MATHS

BOOKS - ARIHANT MATHS

TRIGONOMETRIC FUNCTIONS AND IDENTITIES

Example

1. Convert $40^{o}20'$ 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 $\frac{5\pi}{6}$, Find x.

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9. Find the product of (x + 3) (x + 4)

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10. In the circle of 5cm.radius, what is the length of the arc 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 read print to such distance that the letters subtend and angle of 5 at his eye, find 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) $\sin^8 A - \cos^8 A = \left(\sin^2 A - \cos^2 A\right)\left(1 - 2\sin^2 A.\cos^2 A\right)$

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

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17. Prove that $\frac{\sin^2 A}{\cos^2 A} + \frac{\cos^2 A}{\sin^2 A} = \frac{1}{\sin^2 A \cos^2 A} - 2$.

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

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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 $\cos ec\theta - \sin\theta = m$ and $\sec\theta - \cos\theta = n$ eliminate θ

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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 $x = \sec\theta - \tan\theta and y = \cos ec\theta + \cot\theta$, then prove that $xy + 1 = y - x$

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26. If $x = r\sin\theta\cos\phi, y = r\sin\theta\sin\phi$ and $z = r\cos\theta, then x^2 + y^2 + z^2$ is independent of $(a)\theta, \phi$ (b) r, θ (c) r, ϕ (d) r

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27. For 0ltphilt(pi)/(2)" if " x=sum_(n=0)^(oo)cos^(2n) phi,y=sum_(n=0)^(oo)sin^(2n)phi" and "z=sum_(n=0)^(oo)cos^(2n)phisin^(2n)phi`, then

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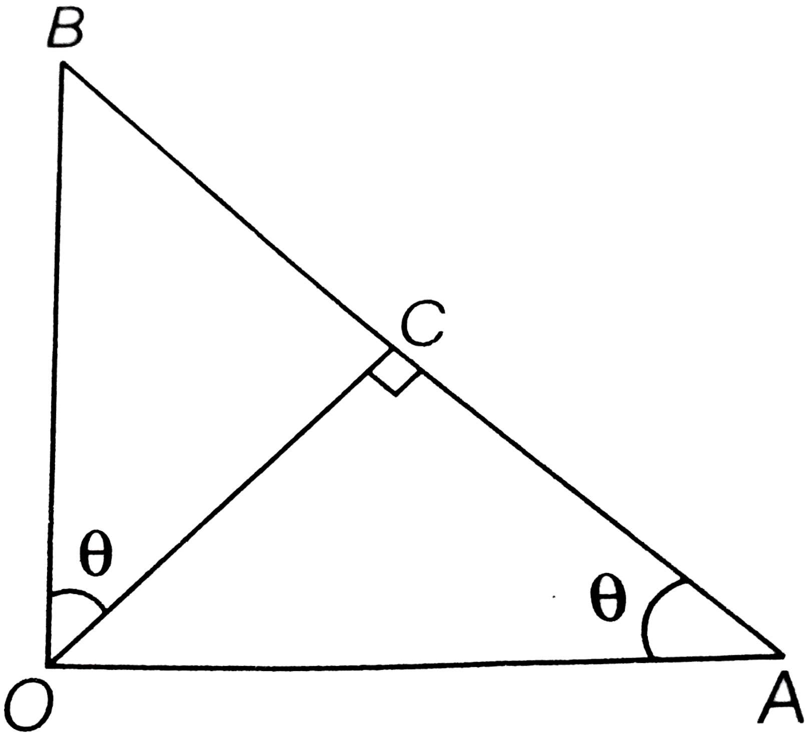
28. If in given fig, $\tan(\angle BAO) = 3$, then find the ratio $BC : CA$



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

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31. Let $PQandRS$ be tangent at the extremities of the diameter PR of a circle of radius r. If $PSandRQ$ intersect at a point X on the circumference of the circle, then prove that $2r = \sqrt{PQxRS}$.

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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.

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33. If $\sin\theta = \frac{12}{13}$ *and* θ 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?

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

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40. Prove that: $2\sin^2\frac{\pi}{6} + cosec^2\frac{7\pi}{6}\cos^2\frac{\pi}{3} = \frac{3}{2}$

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41. Prove that: $\cot^2\frac{\pi}{6} + cosec\frac{5\pi}{6} + 3\tan^2\frac{\pi}{6} = 6$

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

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43. Prove that $\frac{\cos\left(90^0 + \theta\right)\sec(-\theta)\tan\left(180^0 - \theta\right)}{\sec\left(360^0 - \theta\right)\sin\left(180^0 + \theta\right)\cot\left(90^0 - \theta\right)} = -1$

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44. The value of $\left(\tan 1^{\circ} \tan 2^{\circ} \tan 3^{\circ} \ldots \ldots \tan 89^{\circ}\right)$ is

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

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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: $\tan 105^0$

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

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49. If $A + B = 45°$, show that $(1 + \tan A)(1 + \tan B) = 2.$

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50. Find the value of $\frac{\tan 495°}{\cot 855°}$

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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: $\cos 18^0 - \sin 18^0 = \sqrt{2}\sin 27^0$

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53. The value of $\cot\left(\frac{\pi}{4}+\theta\right)\cot\left(\frac{\pi}{4}-\theta\right)$ is

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54. If $\sin\alpha\sin\beta - \cos\alpha\cos\beta + 1 = 0,$ 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. Value of $\tan 75^\circ + \cot 75^\circ = ?$

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

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

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

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

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

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62. If $\sin(A-B)=\frac{1}{\sqrt{10,}}\cos(A+B)=\frac{2}{\sqrt{29}}$

findthe value of tan2A where A and B lies between 0 and $\frac{\pi}{4}$

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

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

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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

$\sum_{r=1}^{8} \tan(rA)\tan((r+1)A)$.

