MATHS

BOOKS - CENGAGE MATHS (HINGLISH)

TRIGONOMETRIC FUNCTIONS

Examples

1. Find the length of the chord which subtends an angle of 120° at the centre of the circle of radius 6 cm.

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2. If the angles of a triangle are $30^0 and 45^0$ and the included side is $(\sqrt{3}+1)cm$ then the area of the triangle is_____.

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3. A circle is inscribed in an equilateral triangle of side a. Find the area of any square inscribed in this circle.

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4. Two parallel chords of a circle of radius 2 units are $\left(\sqrt{3}+1\right)$ units apart. If these chords subtend, at the centre, angles of $\frac{90^\circ}{k}$ and $\frac{180^\circ}{k}$, where kgt0, then find the value of k.

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5. find the height of the regular pyramid with each edge measuring l cm.

Also,

(i) if α is angle between any edge and face not containing that edge, then prove that $\cos\alpha = \frac{1}{\sqrt{3}}$

(ii) if β is the between the two faces, then prove that $\cos\beta = \frac{1}{3}$

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6. By geometrical interpretation, prove that

(i) $\sin(\alpha+\beta) = \sin\alpha\cos\beta + \sin\beta\cos\alpha$

(ii) $\cos(\alpha+\beta) = \cos\alpha\cos\beta - \sin\alpha\sin\beta$

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7. By geometrical interpretation, prove that

$$\tan(\alpha+\beta) = \frac{\tan\alpha+\tan\beta}{1-\tan\alpha\tan\beta}.$$

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8. Find the minimum value of $2\cos\theta + \frac{1}{\sin\theta} + \sqrt{2}\tan\theta$, where θ is acute angle.

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9. For acute angle θ, Prove that $\sin\theta < \theta < \tan\theta$.

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10. If $0 < \alpha < \beta < \gamma > \pi/2$,then prove that $\tan\alpha < \frac{\sin\alpha + \sin\beta + \sin\gamma}{\cos\alpha + \cos\beta + \cos\gamma} < \tan\gamma$.

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11. 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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12. Prove that $\sqrt{\frac{1+\sin\theta}{1-\sin\theta}} = \sec\theta + \tan\theta$.

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13. Prove that $\frac{1}{\sec A - \tan A} - \frac{1}{\cos A} = \frac{1}{\cos A} - \frac{1}{\sec A - \tan A}$.

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14. If $3\sin\theta + 5\cos\theta = 5$, then show that $5\sin\theta - 3\cos\theta = \pm 3$.

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15. If

$(\sec A + \tan A)(\sec B + \tan B)(\sec C + \tan C) = (\sec A - \tan A)(\sec B -$

, prove that value of each side is ± 1.

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

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17. If $\cos ec\theta - \sin\theta = m$ and $\sec\theta - \cos\theta = n$, elimnate θ.

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18. If $\frac{\cos^4 A}{\cos^2 B} + \frac{\sin^4 A}{\sin^2 B} = 1$, then prove that

(i) $\sin^4 A + \sin^4 B = 2\sin^2 A \sin^2 B$

(ii) $\frac{\cos^4 B}{\cos^2 A} + \frac{\sin^4 B}{\sin^2 A} = 1$

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

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20. For acute angle θ, prove the following:

(i) $\sec^2\theta \cos ec\theta \geq 4$

(ii) $\sec^2\theta + \cos ec^2\theta \geq 4$

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21. Express $45^0 20' 10''$ in radian measure $(\pi = 3.1415)$

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22. Express 1.2 rad in degree measure.

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23. Find the length of an arc of a circle of radius 5 cam subtending a central angle measuring 15^0.

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24. Find in degrees the angle subtended at the centre of a circle of diameter 50cm by an arc of length 11cm.

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25. If arcs of same length in two circles subtend angles of $60^0 and 75^0$ at their centers, find the ratios of their radii.

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26. Assuming the distance of the earth from the moon to be 38,400 km and the angle subtended by the moon at the eye of a person on the earth to be 31, find the diameter of the moon.

