\right) = -1$

D. $f_5\left(\frac{\pi}{128}\right) = 1$

Answer: A

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Exercise (More Than One Correct Option Type Questions)

1. Suppose $\cos x = 0$ and $\cos(x + z) = \frac{1}{2}$. Then, the possible value (s) of z is (are).

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

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

C. $\frac{7\pi}{6}$

D. $\frac{11\pi}{6}$

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

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2. Let

$$f_n(\theta) = 2\sin.\frac{\theta}{2}\sin.\frac{3\theta}{2} + 2\sin.\frac{\theta}{2}\sin.\frac{5\theta}{2} + 2\sin.\frac{\theta}{2}\sin.\frac{7\theta}{2} + \ldots + 2\sin(2n+1)\frac{\theta}{2}, n \in$$

,

then which of the following is/are correct ?

A. $f_9\left(\frac{\pi}{4}\right) = \frac{1}{\sqrt{2}}$

B. $f_n\left(\frac{2\pi}{n}\right) = 0, n \in N$

C. $f_3\left(\frac{2\pi}{7}\right) = 0$

D. $f_9\left(\frac{\pi}{4}\right) = -\frac{1}{\sqrt{2}}$

Answer: A::B::C

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3. Let $P = \sin 25^\circ \sin 35^\circ \sin 60^\circ \sin 85^\circ$ and $Q = \sin 20^\circ \sin 40^\circ \sin 75^\circ \sin 80^\circ$. Which of the following relation (s) is (are) correct ?

A. $P + Q = 0$

B. $P - Q = 0$

C. $P^2 + Q^2 = 1$

D. $P^2 - Q^2 = 0$

Answer: B::D

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4. let $0 < \phi < \frac{\pi}{2}, x = \sum_{n=0}^{\infty} \cos^{2n}\phi, y = \sum_{n=0}^{\infty} \sin^{2n}\phi$ and $z = \sum_{n=0}^{\infty} \cos^{2n}\phi \sin^{2n}\phi$

A. $xyz = xz + y$

B. $xyz = xy + z$

C. $xyz = x + y + z$

D. $xyz = yz + x$

Answer: B::C

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5. Let $P(x) = \cot^2 x\left(\frac{1 + \tan x + \tan^2 x}{1 + \cot x + \cot^2 x}\right) + \left(\frac{\cos x - \cos 3x + \sin 3x - \sin x}{2(\sin 2x + \cos 2x)}\right)^2.$

Then, which of the following is (are) correct ?

A. The value of $P(18^\circ) + P(72^\circ)$ is 2.

B. The value of $P(18^\circ) + P(72^\circ)$ is 3.

C. The value of $P\left(\frac{4\pi}{3}\right) + P\left(\frac{7\pi}{6}\right)$ is 3.

D. The value of $P\left(\frac{4\pi}{3}\right) + P\left(\frac{7\pi}{6}\right)$ is 2.

Answer: B::C

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6. It is known that $\sin\beta = \frac{4}{5}$ and $0 < \beta < \pi$ then the value of

$$\frac{\sqrt{3}\sin(\alpha+\beta) - \frac{2}{\cos\left(\frac{\pi}{6}\right)}\cos(\alpha+\beta)}{\sin\alpha}$$ is

A. independent of α for all β in $(0, \pi)$

B. $\frac{5}{\sqrt{3}}$ for $\tan\beta > 1$

C. $\frac{\sqrt{3}(7 + 24\cot\alpha)}{15}$ for $\tan\beta < 0$

D. zero for $\tan\beta > 0$

Answer: B::C

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7. In cyclic quadrilateral ABCD, if $\cot A = \frac{3}{4}$ and $\tan B = \frac{-12}{5}$, then which of the following is (are) correct ?

A. $\sin D = \frac{12}{13}$

B. $\sin(A + B) = \frac{16}{65}$

C. $\cos D = \frac{-15}{13}$

D. $\sin(C + D) = \frac{-16}{65}$

Answer: A::B::D

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8. If the equation $2\cos^2 x + \cos x - a = 0$ has solutions, then a can be

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

B. $\frac{-1}{8}$

C. 2

D. 5

Answer: B::C

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9. If $A = \sin 44^\circ + \cos 44^\circ$, $B = \sin 45^\circ + \cos 45^\circ$ and $C = \sin 46^\circ + \cos 46^\circ$.

Then, correct option(s) is/are

A. $A < B < C$

B. $C < B < A$

C. $B > A$

D. $A = C$

Answer: C::D

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10. If $\tan(2\alpha + \beta) = x \& \tan(\alpha + 2\beta) = y$, then $[\tan 3(\alpha + \beta)].[\tan(\alpha - \beta)]$ is equal to (wherever defined)

A. $\frac{x^2 + y^2}{1 - x^2y^2}$

B. $\frac{x^2 - y^2}{1 + x^2y^2}$

C. $\frac{x^2 + y^2}{1 + x^2y^2}$

D. $\frac{x^2 - y^2}{1 - x^2y^2}$

Answer: D

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11. If $x = \sec\phi - \tan\phi$ and $y = \operatorname{cosec}\phi + \cot\phi$ then

A. $x = \frac{y + 1}{y - 1}$

B. $x = \frac{y - 1}{y + 1}$

C. $y = \frac{1 + x}{1 - x}$

D. $xy + x - y + 1 = 0$

Answer: B::C::D

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12. If $\tan\left(\frac{x}{2}\right) = \operatorname{cosec}x - \sin x$, then $\tan^2\left(\frac{x}{2}\right)$ is equal to