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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 $\cos\alpha = \frac{1}{2}\left(x + \frac{1}{x}\right)$ and $\cos\beta = \frac{1}{2}\left(y + \frac{1}{y}\right)$, $(xy > 0), x, y, \alpha, \beta, \in R$then

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

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

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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. Find the value of x , if $64 \times (512)^2 = x^8$

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77. Find the value of $\left[\left\{\left(-\frac{3}{8}\right)^2\right)\right\}^0]^7$

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

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79. If $\sin A = \frac{3}{5}$, where $0^\circ < A < 90^\circ$, 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+2cos8theta)))=2costheta,0

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84. Show that $\sqrt{3}\,\text{cosec}\,20^0 - \sec 20^0 = 4.$

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

(a)1/4 (b) 3/4 (c) 1/8 (d) 3/8

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

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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 $\sin A = \frac{12}{13}$ and $\sin B = \frac{4}{5}$, where $\frac{\pi}{2} < A < \pi$ and $0 < B < \frac{\pi}{2}$ find the following :

$\sin(A + B)$

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90. Find the value of $\frac{3^n \times 3^{2n+1}}{3^{2n} \times 3^{n-1}}$

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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 $\tan \frac{\pi}{8}$.

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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 $\cos\theta = \dfrac{\cos\alpha - \cos\beta}{1 - \cos\alpha\cos\beta}$, prove that $\dfrac{\tan\theta}{2} = \pm\dfrac{\tan\alpha}{2}\dfrac{\cot\beta}{2}$.

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99. Prove that $4\cos 6^\circ \cos 42^\circ \cos 66^\circ \cos 78^\circ = \dfrac{1}{4}$.

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100. Prove that :

$$\sin\frac{\pi}{5}\sin\frac{2\pi}{5}\sin\frac{3\pi}{5}\sin\frac{4\pi}{5} = \frac{5}{16}.$$

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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. Q. Let n be an odd integer if $\sin n\theta = \sum_{r=0}^{n}\left(b_r\right)\sin^r\theta$, for every value of theta then, a. $b_0 = 1, b_1 = 3$ b. $b_0 = 0, b_1 = 1$ c. $b_0 = -1, b_1 = 1$ d.

$b_0 = 0, b_1 = 2$

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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. Suppose $\sin^3 x \sin 3x = \sum^{n} m = 0 C_m \cos mx$ is an identity in x ,

where $C_0, \ldots. C_n$ are constant and $C_n \neq 0$ then the value of n is _________

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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

$\frac{\sin\pi}{n} + \frac{\sin(3\pi)}{n} + \frac{\sin(5\pi)}{n} + \ldots\ldots\ldots$ to n terms =

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110. 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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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

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

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115. Find the maximum value of $1 + \sin\left(\frac{\pi}{4} + \theta\right)$

$+2\cos\left(\frac{\pi}{4} - \theta\right)$ for all real values of θ.

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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 $f(x) = \dfrac{\sin(3x)}{\sin x}, x \neq n\pi,$

then the range of values of f(x) for real values of x is

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119. If $\tan\frac{\alpha}{2}$ and $\tan\frac{\beta}{2}$ are the roots of the equation

$8x^2 - 26x + 15 = 0,$ then find the value of

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

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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 α and $\operatorname{cosec}\alpha$ 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. The number of values of x in the in interval $[0, 5\pi]$ satisfying the equation $3\sin^2 x$ - $7\sin x + 2 = 0$ is 0 (b) 5 (c) 6 (d) 10

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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 $f(x) = \frac{\tan^2 x + 4\tan x + 9}{1 + \tan^2 x}$, 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. $\cos ec(1^\circ)$

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

D. None of these

Answer: B

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134. The 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 $f(\theta) = \frac{1 - \sin 2\theta + \cos\theta\theta}{2\cos 2\theta}$, then value of $f(11^\circ) \cdot f(34^\circ)$ is ________

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

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

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

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 $\left[0, \frac{\pi}{3}\right]$ (b) $\left(\frac{\pi}{3}, \frac{\pi}{3}\right)$ (c) $\left[\frac{3\pi}{4}, \pi\right]$ (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.)

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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

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 $\theta_1, \theta_2, \ldots., \theta_n \in \left(0, \frac{\pi}{2}\right)$, if $\ln\left(\sec\theta_1 - \tan\theta_1\right) + \ln\left(\sec\theta_2 - \tan\theta_2\right) + \ldots\ldots$ $+ \ln\left(\sec\theta_n - \tan\theta_n\right) + \ln\pi = 0$, then the value of $\cos\left(\left(\sec\theta_1 + \tan\theta_1\right)\left(\sec\theta_2 + \tan\theta_2\right)\ldots.\left(\sec\theta_n + \tan\theta_n\right)\right)$ 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. $\operatorname{cos}ecS > \operatorname{cos}ecP$

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

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

$$\left(\sqrt{\sin^2 x - \sin x + \frac{1}{2}}\right) \cdot 2^{\sec^2 y} \le 1$$ is

A. 0

B. 16

C. infinite

D. 12

Answer: B

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145. The least values of $\operatorname{cosec}^2 x + 25\sec^2 x$ 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 (a)$\sin a, \sin b, \sin c$ (b) $\cos a, \cos b, \cos c$ (c)$\sin 2a, \sin 2b, \sin 2c$ (d) $\cos 2a, \cos 2b\cos 2c$

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. Q. Let n be an odd integer if $\sin n\theta = \sum_{r=0}^{n} \left(b_r\right)\sin^r\theta$, for every value of theta then, a. $b_0 = 1, b_1 = 3$ b. $b_0 = 0, b_1 = 1$ c. $b_0 = -1, b_1 = 1$ d. $b_0 = 0, b_1 = 2$

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 $f(x) = ab\sin x + b\sqrt{1 - a^2}\cos x + c$, lie in the interval (where $|a| < 1, b > 0$)