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27. Find the angle between the minute hand and the hour hand of a clock when the time is 7:20 AM.

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

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29. State if the given angles are coterminal. $\alpha = 185^0, \beta = -545^0$

$\alpha = \frac{17\pi}{36}, \beta\frac{161\pi}{36}$

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30. Find the reference angles corresponding to each of the following angles. It may help if you sketch θ in standard position.

$\theta = -230^\circ \quad (\text{ii})\frac{31\pi}{9} \quad (\text{iii})\theta = 640^\circ$

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31. Suppose the point with coordinates $(-12, 5)$ is on the terminal side of angle θ. Find the values of the six trigonometric functions of θ.

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32. Evaluate the sine, cosine, and tangent of each of the following angles without using a calculator: $300^0,\ -405^0, \frac{7\pi}{6}, \frac{11\pi}{4}$.

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33. Which of the following is not possible?

A. $\sin\theta = \frac{5}{3}$

B. $\tan\theta = 1002$

C. $\cos\theta = \frac{1+p^2}{1-p^2}, (p \neq 0, \pm 1)$

D. $\sec\theta = \frac{1}{2}$

Answer:

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34. Find the values of p so that the equation $2\cos^2 x - (p+3)\cos x + 2(p-1) = 0$ has a real solution.

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35. Find the values of a for which $a^2 - 6\sin x - 5a \leq 0, Aax \in R.$

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36. Which of the following is the greatest?

A. tan 1

B. tan 4

C. tan 7

D. tan 10

Answer: tan 1

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

A. sin 3

B. sin 2

C. sin 1

D. sin 7

Answer: D

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38. Which of the following is the greates? $\cos ec1$ (b) $\cos ec2$ $\cos ec4$ (d) $\cos ec(-6)$

A. cosec 1

B. cosec 2

C. cosec 4

D. cosec (-6)

Answer: D

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39. If A = $4\sin\theta + \cos^2\theta$, which of the following is not true ? (A) Maximum value of A is 5 . (B) Minimum value of A is -4 (C) Maximum value of A occurs when $\sin\theta = 1/2$ (D) Minimum value of A occurs when $\sin\theta = 1$.

A. Maximum value of A is 5 .

B. Minimum value of A is -4

C. Maximum value of A occurs when $\sin\theta = 1/2$

D. Minimum value of A occurs when $\sin\theta = 1$.

Answer: ACD

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40. Find the values of x for which $3\cos\theta = x^2 - 8x + 19$ holds good.

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

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42. If $\sin^2\theta_1 + \sin^2\theta_2 + \sin^2\theta_3 = 0,$ then which of the following is not the possible value of $\cos\theta_1 + \cos\theta_2 + \cos\theta_3$? 3 (b) -3 (c) -1 (d) -2

A. 3

B. -3

C. -1

D. -2

Answer:

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43. For real values of θ, which of the following is/are always positive? $\cos(\cos\theta)$ (b) $\cos(\sin\theta)$ $\sin(\cos\theta)$ (d) $\sin(\sin\theta)$

A. $\cos(\cos\theta)$

B. $\cos(\sin\theta)$

C. $\sin(\cos\theta)$

D. $\sin(\sin\theta)$

Answer:

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44. Find the range of $f(x) = \dfrac{1}{4\cos x - 3}$.

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45. Find the range of $f(x) = \cos^2 x + \sec^2 x$.

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46. Find the range of $f(x) = \dfrac{1}{5\sin x - 6}$

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47. Find the range of $f(x) = \sin^2 x - 3\sin x + 2$.

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48. Find the range of $f(x) = \sqrt{\sin^2 x - 6\sin x + 9} + 3$.

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49. If $f(x, y)$ satisfies the equation $1 + 4x - x^2 = \sqrt{9\sec^2 y + 4\cos ec^2 y}$ then find the value of $xandtan^2 y$.