A. $2 - \sqrt{5}$

B. $\sqrt{5} - 1$

C. $\left(9 - 4\sqrt{5}\right)\left(2 + \sqrt{5}\right)$

D. $\left(9 + 4\sqrt{5}\right)\left(2 - \sqrt{5}\right)$

Answer: B::C

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13. If $y = \dfrac{\sqrt{1 - \sin 4x} + 1}{\sqrt{1 + \sin 4x} - 1}$, then y can be

A. $-\tan A$

B. $\cot A$

C. $\tan\left(\dfrac{\pi}{4} + A\right)$

D. $-\cot\left(\dfrac{\pi}{4} + A\right)$

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

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14. If $3\sin\beta = \sin(2\alpha + \beta)$ then

A. $[\cot\alpha + \cot(\alpha + \beta)][\cot\beta - 3\cot(2\alpha + \beta)] = 6$

B. $\sin\beta = \cos(\alpha + \beta)\sin\alpha$

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

D. $\tan(\alpha + \beta) = 2\tan\alpha$

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

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15. Let $P_n(u)$ be a polynomial is u of degree n. Then, for every positive integern, $\sin 2nx$ is expressible is

A. $P_{2n}(\sin x)$

B. $P_{2n}(\cos x)$

C. $\cos x P_{2n} - 1(\sin x)$

D. $\sin x P_{2n-1}(\cos x)$

Answer: C::D

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16. If $\tan\theta = \dfrac{\sin\alpha - \cos\alpha}{\sin\alpha + \cos\alpha}$, then

A. $\sin\alpha - \cos\alpha = \sqrt{2}\sin\theta$

B. $\sin\alpha + \cos\alpha = \sqrt{2}\cos\theta$

C. $\cos 2\theta = \sin 2\alpha$

D. $\sin 2\theta + \cos 2\alpha = 0$

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17. If $\cos 5\theta = a\cos\theta + b\cos^3\theta + c\cos^5\theta + d$, then

A. $a = 20$

B. $b = -20$

C. $c = 16$

D. $d = 5$

Answer: B::C

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

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

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

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

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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19. If n is an odd positive interger, then

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

A. $2\tan^n\left(\frac{A - B}{2}\right)$

B. $2\cot^n\left(\frac{A - B}{2}\right)$

C. 0

D. None of these

Answer: B::C

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20. Let $P(k) = \left(1 + \frac{\cos\pi}{4k}\right)\left(1 + \frac{\cos((2k-1)\pi)}{4k}\right)\left(1 + \frac{\cos((2k+1)\pi)}{4k}\right)\left(1 + \frac{\cos((4k-1)\pi)}{4k}\right)$. $Then\ P(3) = \frac{1}{16}$ (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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21. if $x = a\cos^3\theta\sin^2\theta$ and $y = a\cos^2\theta\sin^3\theta$ and $\frac{\left(x^2+y^2\right)^p}{(xy)^q}$ is independent of θ, then (A) $4p = 5q$ (B) $5p = 4q$ (C) $p + q = 9$ (D) $pq = 20$

A. $p = 4$

B. $p = 5$

C. $q = 4$

D. $q = 5$

Answer: B::C

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Exercise (Statement I And Ii Type Questions)

1. Statement I $\tan\alpha + 2\tan 2\alpha + 4\tan 4\alpha + 8\tan 8\alpha + 16\cot 16\alpha = \cot\alpha$

Statement II $\cot\alpha - \tan\alpha = 2\cot 2\alpha$

A. Both Statement I and Statement II are individually true and R is the correct explanation of Statement I.

B. Both Statement I and Statement II are individually true but Statement II is not the correct explanaton of Statement I.

C. Statement I is true but Statement II is false.

D. Statement I is false but Statement II is true.

Answer: A

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2. Statement I If $xy + yz + zx = 1$, then

$$\Sigma \frac{x}{\left(1 + x^2\right)} = \frac{2}{\sqrt{\Pi\left(1 + x^2\right)}}.$$

Statement II In a $\Delta ABC \sin 2A + \sin 2B - \sin 2C = 4\cos A \cos B \sin C$

A. Both Statement I and Statement II are individually true and R is the correct explanation of Statement I.

B. Both Statement I and Statement II are individually true but Statement II is not the correct explanaton of Statement I.

C. Statement I is true but Statement II is false.

D. Statement I is false but Statement II is true.

Answer: B

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3. Stastement α and β are tow distinct solutions of the equations $a\cos x + b\sin x = c, then \tan\left(\frac{\alpha + \beta}{2}\right)$ is independent for c, Stastement 2. Solution $\cos x + b\sin x = c$ is possible, if -$\sqrt{a^2 + b^2} \leq csdqrt\left(a^2 + b^2\right)$ (A) Both Statement 1 and Statement 2 are true and Statement 2 is the correct explanation of Statement 1 (B) Both Statement 1 and Statement 2 are true and Statement 2 is not the correct explanatioin of Statement 1

(C) Statement 1 is true but Statement 2 is false. (D) Statement 1 is flse but Stastement 2 is true

A. Both Statement I and Statement II are individually true and R is the correct explanation of Statement I.

B. Both Statement I and Statement II are individually true but Statement II is not the correct explanaton of Statement I.

C. Statement I is true but Statement II is false.

D. Statement I is false but Statement II is true.

Answer: B

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4. Statement-1: If A, B, C are the angles of a triangle such that angle A is obtuse, then tan $C > 1$.

Statement-2: In any $\Delta ABC <$ we have $\tan A = \dfrac{\tan B + \tan C}{\tan B \tan C - 1}$

A. Both Statement I and Statement II are individually true and R is the correct explanation of Statement I.

B. Both Statement I and Statement II are individually true but Statement II is not the correct explanaton of Statement I.