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. $\frac{\sin^3\theta - \cos^3\theta}{\sin\theta - \cos\theta} - \frac{\cos\theta}{\sqrt{1 + \cot^2\theta}} - 2\tan\theta\cot\theta = -1$ if $\theta \in \left(0, \frac{\pi}{2}\right)$ (b)

$\theta \in \left(\frac{\pi}{2}, \pi\right)$ $\theta \in \left(\pi, \frac{3\pi}{2}\right)$ (d) $\theta \in \left(\frac{3\pi}{2}, 2\pi\right)$

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

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

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

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

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

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 $S = \cos^2\left(\frac{\pi}{n}\right) + \cos^2\left(\frac{2\pi}{n}\right) + ... + \cos^2\left(\frac{(n-1)\pi}{n}\right)$, 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. $a + b + c + d = 1$

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. π

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

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

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

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. $k_2 = 2k_1$

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 restrictions $0 \le \alpha_1, \alpha_2..., \alpha_n \le \frac{\pi}{2}$ 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 n may belong to

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 $a = \frac{\sin\pi}{18} \sin 5\frac{\pi}{18} \frac{\sin(7\pi)}{18}$ 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) 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. $f\left(\frac{1}{4}\right) \leq A \leq f(0)$

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. Prove that $\cos\left(\frac{2\pi}{7}\right) + \cos\left(\frac{4\pi}{7}\right) + \cos\left(\frac{6\pi}{7}\right) = -\frac{1}{2}$

A. 1

B. -1

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

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

Answer: D

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165. Find the number of integral values of k for which the equation $7\cos x + 5\sin x = 2k + 1$ has at least one solution.

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. $-\frac{3}{2} \le y \le \frac{1}{2}$

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

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

D. None of these

Answer: D

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167. The distance between the two parallel lines is 1 unit. A pont '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

(a) $\frac{1}{2|b|}\sqrt{d^2 - a^2}$ (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. Find the set of values of $\lambda \in R$ such that $\tan^2\theta + \sec\theta = \lambda$ holds for some θ .

a. $(- \infty, 1]$

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

c. ϕ

d. $[1, \infty)$

A. $(- \infty, 1]$

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

C. ϕ

D. $[1, \infty)$

Answer: D

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170. For 0ltphilt(pi)/(2)" if " x=sum_(n=0)^(oo)cos^(2n) phi,y=sum_(n=0)^(oo)sin^(2n)phi" and "z=sum_(n=0)^(oo)cos^(2n)phisin^(2n)phi`, then

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 acute 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 $0 < \alpha < \frac{\pi}{6}$, than $\alpha(\operatorname{cosec}\alpha)$ 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 $0 \leq x \leq \pi$ and $\cos x = -\frac{4}{5}$ then $\cos\left(\frac{x}{2}\right)$ is equal to:

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. $cosec.\frac{2\pi}{7} + \cot.\frac{2\pi}{7}$

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 $y = \sec^2\theta + \cos^2\theta, \theta \neq 0$, then :

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 $\frac{\sqrt{3}-1}{\sin x} + \frac{\sqrt{3}+1}{\cos x} = 4\sqrt{2} is / are \frac{\pi}{12}$

(b) $\frac{5\pi}{12}$ (c) $\frac{7\pi}{24}$ (d) $\frac{11\pi}{36}$

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)?

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

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

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

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 $\dfrac{3}{4}$

A. the maximum value of y is 2

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

C. $y \leq 1$

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

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

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

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

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) is b, if c = 0

b. difference of maximum and minimum value of f(x) is 2b

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

d. $f(x) = c, \quad \text{if} \quad x = \cos^{-1}a$

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) $\dfrac{\sin\theta}{1 - \cos\phi}$

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194. Let A and B denote the statements

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

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

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. If (x - 2,y + 3) = (5,-6) , then find the value of x and y.

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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 $\sec\theta = \frac{(bc + ca + ab)}{\left(a^2 + b^2 + c^2\right)}$,

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. Simplify : $\dfrac{2^{15} \times 2^{5}}{2^{8}}$

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200. Find x , if $5^{2x} \times 5^{3} = 5^{6}$

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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 $n! = 1.2.........n,$ then $\tan\alpha\tan\beta, \tan\beta\tan\gamma, \tan\gamma\tan\alpha = 1$

Settlement 2 : $\tan\alpha\tan\beta + , \tan\beta\tan\gamma + , \tan\gamma\tan\alpha = 1$

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. Find x , if $\frac{2^{x-1} . 2^{4x+2}}{2^{3x-3}} = 64$

A.

B.

C.

D.

Answer: A

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205. if $\frac{5^9}{5^3} \times \frac{5^{15}}{5^3} = 5^m$

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206. Find the value of $\frac{3^0 \times 4^0 + 2^0 \times 3^0}{16^0}$

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

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

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

A. 0

B. 4

C. 5

D. 6

Answer: B

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

Find all values satisfying the equation

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

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

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

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

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

Answer: D

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210. 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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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 $\frac{x}{a\cos\theta} = \frac{y}{b\sin\theta}$ ...(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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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 $\tan\theta + \sin\theta = m$ 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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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 $\sin\theta + \cos\theta = a$ and $\sin^3\theta + \cos^3\theta = b$, 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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214. Express 32 × 10000000 in standard form.

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215. Find m , if $\dfrac{\left(\frac{3}{7}\right)^{9}}{\left(\frac{3}{7}\right)^{5}} = \left(\frac{3}{7}\right)^{\frac{3m+2}{m-2}}$

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216. Find x , if $800 \times \left(x^{3}\right)^{2} = 8 \times (10)^{8}$

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

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218. 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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219. 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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220. 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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221. Find x , if x = $\dfrac{\left(\frac{2}{3}\right)^4}{\left(\frac{2}{3}\right)^2}$

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222. In triangle ABC, $\frac{\sin A + \sin B + \sin C}{\sin A + \sin B - \sin C}$ is equal to $\frac{\tan A}{2}\frac{\cot B}{2}$ (b) $\frac{\cot A}{2}\frac{\tan B}{2}$ $\frac{\cot A}{2}\frac{\cot B}{2}$ (d) $\frac{\tan A}{2}\frac{\tan B}{2}$

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

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

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226. Usual form of $-4.8 \times (10)^8$ is?