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50. 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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51. Which of the following is/are correct ? (a) $(\tan x)^{In(\cos x)} < (\cot x)^{In(\cos x)} \forall x \in \left(\frac{\pi}{4}, \frac{\pi}{2}\right)$ (b) $(\sin x)^{In(\sec x)} > (\cos x)^{In(\sec x)} \forall x \in \left(0, \frac{\pi}{4}\right)$ (c)

$\left(\sec.\ \frac{\pi}{3}\right)^{In(\tan x)} > \left(\sec.\ \frac{\pi}{3}\right)^{In(\cos x)} \forall x \in \left(\frac{\pi}{4}, \frac{\pi}{2}\right)$ (d)

$\left(\frac{1}{2}\right)^{In(\sin x)} > \left(\frac{3}{4}\right)^{In(\sin x)} \forall x \in \left(0, \frac{\pi}{2}\right)$

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

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53. Find the values of the following trigonometric ratios :

A. $\cos 225^\circ$

B. $\sin 690^\circ$

C. $\tan(-390^\circ)$

D. $\sec 855^\circ$

Answer:

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54. Prove that:

$\sin(-420^0)(\cos 390^0) + \cos(-660^0)(s \in 330^0) = -1.$

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

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56. If A, B, C, D be the angles of acyclic quadrilateral, show that : $\cos A + \cos B + \cos C + \cos D = 0.$

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57. Show that $\tan 1^0 \tan 2^0 \tan 89^0 = 1$

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

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59. Find the value of

$\cos^2.\frac{\pi}{16} + \cos^2.\frac{3\pi}{16} + \cos^2.\frac{7\pi}{16}$.

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60. If `sin(120^0-alpha)=sin(120^0-beta),0

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61. Find the sign of the values of $\tan 113^0 - \cos 107^0 = a$ and $\tan 107^0 - \cos 105^0 = b$

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62. In triangle ABC prove that

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

(iii)$\cos A = -\cos(A + B)$ $(iv)\tan\left(\frac{A+B}{2}\right) = \cot.\frac{C}{2}$

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63. If $2\cos x + \sin x = 1$, then find the valie of $7x + 6\sin x$.

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64. If $u_n = \sin^n \theta + \cos^n \theta$, then prove that $\frac{u_5 - u_7}{u_3 - u_5} = \frac{u_3}{u_1}$.

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65. If $a^2 + b^2 + 2ab\cos\theta = 1, c^2 + a^2 + 2cd\cos\theta = 1$ and $ac + bd + (ad + bc)\cos\theta = 0$, then prove that $a^2 + c^2 = \cos ec^2\theta$

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66. If $\frac{\sec^4\theta}{a}+\frac{\tan^4\theta}{b}=\frac{1}{a+b}$, then prove that $|b|\leq|a|$.

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67. Let $A=\sin x+\cos x$,Then find the value of $\sin^4 c+\cos^4 c$in terms of A.

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68. If $x=\frac{\sin^3 P}{\cos^2 P}, y=\frac{\cos^3 P}{\sin^2 P}$ and $\sin P+\cos P=\frac{1}{2}$ then find the value of x + y.

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69. If $\frac{\sin A}{\sin B}=\frac{\sqrt{3}}{2}$ and $\frac{\cos A}{\cos B}=\frac{\sqrt{5}}{2}, 0<A, B<\frac{\pi}{2}$, then $\tan A-\tan B$ is equal to

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70. A parallelogram containing a 60^0 angle has perimeter p and its longer diagonal is of length .. Find its area.

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71. For each natural number $n \geq 2$, prove that $\sin x_1 \cos x_2+\sin x_2 \cos x_3+\ldots+\sin x_n \cos x_1 \leq n / 2$(where $x_1, x_2, \ldots, x_n$ are arbitrary real numbers).

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72. Find the range of $y=\sin^3 x-6 \sin^2 x+11 \sin x-6$.

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Exercise 2 1

1. Two sides of a parallelgram are 12 cm and 8 cm. If one of the interior angles is 135°, then find area of the parallelogram.