C. Statement I is true but Statement II is false.

D. Statement I is false but Statement II is true.

Answer: D

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5. Statement I $\sin\left(\frac{2\pi}{7}\right) + \sin\left(\frac{4\pi}{7}\right) + \sin\left(\frac{8\pi}{7}\right) = -\frac{1}{2}$.

Statement II $\cos.\ \frac{2\pi}{7} + I\sin.\ \frac{2\pi}{7}$ is complex 7th root of unity.

A. Both Statement I and Statement II are individually true and R is the correct explanation of Statement I.

B. Both Statement I and Statement II are individually true but Statement II is not the correct explanaton of Statement I.

C. Statement I is true but Statement II is false.

D. Statement I is false but Statement II is true.

Answer: D

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6. Statement I The curve $y = 81^{\sin^2 x} + 81^{\cos^2 x} - 30$ intersects X-axis at eight points in the region $-\pi \le x \le \pi$.

Statement II The curve $y = \sin x$ or $y = \cos x$ intersects the X-axis at infinitely many points.

A. Both Statement I and Statement II are individually true and R is the correct explanation of Statement I.

B. Both Statement I and Statement II are individually true but Statement II is not the correct explanaton of Statement I.

C. Statement I is true but Statement II is false.

D. Statement I is false but Statement II is true.

Answer: A

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7. Statement-1: The numbers $\sin 18^{\circ}$ and $-\sin 54^{\circ}$ are the roots of the quadratic equation with integer coefficients.

Statement-2: If $x = 18^{\circ}, \cos 3x = \sin 2x$ and $If y = -54^{\circ}, \sin 2y = \cos 3y$.

A. Both Statement I and Statement II are individually true and R is the correct explanation of Statement I.

B. Both Statement I and Statement II are individually true but Statement II is not the correct explanaton of Statement I.

C. Statement I is true but Statement II is false.

D. Statement I is false but Statement II is true.

Answer: A

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8. The minimum value of the expression $\sin\alpha + \sin\beta + \sin\gamma$, where α, β, γ are real numbers satisfying $\alpha + \beta + \gamma = \pi$ is

A. Both Statement I and Statement II are individually true and R is the correct explanation of Statement I.

B. Both Statement I and Statement II are individually true but Statement II is not the correct explanaton of Statement I.

C. Statement I is true but Statement II is false.

D. Statement I is false but Statement II is true.

Answer: C

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9. Statement-1: If $2\sin\frac{\theta}{2} = \sqrt{1 + \sin\theta} + \sqrt{1 - \sin\theta, then\theta} \in \left((8\pi + 1)\frac{\pi}{2}, (8n + 3)\frac{\pi}{2}\right)$

Statement-2: $If\frac{\pi}{4} \le \theta \le \frac{3\pi}{4}, then\sin\frac{\theta}{2} > 0.$

A. Both Statement I and Statement II are individually true and R is the correct explanation of Statement I.

B. Both Statement I and Statement II are individually true but Statement II is not the correct explanaton of Statement I.

C. Statement I is true but Statement II is false.

D. Statement I is false but Statement II is true.

Answer: B

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10. Statement I If $2\cos\theta + \sin\theta = 1\left(\theta \ne \frac{\pi}{2}\right)$ then the value of $7\cos\theta + 6\sin\theta$ is 2.

Statement II If $\cos 2\theta - \sin\theta = \frac{1}{2}, 0 < \theta < \frac{\pi}{2}$, then $\sin\theta + \cos 6\theta = 0$.

A. Both Statement I and Statement II are individually true and R is the correct explanation of Statement I.

B. Both Statement I and Statement II are individually true but Statement II is not the correct explanaton of Statement I.

C. Statement I is true but Statement II is false.

D. Statement I is false but Statement II is true.

Answer: B

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11. Statement I If $A > 0, B > 0$ and $A + B = \frac{\pi}{3}$, then the maximum value of tan A tan B is $\frac{1}{3}$.

Statement II If $a_1 + a_2 + a_3 + \ldots + a_n = k$(constant), then the value $a_1 a_2 a_3 \ldots a_n$ is greatest when

$a_1 = a_2 = a_3 = \ldots + a_n$

A. Both Statement I and Statement II are individually true and R is the correct explanation of Statement I.

B. Both Statement I and Statement II are individually true but Statement II is not the correct explanaton of Statement I.

C. Statement I is true but Statement II is false.

D. Statement I is false but Statement II is true.

Answer: B

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Exercise (Passage Based Questions)

1. If a, b, c are the sides of ΔABC such that

$3^{2a^2} - 2 \cdot 3^{a^2+b^2+c^2} + 3^{2b^2+2c^2} = 0$, then

Triangle ABC is

A. equilateral

B. right angled

C. isosceles right angled

D. obtuse angled

Answer: B

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2. If a, b, c are the sides of ΔABC such that

$3^{2a^2} - 2 \cdot 3^{a^2+b^2+c^2} + 3^{2b^2+2c^2} = 0$, then

If sides of ΔPQR are a, b sec C, c cosec C. Then, area of ΔPQR is

A. $\frac{\sqrt{3}}{4}a^2$

B. $\frac{\sqrt{3}}{4}b^2$

C. $\frac{\sqrt{3}}{4}b^2$

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

Answer: A

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3. For $0 < x < \frac{\pi}{2}$, let $P_{mn}(x) = m\log_{\cos x}(\sin x) + n\log_{\cos x}(\cot x)$,

where $m, n \in \{1, 2, ..., 9\}$

[For example: $P_{29}(x) = 2\log_{\cos x}(\sin x) + 9\log_{\cos x}(\cot x)$ and

$P_{77}(x) = 7\log_{\cos x}(\sin x) + \left(7\log_{\cos x}(\cot x)\right]$

On the basis of above information, answer the following questions :