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

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228. If $\sec A \tan B + \tan A \sec B = 91$, then the value of $(\sec A \sec B + \tan A \tan B)^2$ is equal to....

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229. 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 $\text{cosec}^2\theta$ is

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230. Find the value of t , if $\dfrac{9^0 \times 7^0}{(-1)^6} = 7^t$

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231. 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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232. 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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233. Given that $f(n\theta) = \dfrac{2\sin 2\theta}{\cos 2\theta - \cos 4n\theta}$, and $f(\theta) + f(2\theta) + f(3\theta) + \;\; + f(n\theta) = \dfrac{\sin\lambda\theta}{\sin\theta\sin\mu\theta}$, then the value of $\mu - \lambda$ is ______

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

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

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

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

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239. Find x in the following proportional :

15 : x = 7 : 14

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

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241. 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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242. Find x in the following proportional :

18 : x = 27 : 3

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

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

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246. In any ΔABC, $\frac{\tan\frac{A}{2} - \tan\frac{B}{2}}{\tan\frac{A}{2} + \tan\frac{B}{2}}$ is equal to:

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

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248. 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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249. Find x in the following proportional :

16 : 18 = x : 96

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250. Find x in the following proportion

x : 92 = 87 : 116

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251. Find x in the following proportion :

x : 6 = 55 : 11

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252. Find the product : $\frac{8}{2} \times \left(-\frac{5}{3}\right)$

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253. Find the product : $-\frac{7}{6} \times \frac{9}{10}$

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

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255. 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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256. 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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257. Find $\frac{dy}{dx}$ in the following

$x=a(1-\cos\theta), y=a(\theta+\sin\theta)$

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258. If A, B, C and D are angles of quadrilateral and $\frac{\sin(A)}{2}\frac{\sin(B)}{2}\frac{\sin(C)}{2}\frac{\sin(D)}{2} = \frac{1}{16}$, prove that $A = B = C = D = \frac{\pi}{2}$

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

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

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261. Prove that

$\tan^{-1}\frac{1}{2} + \tan^{-1}\frac{2}{11} = \tan^{-1}\frac{3}{4}$

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262. The value of $\sin^{-1}\left(\cos\frac{43\pi}{5}\right)$ is

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263. In any triangle ABC : If $\frac{\cos A}{a} = \frac{\cos B}{b}$, prove that the triangle is isosceles.

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Solved Examples Single Option Correct Type Questions

1. Find value of a , if $\left(\frac{6}{7}\right)^{a} \times \left(\frac{6}{7}\right)^{3a} = \frac{36}{49}$

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2. Find x in the following proportion :

8 : x :: 16 : 8

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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 post by a rope. If the horse moves along circular path always keeping the tight and describes 88m, when it has traced out 72° at centre, find the length of 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. If a train is moving on the circular path of 1500 m radius at the rate of 66km//h, find the angle in radian, if it has in 10 second.

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7. The diameter of an optical fibre is:

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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 read print to such distance that the letters subtend and angle of 5 at his eye, find the height of the letters that he can read at a distance of 12 metres.

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10. Why the direction of motion of a particle is given by its velocity and not by acceleration?

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Exercise For Session 2

1. Prove that

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

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2. If $\cos^2\alpha - \sin^2\alpha = \tan^2\beta$, 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 $a\cos\theta - b\sin\theta = c$, show that $a\sin\theta + b\cos\theta = \pm\sqrt{a^2 + b^2 - c^2}$.

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

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

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7. If $f_k(x) = \frac{1}{k}\left(\sin^k x + \cos^k x\right)$, where $x \in R$ and $k \le 1$, then $f_4(x) - f_0(x)$ is equal to

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8. 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) $\frac{\sin^8 x}{8} + \frac{\cos^8 x}{27} = \frac{2}{125}$

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

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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 $x\sin\theta = y\cos\theta$, prove that $x^2 + y^2 = 1$

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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 $\sin^2\theta = \frac{x^2 + y^2 + 1}{2x}$. 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. If $\frac{x}{a}\cos\theta + \frac{y}{b}\sin\theta = 1, \frac{x}{a}\sin\theta - \frac{y}{b}\cos\theta = 1$,' then prove that $\frac{x}{a^2}+\frac{y}{b^2}$=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 prove that $\frac{a^2}{b^2} = \frac{(d - a)(c - a)}{(b - c)(b - d)}$.

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9. If $a + b\tan\theta = \sec\theta$ and $b - a\tan\theta = 3\sec\theta$, then findthe 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 `sin θ.

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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. Find the values of the trigonometric function:- $\tan\frac{19\pi}{3}$

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2. Find the sign of $\sec 2000^{\circ}$

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3. $\cos 1^{\circ} + \cos 2^{\circ} + \cos 3^{\circ} + \ldots. + \cos 180^{\circ}$ 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 $S_n = \cos^n\theta + \sin^n\theta$ then find the value of $3S_4 - 2S_6$

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

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

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

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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 $3 tanA tanB = 1$, 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 $\cos(\alpha + \beta) = \frac{4}{5}$ and $\sin(\alpha - \beta) = \frac{5}{13}$, where α lie between 0 and $\frac{\pi}{4}$, then find that value of $\tan 2\alpha$.