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2. In triangle $ABC, AB = 6, AC = 3\sqrt{6}, \angle B = 60^\circ$ and $\angle C = 45^\circ$. Find length of side BC.

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3. The circumference of a circle circumscribing an equilateral triangle is $24\pi units$. Find the area of the circle inscribed in the equilateral triangle.

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4. In an equilateral triangle, three identical coins of radii 1 units each, are kept so that they touch each other and also the sides of a triangle. Find the area of the triangle.

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5. A polygon of nine sides, each pf length 2, is inscribed in a circle. Prove that the radius of the circle is $\cos ec20^\circ$.

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

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7. 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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8. If

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

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Exercise 2 2

1. Prove that $\frac{\sin x - \cos x + 1}{\sin x + \cos - 1} = \sec x + \tan x$.

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2. If $15\sin^4\alpha + 10\cos^4\alpha = 6$ then find the value of $8\cos ec^6\alpha + 27\sec^6\alpha$.

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3. If $\sec\theta + \tan\theta = p$. Then find the value of $\tan\theta$.

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4. If $(1+\sin A)(1+\sin B)(1+\sin C) = (1-\sin-A)$

$(1-\sin B)(1-\sin C)$, then prove that $(1+\sin A)$

$(1-\sin B)(1-\sin C) = \pm\cos A.\cos B.\cos C.$

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5. If

$(\sec\theta+\tan\theta)(\sec\phi+\tan\phi)(\sec\Psi+\tan\Psi) = \tan\theta\tan\phi\tan\Psi$, then pr

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6. If $\frac{x}{a}\cos\theta + \frac{y}{b}\sin\theta = 1, \frac{x}{a}\sin\theta - \frac{y}{b}\cos\theta = 1$, then eliminate θ.

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7. 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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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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Exercise 2 3

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

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2. If the angular diameter of the moon be 30, how far from the eye a coin of diameter $2.\ 2cm$ be kept to hide the moon?

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3. Find the degrees and radians the angle between the hour hand and the minute hand of a clock at half past three.

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4. There is an equilateral triangle with side 4 and a circle with the centre on one of the vertex of that triangle. The arc of that circle divides the triangle into two parts of equal area. How long is the radius of the circle?

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Exercise 2 4

1. Let (-3, -4) be a point on the terminal side of θ. Find the sine, cosine and tangent of θ.

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2. Find the reference angle θ'for the following angles in standerd position : (a)$\theta = 300^\circ$ (b) $\theta = 2.3$ (c) $\theta = -135^\circ$

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3. Evaluate each of the following trigonometric functions:

(a) $\cos. \frac{4\pi}{3}$ (b) $\tan(-210^\circ)$ (c) $\cos ec. \frac{11\pi}{4}$

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4. State if the given pairs of angles are coterminal.

(a) $-185^\circ, 535^\circ$ (b) $1000^\circ, 270^\circ$ (c) $\frac{15\pi}{4}, -\frac{17\pi}{4}$

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Exercise 2 5

1. Find the range of $f(x) = \frac{8}{\sin x + 3}$

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2. Find the range of $f(x) = \sin(\cos x)$.

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3. Find the range of $12\sin\theta - 9\sin^2\theta$

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4. Find the minimum value of $9\tan^2\theta + 4\cot^2\theta$

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5. Which of following is correct (where $n \in N$) ?

A. $\sin\theta = \dfrac{n+1}{n}$

B. $\sin\theta = \dfrac{n^2+1}{n+1}$

C. $\sec\theta = \dfrac{n+2}{n-1}$

D. $\sec\theta = \dfrac{n}{\sqrt{n^2+1}}$

Answer: C

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6. If $\sin^2\theta_1 + \sin^2\theta_2 + \ldots + \sin^2\theta_n = 0$, then find the minimum value of $\cos\theta_1 + \cos\theta_2 + \ldots + \cos\theta_n$.