If $P_{34}(x) = P_{22}(x)$, then the value of sin x is expressed as $\left(\frac{\sqrt{q} - 1}{p}\right)$, then

(p+q) equals

A. $P_{mn}(x) \geq m \forall m \geq n$

B. $P_{mn}(x) \geq n \forall m \geq n$

C. $2P_{mn}(x) \leq n \forall m \leq n$

D. $2P_{mn}(x) \leq m \forall m \leq n$

Answer: B

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4. For $0 < x < \frac{\pi}{2}$, let $P_{mn}(x) = m\log_{\cos x}(\sin x) + n\log_{\cos x}(\cot x)$,

where $m, n \in \{1, 2, ..., 9\}$

[For example: $P_{29}(x) = 2\log_{\cos x}(\sin x) + 9\log_{\cos x}(\cot x)$ and

$P_{77}(x) = 7\log_{\cos x}(\sin x) + \left(7\log_{\cos x}(\cot x)\right]$

On the basis of above information, answer the following questions :

If $P_{34}(x) = P_{22}(x)$, then the value of sin x is expressed as $\left(\frac{\sqrt{q} - 1}{p}\right)$, then (p+q) equals

A. 4

B. 6

C. 9

D. 10

Answer: B

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5. For $0 < x < \frac{\pi}{2}$, let $P_{mn}(x) = m\log_{\cos x}(\sin x) + n\log_{\cos x}(\cot x)$,

where $m, n \in \{1, 2, ..., 9\}$

[For example: $P_{29}(x) = 2\log_{\cos x}(\sin x) + 9\log_{\cos x}(\cot x)$ and

$P_{77}(x) = 7\log_{\cos x}(\sin x) + \left(7\log_{\cos x}(\cot x)\right]$

On the basis of above information, answer the following questions :

If $P_{34}(x) = P_{22}(x)$, then the value of sin x is expressed as $\left(\frac{\sqrt{q} - 1}{p}\right)$, then (p+q) equals

A. 3

B. 4

C. 7

D. 9

Answer: C

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6. If $7\theta = (2n + 1)\pi$, where $n = 0, 1, 2, 3, 4, 5, 6$, then answer the following questions.

The equations whose roots are $\cos. \frac{\pi}{7}, \cos. \frac{3\pi}{7}, \cos. \frac{5\pi}{7}$ is

A. $8x^2 + 4x^2 + 4x + 1 = 0$

B. $8x^3 - 4x^2 - 4x - 1 = 0$

C. $8x^3 - 4x^2 - 4x - 1 = 0$

D. $8x^3 + 4x^2 + 4x - 1 = 0$

Answer: B

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7. If $7\theta = (2n + 1)\pi$, where $n = 0, 1, 2, 3, 4, 5, 6$, then answer the following questions.

The value of $\sec. \frac{\pi}{7} + \sec. \frac{3\pi}{7} + \sec. \frac{5\pi}{7}$ is

A. 4

B. -4

C. 3

D. -3

Answer: A

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8. If $7\theta = (2n+1)\pi$, where $n = 0, 1, 2, 3, 4, 5, 6$, then answer the following questions.

The value of $\sec^2.\frac{\pi}{7} + \sec^2.\frac{3\pi}{7} + \sec^2.\frac{5\pi}{7}$ is

A. -24

B. 80

C. 24

D. -80

Answer: C

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9. If $1 + 2\sin x + 3\sin^2 x + 4\sin^3 x + \ldots$ upto infinite terms = 4 and number of solutions of the equation in $\left[\frac{-3\pi}{2}, 4\pi\right]$ is k.

The value of k is equal to

A. 4

B. 5

C. 6

D. 7

Answer: B

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10. If $1 + 2\sin x + 3\sin^2 x + 4\sin^3 x + \ldots$ upto infinite terms = 4 and number of solutions of the equation in $\left[\frac{-3\pi}{2}, 4\pi\right]$ is k.

The value of $\left|\frac{\cos 2x - 1}{\sin 2x}\right|$ is equal to

A. 1

B. $\sqrt{3}$

C. $2 - \sqrt{3}$

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

Answer: D

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11. If $1 + 2\sin x + 3\sin^2 x + 4\sin^3 x + \ldots$ upto infinite terms = 4 and number of solutions of the equation in $\left[\frac{-3\pi}{2}, 4\pi\right]$ is k.

Sum of all internal angles of a k-sided regular polygon is

A. 5π

B. 4π

C. 3π

D. 2π

Answer: C

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12. α is a root of equation $(2\sin x - \cos x)(1 + \cos x) = \sin^2 x$, β is a root of the equation $3\cos 2x - 10\cos x + 3 = 0$ and γ is a root of the equation $1 - \sin 2x = \cos x - \sin x : 0 \le \alpha, \beta, \gamma, \le \pi/2$

$\cos\alpha + \cos\beta + \cos\gamma$ can be equal to

A. $\dfrac{3\sqrt{6} + 2\sqrt{2} + 6}{6\sqrt{2}}$

B. $\dfrac{3\sqrt{3} + 8}{6}$

C. $\dfrac{3\sqrt{3} + 2}{6}$

D. None of these

Answer: B

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13. α is a root of equation $(2\sin x - \cos x)(1 + \cos x) = \sin^2 x$, β is a root of the equation $3\cos 2x - 10\cos x + 3 = 0$ and γ is a root of the equation $1 - \sin 2x = \cos x - \sin x : 0 \le \alpha, \beta, \gamma, \le \pi/2$