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5. If $\alpha + \beta = \frac{\pi}{2} and \beta + \gamma = \alpha$, then $\tan\alpha$ equals

A. (a) $2(\tan\beta + \tan\gamma)$

B. (b) $\tan\beta + \tan\gamma$

C. (c) $\tan\beta + 2\tan\gamma$

D. (d) $2\tan\beta + \tan\gamma$

Answer: $\tan\beta + 2\tan\gamma$

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

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

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3. Prove that

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

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

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6. Prove that $\left(\frac{\cos A + \cos B}{\sin A - \sin B}\right)^n + \left(\frac{\sin A + \sin B}{\cos A - \cos B}\right)^n$ $= 2\cot^n\frac{A - B}{2}$ or 0, accordingly as n is even or odd.

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7. Prove that: $\left(1 + \cos.\frac{\pi}{8}\right)\left(1 + \cos.\frac{3\pi}{8}\right)\left(1 + \cos.\frac{5\pi}{8}\right)\left(1 + \cos.\frac{7\pi}{8}\right) = \frac{1}{8}$

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8. If in a triangle ABC, $\cos 3A + \cos 3B + \cos 3C = 1$, then one angle must be exactly equal to

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Exercise For Session 8

1. This question has statement which is true or false. 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 Il quadrant, then find the value of $\sin\left(\frac{x}{2}\right)$

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

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5. If $A = 2\sin^2\theta - \cos 2\theta$ 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. $\tan\theta + 2\tan 2\theta + 4\tan 4\theta + 8\cot 8\theta = \cot\theta$.

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9. $\cos\frac{2\pi}{15}\cos\frac{4\pi}{15}\cos\frac{8\pi}{15}\cos\frac{16\pi}{15} = \frac{1}{16}$

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10. If $\theta = \dfrac{\pi}{2^n + 1}$ prove that $2^n \cos\theta \cos 2\theta \cos 2^2\theta \ldots \cos 2^{n-1}\theta = 1$

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Exercise For Session 9

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

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

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

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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. Prove that $\sin 47^\circ + \sin 61^\circ - \sin 11^\circ - \sin 25^\circ = \cos 7^\circ$.

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6. If α and β are the solution of $a\cos\theta + b\sin\theta = c$, then

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7. If $\sin\alpha + \sin\beta = a$ 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 $\frac{\tan\theta}{2} = \pm\frac{\tan\alpha}{2}\frac{\tan\beta}{2}$

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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 $A + B + C = \pi$, then, find

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

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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

$\cos\theta(\sin B + \sin C) = \sin A$.

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3. In ΔABC,prove that:

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

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4. In any triangle, if $(\sin A + \sin B + \sin C)(\sin A + \sin B - \sin C) = 3\sin A\sin B$,

then the angle $\frac{C}{10}$ (in degree).

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

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

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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

(a) $\tan 3A + \tan 3B + \tan 3C = \tan 3A \tan 3B \tan 3C$

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

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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 $\sin\theta_1 + \sin\theta_2 + \sin\theta_3 = 3$ then find the value of $\cos\theta_1 + \cos\theta_2 + \cos\theta_3$.

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3. If $x = r\sin\theta\cos\phi, y = r\sin\theta\sin\phi$ and $z = r\cos\theta$, then $x^2 + y^2 + z^2$ is independent of

A. (a) θ, φ

B. (b) r, θ

C. (c) r, φ

D. (d) r

Answer:

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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 $\sec^2\theta + \cos ec^2\theta$ - 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 $t_1 = \tan\theta)^{\tan\theta}, t_2 = (\tan\theta)^{\cot\theta}, t_3 = (\cot\theta)^{\tan\theta}$ and $t_4 = (\cot\theta)^{\cot\theta}$, then show that $t_4 > t_3 > t_1 > t_2$.

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

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

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Exercise Single Option Correct Type Questions

1. Find the value of $\sum_{k=1}^{10}\left[\sin\left(\frac{2\pi k}{11}\right) - i\cos\left(\frac{2\pi k}{11}\right)\right], where i = \sqrt{-1}.$

A. 2

B. 1

C. 0

D. -1

Answer: B

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2. If $a^2 + 2a + \text{cosec}^2\left(\frac{\pi}{2}(a + x)\right) = 0$, then, find the values of a and x.

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

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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 $P = \left(\tan\left(3^{n+1}\theta\right) - \tan\theta\right)$ and $Q = \sum_{r=0}^{n} \frac{\sin\left(3^r\theta\right)}{\cos\left(3^{r+1}\theta\right)}$, then

A. $P = 2Q$

B. $P = 3Q$

C. $2P = Q$

D. $3P = Q$

Answer: A

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10. Find the value of

$\left(\cos^4 1^\circ + \cos^4 2^\circ + \cos^4 3^\circ + \ldots\ldots + \cos^4 179^\circ\right) - \left(\sin^4 1^\circ + \sin^4 2^\circ + \sin^4 3^\circ +$

.

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 $f_n(a) = \dfrac{\sin\alpha + \sin 3\alpha + \sin 5\alpha + \ldots + \sin(2n - 1)\alpha}{\cos\alpha + \cos 3\alpha + \cos 5\alpha + \ldots + \cos(2n - 1)\alpha}$ 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 $\left|\sin x + \cos x + \dfrac{\cos x + \sin x}{\cos^4 x - \sin^4 x}\right|$ is

A. 2

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

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. $a = b < c$

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. If 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. (a)$\tan A + \tan B + \tan C$

B. (b)$\cot A + \cos B + \cot C$

C. (c)$\cos A + \cos B + \cos C$

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

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

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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 $\cos\theta$ is equal

A. (a) -2

B. (b) - 1

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

D. (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 $real\theta$, 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