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7. If $\sin^2\theta = x^2 - 3x + 3$ is meaningful, then find the values of x.

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8. If $a, b, c \in R$ then prove that $\sec^2\theta = \frac{bc + ca + ab}{a^2 + b^2 + c^2}$ only if a = b = c.

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9. Find the range of $f(x) = \sqrt{4 - \sqrt{1 + \tan^2 x}}$.

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10. Find the range of $f(x) = \dfrac{1}{2|\cos x| - 3}$

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11. Find the tange of $f(x) = \cos^4 x + \sin^2 x - 1.$

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12. Find the minimum value of the function

$f(x) = (1 + \sin x)(1 + \cos x),\ \forall x \in R.$

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13. Prove that $(\sin\theta + \cos ec\theta)^2 + (\cos\theta + \sec\theta)^2 \geq 9.$

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14. Find the range of $f(x) = \cos ec^2 x + 25 \sec^2 x$.

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15. If $\cos^2 x + \cos x = a + 2$, then find the value of a for which equation has solution.

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

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Exercise 2 6

1. Prove that: $tan720^0 - \cos 270^0 - s \in 150^0 \cos 120^0 = \frac{1}{4}$

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2. Find the value of the expression

$\sec 610^\circ \cos ec160^\circ - \cot 380^\circ \tan 470^\circ$

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3. If $\alpha = \frac{\pi}{3}$, prove that

$\cos\alpha \cos 2\alpha \cos 3\alpha \cos 4\alpha \cos 5\alpha \cos 6\alpha = -\frac{1}{16}$

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4. Find the value of $\tan.\frac{\pi}{20}\tan.\frac{3\pi}{20}\tan.\frac{5\pi}{20}\tan.\frac{7\pi}{20}\tan.\frac{9\pi}{20}$.

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5. Find the value of $\frac{\cot 54^\circ}{\tan 36^\circ} + \frac{\tan 20^\circ}{\cot 70^\circ}$

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6. Prove that: $\sin^2\left(\frac{\pi}{18}\right)+\sin^2\left(\frac{\pi}{9}\right)+\sin^2\left(\frac{7\pi}{18}\right)+\sin^2\left(\frac{4\pi}{9}\right)=2$

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7. Prove that

$$\sec\left(\frac{3\pi}{2}-\theta\right)\sec\left(\theta-\frac{5\pi}{2}\right)+\tan\left(\frac{5\pi}{2}+\theta\right)\tan\left(\theta-\frac{3\pi}{2}\right)=-1$$

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8. If $\theta=\frac{\pi}{4n}$ then the value of $\tan\theta\tan(2\theta)\tan(3\theta)....\tan((2n-1)\theta)$ is

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9. If any quadrilateral ABCD, prove that $\sin(A+B)+\sin(C+D)=0$

$\cos(A+B)=\cos(C+D)$

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Exercise Single

1. If $5\tan\theta = 4$, then $\dfrac{5\sin\theta - 3\cos\theta}{5\sin\theta + 2\cos\theta}$ is equal to

A. 0

B. -6

C. $\dfrac{1}{6}$

D. 6

Answer: C

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2. If $\tan\theta = -\dfrac{4}{3}$, then $\sin\theta$ is

A. $-\dfrac{4}{5}$ but not $\dfrac{4}{5}$

B. $-\dfrac{4}{5}$ or $\dfrac{4}{5}$

C. $\frac{4}{5}$ but not $-\frac{4}{5}$

D. None of these

Answer: B

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3. If $\sin x + \cos ecx = 2$, then $\sin^n x + \cos ec^n x$ is equal to

A. 2

B. 2^n

C. 2^{n-1}

D. 2^{n-2}

Answer: A

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4. If $\tan\theta + \sin\theta = m$ and $\tan\theta - \sin\theta = n$,then

A. $m^2 - n^2 = 4mn$

B. $m^2 + n^2 = 4mn$

C. $m^2 - n^2 = m^2 + n^2$

D. $m^2 - n^2 = 4\sqrt{mn}$

Answer: D

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5. If $\cos ec\theta - \cot\theta = q$, then the value of $\cos ec\theta$ is