$\sin(\alpha - \beta)$ is equal to

A. 1

B. 0

C. $\frac{1 - \sqrt{6}}{6}$

D. $\frac{\sqrt{3} - 2\sqrt{2}}{6}$

Answer: C

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Exercise (Matching Type Questions)

1. Match the following Column I and Column II

	Column I		Column II
(A)	If $\theta + \phi = \frac{\pi}{2}$, where θ and ϕ are positive, then $(\sin\theta + \sin\phi)\sin\left(\frac{\pi}{4}\right)$ is always less than	(p)	1
(B)	If $\sin\theta - \sin\phi = a$ and $\cos\theta + \cos\phi = b$, then $a^2 + b^2$ cannot exceed	(q)	2
(C)	If $3\sin\theta + 5\cos\theta = 5$, $(\theta \neq 0)$ then the value of $5\sin\theta - 3\cos\theta$ is	(r)	3
		(s)	4
		(t)	5

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2. Match the following Column I and Column II

Column I	Column II
(A) If maximum and minimum values of $\frac{7 + 6\tan\theta - \tan^2\theta}{(1 + \tan^2\theta)}$ for all real values of $\theta \sim \frac{\pi}{2}$ are λ and μ respectively, then	(p) $\lambda + \mu = 2$
(B) If maximum and minimum values of $5\cos\theta + 3\cos\left(\theta + \frac{\pi}{3}\right) + 3$ for all real values of θ are λ and μ respectively, then	(q) $\lambda - \mu = 6$
(C) If maximum and minimum values of $1 + \sin\left(\frac{\pi}{4} + \theta\right) + 2\cos\left(\frac{\pi}{4} - \theta\right)$ for all real values of θ and λ and μ respectively, then	(r) $\lambda + \mu = 6$
	(s) $\lambda - \mu = 10$
	(t) $\lambda - \mu = 14$

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3. Match the following Column I and Column II

Column I		Column II
(A) The number of solutions of the equation $\lvert \cot x \rvert = \cot x + \frac{1}{\sin x}$ $(0 < x < \pi)$ is	(p)	no solution
(B) If $\sin\theta + \sin\phi = \frac{1}{2}$ and $\cos\theta + \cos\phi = 2$, then value of $\cot\left(\frac{\theta+\phi}{2}\right)$ is	(q)	$\frac{1}{3}$
(C) The value of $\sin^2\alpha + \sin\left(\frac{\pi}{3}-\alpha\right)\sin\left(\frac{\pi}{3}+\alpha\right)$ is	(r)	1
(D) If $\tan\theta = 3\tan\phi$, then maximum value of $\tan^2(\theta-\phi)$ is	(s)	2
	(t)	4

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Exercise (Single Integer Answer Type Questions)

1. In a

$$\Delta ABC, \frac{1}{1+\tan^2\left(\frac{A}{2}\right)} + \frac{1}{1+\tan^2\left(\frac{B}{2}\right)} + \frac{1}{1+\tan^2\left(\frac{C}{2}\right)} = k\left[1+\sin\left(\frac{A}{2}\right)\sin\left(\frac{B}{2}\right)\sin\right.$$

then the value of k is

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2. If $\frac{\sin\alpha}{\sin\beta} = \frac{\cos\gamma}{\cos\delta}$, *then* $\frac{\sin\left(\frac{\alpha - \beta}{2}\right)\cdot\cos\left(\frac{\alpha + \beta}{2}\right)\cdot\cos\delta}{\sin\left(\frac{\delta - \gamma}{2}\right)\cdot\sin\left(\frac{\delta + \gamma}{2}\right)\cdot\sin\beta}$ is equal to

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3. Find the exact value of the expression $\tan\left(\frac{\pi}{20}\right) - \tan\left(\frac{3\pi}{20}\right) + \tan\left(\frac{5\pi}{20}\right) - \tan\left(\frac{7\pi}{20}\right) + \tan\left(\frac{9\pi}{20}\right)$.

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4. Let $x = \frac{\sum_{n=1}^{44}\cos n^\circ}{\sum_{n=1}^{44}\sin n^\circ}$, find the greatest integer that does not exceed.

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5. Find θ (in degree) satisfying the equation, $\tan 15^\circ \cdot \tan 25^\circ \cdot \tan 35^\circ = \tan\theta$, where $\theta \in \left(0, 45^\circ\right)$

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6. Find the exact value of $\operatorname{cosec} 10^\circ + \operatorname{cosec} 50^\circ - \operatorname{cosec} 70^\circ$.

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7. If $\cos 5\alpha = \cos^5\alpha$, where $\alpha \in \left(0, \frac{\pi}{2}\right)$ then find the possible values of $\left(\sec^2\alpha + \operatorname{cosec}^2\alpha + \cot^2\alpha\right)$.