$\angle ADB = \theta, BC = p \text{ and } CD = q$, then AB is equal to

(a) $\dfrac{\left(p^2 + q^2\right)\sin\theta}{p\cos\theta + q\sin\theta}$

(b) $\dfrac{p^2 + q^2\cos\theta}{p\cos\theta + q\sin\theta}$

(c) $\dfrac{p^2 + q^2}{p^2\cos\theta + q^2\sin\theta}$

(d) $\dfrac{\left(p^2 + q^2\right)\sin\theta}{(p\cos\theta + \sin\theta)^2}$

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

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

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

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

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 $\cos\theta = \sin\beta / \sin\alpha, \cos\varphi = \sin\gamma\sin\alpha and \cos(\theta - \varphi) = \sin\beta\sin\gamma$, 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. None of these

Answer: B

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36. If $tan\beta = \dfrac{n\sin\alpha\cos\alpha}{1 - n\sin^2\alpha}$, show 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 $\frac{\cos\theta}{a} = \frac{\sin\theta}{b}, then \frac{a}{\sec 2\theta} + \frac{b}{\cos ec 2\theta}$ 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

$y = \cos x \cos(x + 2) - \cos^2(x + 1)$ 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 $\frac{v_n - v_{n-1}}{u_{n-1}} + \frac{1}{n}\frac{u_n}{v_n}$=`

A. a) 0

B. b) $\tan\theta$

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

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

Answer: C

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42. 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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43. 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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44. The maximum value of the function $f(x) = \sin\left(x + \frac{\pi}{6}\right) + \cos\left(x + \frac{\pi}{6}\right)$ in the interval $\left(0, \frac{\pi}{2}\right)$ occurs at (a) $\frac{\pi}{12}$ (b) $\frac{\pi}{6}$ (c) $\frac{\pi}{4}$ (d) $\frac{\pi}{3}$

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

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

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

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

Answer: A

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

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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46. 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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47. If $\cos x$ - $\sin\alpha\cot\beta\sin x = \cos\alpha$, then the value of $\tan(x/2)$ is

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

A. AP

B. GP

C. HP

D. None of these

Answer: A

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49. The maximum value of $(\cos\alpha_1)(\cos\alpha_2)...(\cos\alpha_n)$,

under the restrictions $0 \le \alpha_1, \alpha_2..., \alpha_n \le \frac{\pi}{2}$ 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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50. Find the set of values of x , which satisfy $\sin x \cdot \cos^3 x > \cos \cdot \sin^3 x, 0 \leq x \leq 2\pi$.

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

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

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

C. $(a + b)^2$

D. $(a - b)^2$

Answer: D

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52. For a positive integer n, let $f_n(\theta) = (\tan\theta/2)(1 + \sec\theta)(1 + \sec 2\theta)(1 + \sec 4\theta)\ldots\ldots\ldots\left(1 + \sec 2^n\theta\right)$. Then (a) $f_2\left(\frac{\pi}{16}\right) = 1$ (b) $f_3\left(\frac{\pi}{32}\right) = 1$ (c)$f_4\left(\frac{\pi}{64}\right) = 1$ (d) $f_5\left(\frac{\pi}{128}\right) = 1$

A. $f_2\left(\frac{\pi}{16}\right) = 1$

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. (a) $\frac{\pi}{6}$

B. (b) $\frac{5\pi}{6}$

C. (c) $\frac{7\pi}{6}$

D. (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. For 0ltphilt(pi)/(2)" if " x=sum_(n=0)^(oo)cos^(2n) phi,y=sum_(n=0)^(oo)sin^(2n)phi" and "z=sum_(n=0)^(oo)cos^(2n)phisin^(2n)phi`, then

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 $P(x)=\cot^2x\left(\frac{1+\tan x+\tan^2x}{1+\cot x+\cot^2x}\right)+\left(\frac{\cos x-\cos3x+\sin3x-\sin x}{2(\sin2x+\cos2x)}\right)^2.$

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

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

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

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

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

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

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

D. (d)none

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: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 $y = \text{cosec}\phi + \cot\phi$, then show that $xy + x - y + 1 = 0$.

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 $\tan\left(\frac{x}{2}\right) = \text{cosec}x - \sin x$, then find the value of $\tan^2\left(\frac{x}{2}\right)$.

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 $y=\dfrac{\sqrt{1-\sin 4A}+1}{\sqrt{1+\sin 4A}-1}$, 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 $\tan\theta = \frac{\sin\alpha - \cos\alpha}{\sin\alpha + \cos\alpha}$, then:

A. (a) $\sin\alpha - \cos\alpha = \pm\sqrt{2}\sin\theta$

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

C. (c) $\cos 2\theta = \sin 2\alpha$

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

Answer: B

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17. If $\cos 5\theta = a\cos^5\theta + b\cos^3\theta + c\cos\theta$. Then, find the value of c.

A. $a = 20$

B. $b = -20$

C. $c = 16$

D. $c = 5$

Answer: B::C

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18. $x = \sqrt{a^2\cos^2\alpha + b^2\sin^2\alpha} + \sqrt{\alpha^2\sin^2\alpha + b^2\cos^2\alpha}$

then $x^2 = \alpha^2 + b^2 + 2\sqrt{p(a^2 + b^2) - p^2}$, where p 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. $\frac{1}{2}\left[a^2 + b^2 + (a^2 - b^2)\cos2\alpha\right]$

D. $\frac{1}{2}\left[a^2 + b^2 - (a^2 - b^2)\cos2\alpha\right]$

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

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19. 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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20. Let $p(k) = \left(1 + \cos\left(\frac{\pi}{4k}\right)\right)\left(1 + \cos' \frac{(2k - 1)\pi}{4k}\right)$
$\left(1 + \cos\frac{(2k + 1)\pi}{4k}\right)\left(1 + \cos\frac{(4k - 1)\pi}{4k}\right)$, then

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

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

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

D. (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 $\frac{(x^2+y^2)^p}{(xy)^q}$ is independent of θ, then (A) $4p = 5q$ (B) $5p = 4q$ (C) $p + q = 9$ (D) $pq = 20$

A. 4P=5Q

B. 5P=4Q

C. `P+Q=9

D. PQ=20

Answer: A

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Exercise Statement I And Ii Type Questions

1. Find x in the following proportion :

5 : 15 :: 3 : x

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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 - 1 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,

Statement 2. Solution $\cos x + b\sin x = c$ is possible, if -$\sqrt{a^2 + b^2} \leq C \leq \sqrt{a^2 + b^2}$

A. (a)Both Statement I and Statement II are individually true and R is the correct explanation of Statement I.

B. (b)Both Statement I and Statement II are individually true but Statement II is not the correct explanaton of Statement I.