A. $q + \frac{1}{q}$

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

C. $\frac{1}{2}\left(q + \frac{1}{q}\right)$

D. None of these

Answer: C

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6. If $\frac{\sin x}{a} = \frac{\cos x}{b} = \frac{\tan x}{c} = k$, then $bc + \frac{1}{ck} + \frac{ak}{1+bk}$ is equal to $k\left(a + \frac{1}{a}\right)$ (b) $1/k\left(a + \frac{1}{a}\right)$ $\frac{1}{k^2}$ (d) $\frac{a}{k}$

A. $k\left(a + \frac{1}{a}\right)$

B. $\frac{1}{k}\left(a + \frac{1}{a}\right)$

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

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

Answer: B

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7. If $\sec^4\theta + \sec^2\theta = 10 + \tan^4\theta + \tan^2\theta$, then $\sin^2\theta =$

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

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

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

D. $\frac{5}{6}$

Answer: C

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8. If $x = \frac{2\sin\theta}{1+\cos\theta+\sin\theta}, then \frac{1-\cos\theta+\sin\theta}{1+\sin\theta}$ is equal to $1+x$ (b) $1-x$ (c) x (d) $\frac{1}{x}$

A. 1+x

B. 1-x

C. x

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

Answer: C

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9. If $\sec\alpha$ and $\cos ec\alpha$ are the roots of the equation $x^2 - px + q = 0$, then (i)$p^2 = q(q-2)$ (ii)$p^2 = q(q+2)$ (iii)$p^2 + q^2 = 2q$ (iv) none of these

A. $p^2 = q(q-2)$

B. $p^2 = q(q+2)$

C. $p^2 + q^2 = 2q$

D. None of these

Answer: B

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10. Which of the following is not the quadratic equation whose roots are $\cos ec^2\theta$ and $\sec^2\theta$?

A. $x^2 - 6x + 6 = 0$

B. $x^2 - 7x + 7 = 0$

C. $x^2 - 4x + 4 = 0$

D. None of these

Answer: D

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11. If $\sin x + \sin^2 x = 1$, then find the value of $\cos^{12} x + 3\cos^{10} x + 3\cos^8 x + \cos^6 x - 1$

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12. $3(\sin\theta - \cos\theta)^4 + 6(\sin\theta + \cos\theta)^2 + 4\left(\sin^6\theta + \cos^6\theta\right) = ?$

A. 11

B. 12

C. 13

D. 14

Answer: C

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13. If $\sin x + \sin^2 x = 1$ then the value of $\tan^8 x - \tan^4 x - 2\tan^2 x + 1$ will be equal to 0 (b) 1 (c) 2 (d) 3

A. 0

B. 1

C. 2

D. 3

Answer: C

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14. $(1+\tan\alpha\tan\beta)^2+(\tan\alpha-\tan\beta)^2=$

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

B. $\sec^2\alpha\sec^2\beta$

C. $\tan^2\alpha\cot^2\beta$

D. $\sec^2\alpha\cos^2\beta$

Answer: B

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15. Let $A_0A_1A_2A_3A_4A_5$ be a regular hexagon inscribed in a circle of unit radius. Then the product of the lengths the line segments A_0A_1, A_0A_2 and A_0A_4 is