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8. $\tan^2\left(\frac{\pi}{16}\right) + \tan^2\left(\frac{2\pi}{16}\right) + \tan^2\left(\frac{3\pi}{16}\right) \ldots\ldots\ldots + \tan^2\left(\frac{7\pi}{16}/\right) = 35$

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9. Compute the square of the value of the expression $\frac{4+\sec 20^\circ}{\operatorname{cosec} 20^\circ}$

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10. In ΔABC, if $\frac{\sin A}{3}=\frac{\cos B}{3}=\frac{\tan C}{2}$, then the value of

$\left(\frac{\sin A}{\cot 2A}+\frac{\cos B}{\cot 2B}+\frac{\tan C}{\cot 2C}\right)$ is

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11. It f and g be function defined by $f(\theta)=\cos^2\theta$ and $(\theta)=\tan^2\theta$, suppose α and β satisfy $2f(\alpha)-g(\beta)=1$, then value of $2f(\beta)-g(\alpha)$ is

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12. If sum of the series

$$1 + x\log\left|\frac{1 - \sin x}{\cos x}\right|\left(\frac{1 + \sin x}{\cos x}\right)^{1/2} + x^2\log\left|\frac{1 - \sin x}{\cos x}\right|\left(\frac{1 + \sin x}{\cos x}\right)^{1/4} + \dots\infty$$

(wherever defined) is equal to $\frac{k(1 - x)}{(2 - x)}$, then k is equal to

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13. If $9\frac{x}{\cos\theta} + 5\frac{y}{\sin\theta} = 56$ and $9x\frac{\sin\theta}{\cos^2\theta} - 5y\frac{\cos\theta}{\sin^2\theta} = 0$ then value of $\frac{\left[(9x)^{\frac{2}{3}} + (5y)^{\frac{2}{3}}\right]^3}{784}$ is

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14. The angle A of the ΔABC is obtuse. $x = 2635 - \tan B \tan C$, if $[x]$ denotes the greatest integer function, the value of $[x]$ is

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15. If $\cos 36^\circ + \cot\left(7\frac{1}{2}^\circ\right) = \sqrt{n_1} + \sqrt{n_2} + \sqrt{n_3} + \sqrt{n_1} + \sqrt{n_5} + \sqrt{n_6}$, then the value of $\sum_{i=1}^{6} n_i^2$ must be

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16. If $\sin^2 A = x$ and $\Pi_{r=1}^{4}\sin(rA) = ax^2 + bx^3 + cx^4 + dx^5$, then the value of $10a - 7b + 15c - 5d$ must be

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17. 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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18. The least degree of a polynomial with integer coefficient whose one of the roots may be $\cos 12^\circ$ is

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19. If $A+B+C=180^\circ$, $\frac{\sin 2A+\sin 2B+\sin 2C}{\sin A+\sin B+\sin C}=k\sin.\frac{A}{2}\sin.\frac{B}{2}\sin.\frac{C}{2}$ then the value of $3k^3+2k^2+k+1$ is equal to

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20. 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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21. In any ΔABC, then minimum value of

$2020\sum\frac{\sqrt{(\sin A)}}{\left(\sqrt{(\sin B)}+\sqrt{(\sin C)}-\sqrt{(\sin A)}\right)}$ must be

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22. If $\sin\theta + \sin^2\theta + \sin^3\theta = 1$ then value of $\cos^6\theta - 4\cos^4\theta + 8\cos^2\theta$ is

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23.

$$16\left(\cos\theta - \frac{\cos\pi}{8}\right)\left(\cos\theta - \frac{\cos(3\pi)}{8}\right)\left(\cos\theta - \frac{\cos(5\pi)}{8}\right)\left(\cos\theta - \frac{\cos(7\pi)}{8}\right) = \lambda\cos4\theta,$$

then the value of λ is _____.

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24. If $\dfrac{1}{\sin20^\circ} + \dfrac{1}{\sqrt{3}\cos20^\circ} = 2k\cos40^\circ$, then $18k^4 + 162k^2 + 369$ is divisible by

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Exercise (Subjective Type Questions)

1. Prove that, $\cot 7\frac{1}{2}^\circ$ or $\tan 82\frac{1}{2}^\circ = (\sqrt{3}+\sqrt{2})(\sqrt{2}+1)$ or $\sqrt{2}+\sqrt{3}+\sqrt{4}+\sqrt{6}$

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2. If $m\sin(\alpha+\beta)=\cos(\alpha-\beta)$, prove that

$$\frac{1}{1-m\sin 2\alpha}+\frac{1}{1-m\sin 2\beta}=\frac{2}{1-m^2}.$$

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3. If $\alpha+\beta+\gamma=\pi$ and $\tan\left(\frac{\beta+\gamma-\alpha}{4}\right)\tan\left(\frac{\gamma+\alpha-\beta}{4}\right)\tan\left(\frac{\alpha+\beta-\gamma}{4}\right)=1.$

Prove that $1+\cos\alpha+\cos\beta+\cos\gamma=0$

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4. The set of values of a for which the equation $\sin^4 x+\cos^4 x=a$ has a solution is

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5. If a and b are positive quantities, $(a > b)$ find minimum positive value of $(a\sec\theta - b\tan\theta)$

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6. If a, b, c and k are real constants and α, β, γ are variables subject to the condition that $a\tan\alpha + b\tan\beta + c\tan\gamma = k$, then prove using vectors that $\tan^2\alpha + \tan^2\beta + \tan^2\gamma \geq \dfrac{k^2}{a^2 + b^2 + c^2}$

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7. If $\dfrac{x}{\tan(\theta + \alpha)} = \dfrac{y}{\tan(\theta + \beta)} = \dfrac{z}{\tan(\theta + \gamma)}$, then show that $\sum \dfrac{x + y}{x - y}\sin^2(\alpha - \beta) = 0$

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8. Let

$f(x) = \cos\left(a_1 + x\right) + \frac{1}{2}\cos\left(a_2 + x\right) + \frac{1}{2^2}\cos\left(a_1 + x\right) + \; + \frac{1}{2^{n-1}}\cos\left(a_n + x\right)$

where $a\Big)1, a_2 a_n \in R^{\cdot}$ If $f\left(x_1\right) = f\left(x_2\right) = 0, then\left|x_2 - x_1\right|$ may be equal to π