C. (c)Statement I is true but Statement II is false.

D. (d)Statement I is false but Statement II is true.

Answer: B

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4. Statement 1 : The curve $y = -\frac{x^2}{2} + x + 1$ is symmetric with respect to the line $x = 1$ Statement 2 : A parabola is symmetric about its axis.

a. Both the statements are true and Statements 1 is the correct explanation of Statement 2.

b. Both the statements are true but Statements 1 is not the correct explanation of Statement 2.

c. Statement 1 is true and Statement 2 is false

d. Statement 1 is false and Statement 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: D

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5. Find x in the following proportion :

7 : 4 :: x : 16

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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. Statement I The minimum value of the expression $\sin\alpha + \sin\beta + \sin\gamma$ whereα, β, γ are real numbers such that $\alpha + \beta + \gamma = \pi$ is negative.

Statement II If $\alpha + \beta + \gamma = \pi$, then α, β, γ are the angles of a triangle.

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. Express the following ratio in its simplest form :

150 : 400

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10. Express the following ratio in its simplest form :

85 : 170

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11. Find the sum of the following :

$-\frac{8}{19} + -\frac{2}{57}$

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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. Find the sum of the following :

$-\frac{7}{5} + -\frac{2}{3}$

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3. Find the product : $-\frac{2}{9} \times \frac{10}{3}$

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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. (a)3

B. (b)4

C. (c)7

D. (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. (a)4

B. (b)-4

C. (c)3

D. (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 equations whose roots are $\cos.\frac{\pi}{7}, \cos.\frac{3\pi}{7}, \cos.\frac{5\pi}{7}$ 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.

Sum of all internal angles of a k-sided regular polygon is

A. 4

B. 5

C. 6

D. 7

Answer: B

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10. Find the value of x , if x = $\frac{5}{7} - \left(-\frac{6}{21}\right)$

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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. Find the value of $(-5) \div \frac{4}{3}$

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13. Find the value of x , if $x = -\frac{4}{3} + \frac{8}{7}$

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Exercise Matching Type Questions

1. Match the following Column I to 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. Find the value of $\left(-\frac{2}{9}\right) \div \left(\frac{1}{7}\right)$

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3. Find the 10th term of an AP whose 7th and 12th terms are 34 and 64.

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Exercise 5 Matching Type Questions

1. How many terms are identical in the given two APs. 2,4,6,8......upto 100 3,6,9......upto 80.

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Exercise Single Integer Answer Type Questions

1. In a $\Delta ABC, \frac{1}{1+\tan^2\left(\frac{A}{2}\right)}+\frac{1}{1+\tan^2\left(\frac{B}{2}\right)}+\frac{1}{1+\tan^2\left(\frac{C}{2}\right)}=$ $k\left[1+\sin\left(\frac{A}{2}\right)\sin\left(\frac{B}{2}\right)\sin\left(\frac{C}{2}\right)\right]$, 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. 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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5. The value of $\operatorname{cosec} 10^{\circ} + \operatorname{cosec} 50^{\circ} - \operatorname{cosec} 70^{\circ}$ is _____

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6. 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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7. $\tan^2\left(\frac{\pi}{16}\right) + \tan^2\left(\frac{2\pi}{16}\right) + \tan^2\left(\frac{3\pi}{16}\right) \ldots\ldots\ldots + \tan^2\left(\frac{7\pi}{16}\right) = 35$

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8. Compute the square of the value of the expression $\frac{4 + \sec 20^{\circ}}{\operatorname{cosec} 20^{\circ}}$

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9. 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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10. 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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11. If sum of the series $1 + x\log\left|\frac{1 - \sin x}{\cos x}\right|\left(\frac{1 + \sin x}{\cos x}\right)^{1/2} + x^2\log\left|\frac{1 - \sin x}{\cos x}\right|\left(\frac{1 + \sin x}{\cos x}\right)^{1/4} + \ldots\infty$ (wherever defined) is equal to $\frac{k(1 - x)}{(2 - x)}$, then k is equal to

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12. 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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13. 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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14. 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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15. 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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16. The least degree of a polynomial with integer coefficient whose one of the roots may be $\cos 12^\circ$ is

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17. If $A + B + C = 180^\circ$, $\dfrac{\sin 2A + \sin 2B + \sin 2C}{\sin A + \sin B + \sin C} = k \sin.\dfrac{A}{2} \sin.\dfrac{B}{2} \sin.\dfrac{C}{2}$ then the value of $3k^3 + 2k^2 + k + 1$ is equal to

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18. The value of $p(x) = 5x - 4x^2 + 3$ for $x = 1$ is :

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19. 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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20. If $\sin\theta+\sin^2\theta+\sin^3\theta=1$, then prove that $\cos^6\theta-4\cos^4\theta+8\cos^2\theta=4$

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21. $$16\left(\cos\theta-\cos\left(\frac{\pi}{8}\right)\right)\left(\cos\theta-\cos\left(\frac{3\pi}{8}\right)\right)\left(\cos\theta-\cos\left(\frac{5\pi}{8}\right)\right)\left(\cos\theta-\cos\left(\frac{7\pi}{8}\right)\right)=\lambda\cos 4\theta,$$ then the value of λ is ____.

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22. If $\frac{1}{\sin 20^\circ} + \frac{1}{\sqrt{3}\cos 20^\circ} = 2k\cos 40^\circ$, 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 $\tan 82\frac{1}{2}^\circ = \left(\sqrt{3} + \sqrt{2}\right)\left(\sqrt{2} + 1\right)$ 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 α, β, γ are the roots of the cubic $x^3 - px^2 + qx - r = 0$

Find the equations whose roots are

(i) $\beta\gamma + \frac{1}{\alpha}, \gamma\alpha + \frac{1}{\beta}, \alpha\beta + \frac{1}{\gamma}$

(ii)$(\beta + \gamma - \alpha), (\gamma + \alpha - \beta), (\alpha + \beta - \gamma)$

Also find the valueof $(\beta + \gamma - \alpha)(\gamma + \alpha - \beta)(\alpha + \beta - \gamma)$

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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 $aandb$ are positive quantities such that $a > b$, the minimum value of $asec\theta - btan\theta$ is (a) $2ab$ (b) $\sqrt{a^2 - b^2}$ (c) $a - b$ (d) $\sqrt{a^2 + b^2}$

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6. 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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7. 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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8. Let $f(x) = \cos\left(a_1 + x\right) + \frac{1}{2}\cos\left(a_2 + x\right) + \frac{1}{2^2}\cos\left(a_1 + x\right) + \quad + \frac{1}{2^{n-1}}\cos\left(a_n + x\right)$ where $a\Big)1, a_2a_n \in R^{\cdot}$ 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 $\cos^2\alpha - \sin^2\alpha = \tan^2\beta$, then show that $\tan^2\alpha = \cos^2\beta - \sin^2\beta$.

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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. Find all value of θ which satisfy,

$\sin(3\theta + \alpha) + \sin(3\theta - \alpha) + \sin(\alpha - \theta) - \sin(\alpha + \theta) = \cos\alpha$ given $\cos\alpha \neq 0$.

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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 meal roots, then find all the possible value of $\cos\alpha + \cos^{-1}\beta$.

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15. If $2\cos\theta = x + \frac{1}{x}$, 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

$$\sum_{k=1}^{n-1} {}^nC_k[\cos kx.\ \cos(n+k)x + \sin(n-k)x.\ \sin(2n-k)x] = \left(2^n - 2\right)\cos nx.$$

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18. Solve $\sin 2x > \sqrt{2}\sin^2 x + \left(2 - \sqrt{2}\right)\cos^2 x$

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19. The number of solutions of the equation $\cos[x] = e^{2x-1}, x \in [0, 2\pi]$, where [.] denotes the greates integar function is

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20. Prove that: $\sum_{r=0}^{n} 3^{r n}C_r = 4^n$.

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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

$8x^3 - 4x^2 - 4x + 1 = 0$ are $\cos\frac{\pi}{7}, \cos\frac{3\pi}{7}$ and $\cos\frac{5\pi}{7}$.

Evaluate $\sec\frac{\pi}{7} + \sec\frac{3\pi}{7} + \sec\frac{5\pi}{7}$

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Exercise Questions Asked In Previous 13 Years Exam

1. Let α and β be non-zero real numbers such that $2(\cos\beta - \cos\alpha) + \cos\alpha\cos\beta = 1$. Then which of the following is/are true ?

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 $-\frac{\pi}{6} < \theta < -\frac{\pi}{12}$. 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 $f:(-1,1)\vec{R}$ be such that $f(\cos 4\theta)=\dfrac{2}{2-\sec^2\theta}$ for $\theta \in \left(0, \dfrac{\pi}{4}\right) \cup \left(\dfrac{\pi}{4}, \dfrac{\pi}{2}\right)$. Then the value(s) of $f\left(\dfrac{1}{3}\right)$ is (are)

A. $1-\sqrt{\dfrac{3}{2}}$

B. $1+\sqrt{\dfrac{3}{2}}$

C. $1-\sqrt{\dfrac{2}{3}}$

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

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

$$(y + z)\cos 3\theta = (xyz)\sin 3\theta$$

$$x\sin 3\theta = \frac{2\cos 3\theta}{y} + \frac{2\sin 3\theta}{z}$$

$$(xyz)\sin 3\theta = (y + 2z)\cos 3\theta + y\sin 3\theta$$

has a solution $\left(x_0, y_0, z_0\right)$ with $y_0 z_0 \neq 0$ is ______.

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6. For $0 < \theta < \frac{\pi}{2}$, the solution (s) of $\sum_{m=1}^{6} cosec\left(\theta + \left((m - 1)\frac{\pi}{4}\right)\right)cosec\left(\theta + \frac{m\pi}{4}\right) = 4\sqrt{2}$. Find correct options

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 $t_1 = \tan\theta)^{\tan\theta}, t_2 = (\tan\theta)^{\cot\theta}, t_3 = (\cot\theta)^{\tan\theta}$ and $t_4 = (\cot\theta)^{\cot\theta}$, then show that $t_4 > t_3 > t_1 > t_2$.

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. if $\cos(\alpha - \beta) = 1 and \cos(\alpha + \beta) = \frac{l}{e},$ 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 $\cos 4x$ 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 $x \in R$ and $k \geq 1$, then find the value of $F_4(x) - F_6(x)$.

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) $sec A cosec A + 1$ (2) $tan A + \cot A$ (3) $sec A + \cos ec A$ (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. $\frac{13}{16} \le A \le 1$

B. $1 \le A \le 2$

C. $\frac{3}{4} \le A \le \frac{13}{16}$

D. $\frac{3}{4} \le A \le 1$

Answer: D

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15. Let $\cos(\alpha + \beta) = \frac{4}{5}$ and let $\sin(\alpha + \beta) = \frac{5}{13}$ where $0 \leq \alpha, \beta \leq \frac{\pi}{4}$, then $tan2\alpha =$

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. 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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