(b) 2π (c) 3π (d) $\frac{\pi}{2}$

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9. Eliminate θ from the equations

$\tan(n\theta + \alpha) - \tan(n\theta + \beta) = x$ and

$\cot(n\theta + \alpha) - \cot(n\theta + \beta) = y.$

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10. If $\{\sin(\alpha - \beta) + \cos(\alpha + 2\beta)\sin\beta\}^2 = 4\cos\alpha\sin\beta(\alpha + \beta).$

Then, prove that $\tan\alpha + \tan\beta = \frac{\tan\beta}{\left(\sqrt{2}\cos\beta - 1\right)^2}, \alpha\beta \in (0, \pi/4).$

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11. If A, B, C are the angle of a triangle and

$$\begin{vmatrix} \sin A & \sin B & \sin C \\ \cos A & \cos B & \cos C \\ \cos^3 A & \cos^3 B & \cos^3 C \end{vmatrix} = 0,$$ then show that ΔABC is an isosceles.

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12. In any ΔABC, prove that

$$\Sigma \frac{\sqrt{\sin A}}{\sqrt{\sin B} + \sqrt{\sin C} - \sqrt{\sin A}} \geq 3$$

and the equality holds if and only if triangle is equilateral.

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13. If $2(\cos(\alpha - \beta) + \cos(\beta - \gamma) + \cos(\gamma - \alpha) + 3 = 0$, prove that

$$\frac{d\alpha}{\sin(\beta + \theta)\sin(\gamma + \theta)} + \frac{d\beta}{\sin(\alpha + \beta)\sin(\beta + \theta)} + \frac{d\gamma}{\sin(\alpha + \theta)\sin(\beta + \theta)} = 0,$$

where, $'\theta'$ is any real angle such that $\alpha + \theta, \beta + \theta, \gamma + \theta$ are not the multiple of π.

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14. If the quadratic equation

$4^{\sec^2\alpha}x^2 + 2x + \left(\beta^2 - \beta + \frac{1}{2}\right) = 0$ have real roots, then find all the possible values of $\cos\alpha + \cos^{-1}\beta$.

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15. If $\cos 2\theta = x + \frac{1}{x}$, prove that $2\cos 3\theta = x^3 + \frac{1}{x^3}$

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16. If $\frac{\cos\theta_1}{\cos\theta_2} + \frac{\sin\theta_1}{\sin\theta_2} = \frac{\cos\theta_0}{\cos\theta_2} + \frac{\sin\theta_0}{\sin\theta_2} = 1$, where θ_1 and θ_0 do not differ by can even multiple of π, prove that

$$\frac{\cos\theta_1 \cdot \cos\theta_0}{\cos^2\theta_2} + \frac{\sin\theta_1 \cdot \sin\theta_0}{\sin^2\theta_2} = -1$$

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17. Prove that

$$\sum_{k=1}^{n-1} {}^{n}C_k[\cos kx.\cos(n+k)x+\sin(n-k)x.\sin(2n-k)x]=\left(2^n-2\right)\cos nx.$$

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18. Determine all the values of x in the interval $x \in [0, 2\pi]$ which satisfy the inequality

$$2\cos x \leq \left|\sqrt{1+\sin 2x}-\sqrt{1-\sin 2x}\right| \leq \sqrt{2}.$$

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19. Total number of solution for the equation $x^2-3\left[\sin\left(x-\frac{\pi}{6}\right)\right]=3$ is _____(where [.] denotes the greatest integer function)

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20. In aΔABC, prove that

$\Sigma_{r=0}^{n}{}^{n}C_{r}a^{r}b^{n-r}\cos(rB - (n - r)A) = c^{n}$.

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21. Resolve $Z^{5} + 1$ into linear & quadratic factors with real coefficients.

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22. Prove that the roots of the equation

$8x^{2} - 4x^{2} - 4x + 1 = 0$ are $\cos.\frac{\pi}{7}, \cos.\frac{3\pi}{7}, \cos.\frac{5\pi}{7}$ and hence, show that $\sec.\frac{\pi}{7} + \sec.\frac{3\pi}{7} + \sec.\frac{5\pi}{7} = 4$ and deduce the equation whose roots are $\tan^{2}.\frac{\pi}{7} + \sec.\frac{3\pi}{7} + \sec.\frac{5\pi}{7} = 4$ and deduce the equation whose roots are $\tan^{2}.\frac{\pi}{7}, \tan^{2}.\frac{3\pi}{7}, \tan^{2}.\frac{5\pi}{7}$.

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Exercise (Questions Asked In Previous 13 Years Exam)

1. 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. $\sqrt{3}\tan\left(\frac{\alpha}{2}\right) - \tan\left(\frac{\beta}{2}\right) = 0$

B. $\tan\left(\frac{\alpha}{2}\right) - \sqrt{3}\tan\left(\frac{\beta}{2}\right) = 0$

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: B::C

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2. Let $-\frac{1}{6} < \theta < -\frac{\pi}{12}$ Suppose α_1 and β_1, are the roots of the equation $x^2 - 2x\sec\theta + 1 = 0$ and α_2 and β_2 are the roots of the equation $x^2 + 2x\tan\theta - 1 = 0$. If $\alpha_1 > \beta_1$ and $\alpha_2 > \beta_2$, then $\alpha_1 + \beta_2$ equals

A. $2(\sec\theta - \tan\theta)$

B. $2\sec\theta$

C. $-2\tan\theta$

D. 0

Answer: C

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

C. $2\left(\sqrt{3} - 1\right)$

D. $2\left(2 + \sqrt{3}\right)$

Answer: C

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4. 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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5. The number of all possible values of θ, where $0<\theta<\pi$, for which the system of equations

$(y+z)\cos 3\theta=(xyz)\sin 3\theta$, $x\sin 3\theta=\frac{2\cos 3\theta}{y}+\frac{2\sin 3\theta}{z}$ and $(xyz)\sin 3\theta=(y+2z)\text{co}$

have a solution $\left(x_0,y_0,z_0\right)$ wiith $y_0z_0\neq 0$ is

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6. For $0 < \theta < \frac{\pi}{2}$, the solution (s) of

$$\sum_{m=1}^{6} \operatorname{cosec}\left(\theta + \frac{(m - 1)\pi}{4}\right)\operatorname{cosec}\left(\theta + \frac{m\pi}{4}\right) = 4\sqrt{2}$$ is/are

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

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

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

D. $\frac{5\pi}{12}$

Answer: C::D

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7. If $\frac{\sin^4 x}{2} + \frac{\cos^4 x}{3} = \frac{1}{5}$ then

A. $\tan^2 x = \frac{2}{3}$

B. $\frac{\sin^8 x}{8} + \frac{\cos^8 x}{27} = \frac{1}{125}$

C. $\tan^2 x = \frac{1}{3}$

D. $\frac{\sin^8 x}{8} + \frac{\cos^8 x}{27} = \frac{2}{125}$

Answer: B

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8. Let

$\theta \in \left(0, \frac{\pi}{4}\right)$ and $t_1 = (\tan\theta)^{\tan\theta}, t_2 = (\tan\theta)6(\cot\theta), t_3 = (\cot\theta)^{\tan\theta}$ and $t_4 = (\cot\theta$

then

A. $t_1 > t_2 > t_3 > t_4$

B. $t_4 > t_3 > t_1 > t_2$

C. $t_3 > t_1 > t_2 > t_4$

D. $t_2 > t_3 > t_1 > t_4$

Answer: B

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9. $\cos(\alpha - \beta) = 1 and \cos(\alpha + \beta) = \frac{l}{e}$, where $\alpha, \beta\mu \in [-\pi, \pi]$. Number of pairs of α, β which satisfy both the equations is 0 (b) 1 (c) 2 (d) 4

A. 0

B. 1

C. 2

D. 4

Answer: D

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10. If $5\left(\tan^2 x - \cos^2 x\right) = 2\cos 2x + 9$, then the value of cos4x is

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

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

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

D. $-\frac{7}{9}$

Answer: D

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11. Let $f_k(x) = \frac{1}{k}\left(\sin^k x + \cos^k x\right)$ where $x \in \mathbb{R}$ and $k \geq 1$. Then $f_4(x) - f_6(x)$ equals

A. $\frac{1}{6}$

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

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

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

Answer: D

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12. The expression $\frac{\tan A}{1 - \cot A} + \frac{\cot A}{1 - \tan A}$ can be written as (1) $secAcosecA + 1$

(2) $tanA + \cot A$ (3) $secA + \cos ecA$ (4) $s \in A\cos A + 1$

A. sin A cos A + 1

B. sec A cosec A + 1

C. tan A + cot A

D. sec A + cosec A

Answer: B

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13. If a ΔPQR if$3\sin P + 4\cos Q = 6$ and $4\sin Q + 3\cos P = 1$, then$\angle R$ 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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14. If $A = \sin^2 x + \cos^4 x$, then for all real x :

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

B. $1 \leq A \leq 2$

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

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

Answer: D

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

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

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

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

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

Answer: B

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16. If $\cos\alpha + \cos\beta + \cos\gamma = 0 = \sin\alpha + \sin\beta + \sin\gamma$, then which of the following is/are true:- (a)$\cos(\alpha - \beta) + \cos(\beta - \gamma) + \cos(\gamma - \delta) = -\frac{3}{2}$ (b) $\cos(\alpha - \beta) + \cos(\beta - \gamma) + \cos(\gamma - \delta) = -\frac{1}{2}$ (c) $\sum \cos 2\alpha + 2\cos(\alpha + \beta) + 2\cos(\beta + \gamma) + 2\cos(\gamma + \alpha) = 0$ (d) $\sum \sin 2\alpha + 2\sin(\alpha + \beta) + 2\sin(\beta + \gamma) + 2\sin(\gamma + \alpha) = 0$

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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17. A triangular park is enclosed on two sides by a fence and on the third side by a straight river bank. Two having fence are of same length x. The maximum area enclosed by the park is :-

A. $\frac{\sqrt{x^3}}{8}$

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

C. πx^2

D. $\frac{3}{2}x^2$

Answer: B

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18. If $0 < x < \pi$ and $\cos x + \sin x = \frac{1}{2}$, then tan x is

A. $\frac{(4 - \sqrt{7})}{3}$

B. $-\frac{(4 + \sqrt{7})}{3}$

C. $\frac{(1 + \sqrt{7})}{4}$

D. $\frac{(1 - \sqrt{7})}{4}$

Answer: B

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19. In ΔPQR , $\angle R = \frac{\pi}{4}$, $\tan\left(\frac{P}{3}\right)$, $\tan\left(\frac{Q}{3}\right)$ are the roots of the equation $ax^2 + bx + c = 0$, then

A. $b = a + c$

B. $b = c$

C. $c = a + b$

D. $a = b + c$

Answer: C

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