A. $3/4$

B. $3\sqrt{3}$

C. 3

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

Answer: C

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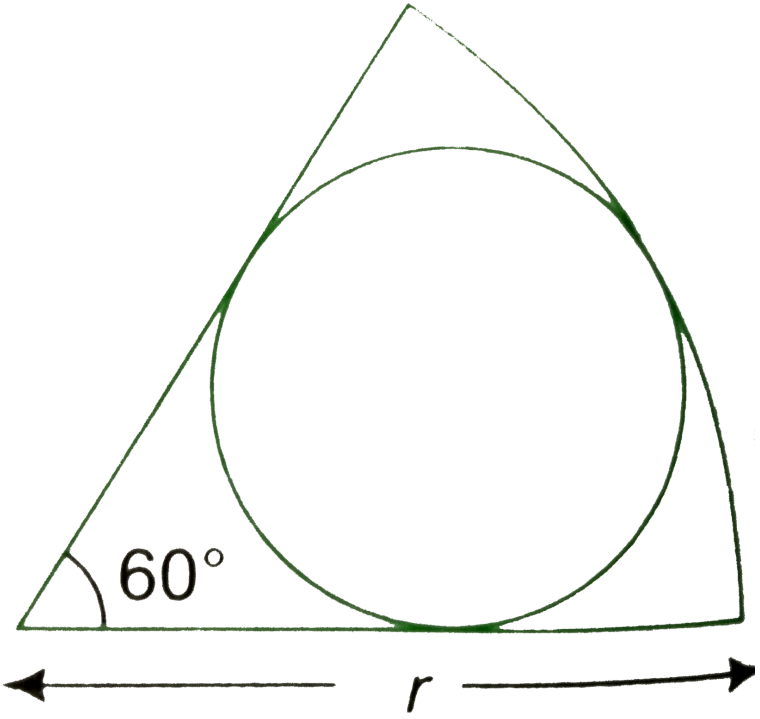
16. A circle is drawn in a sectore of a larger circle of radius r, as shown in fugure. The smaller circle is tangent to the two bounding radii and the are of the sector. The radius of the smaller circle is



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

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

C. $\frac{2\sqrt{3}r}{5}$

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

Answer: A

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17. A right triangle has perimeter of length 7 and hypotenuse of length 3.

If θ is the larger non-right angle in the triangle, then the value of $\cos\theta equal\cdot \frac{\sqrt{6}-\sqrt{2}}{4}$ (b) $\frac{4+\sqrt{2}}{6}$ $\frac{4-\sqrt{2}}{3}$ (d) $\frac{4-\sqrt{2}}{6}$

A. $\frac{\sqrt{6}-\sqrt{2}}{4}$

B. $\frac{4+\sqrt{2}}{6}$

C. $\frac{4-\sqrt{2}}{3}$

D. $\frac{4-\sqrt{2}}{6}$

Answer: D

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18. Given that the side length of a rhombus is the geometric mean of the length of its diagonals. The degree measure of the acute angle of the rhombus is 15^0 (b) 30^0 (c) 45^0 (d) 60^0

A. 15°

B. 30°

C. 45°

D. 60°

Answer: B

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19. Which of the following is correct?

A. $\sin 1^\circ > \sin 1$

B. $\sin 1^\circ < \sin 1$

C. $\sin 1^\circ = \sin 1$

D. $\sin 1^\circ = \frac{\pi}{180}\sin 1$

Answer: B

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20. The equation $\sin^2\theta = \frac{x^2+y^2}{2xy}, x, y \neq 0$ is possible if

A. x = y

B. x = - y

C. 2x = y

D. None of these

Answer: A

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21. if $\sin^2\theta = \frac{x^2+y^2+1}{2x}$ then x must be

A. -3

B. -2

C. 1

D. None of these

Answer: C

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22. $\sec^2 x = \frac{4xy}{(x+y)^2}$ is true if and only if

A. $x + y \neq 0$

B. $x = y, x \neq 0$

C. $x = y$

D. $x \neq 0, y \neq 0$

Answer: B

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23. If $\sin\theta_1 + \sin\theta_2 + \sin\theta_3 = 3$, then $\cos\theta_1 + \cos\theta_2 + \cos\theta_3$ is equal to

A. 3

B. 2

C. 1

D. 0

Answer: D

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24. If $\sin x + \sin y + \sin z + \sin w = -4$ then the value of $\sin^{400} x + \sin^{300} y -$ is

A. $\sin^{400} x . \sin^{300} y . \sin^{200} z . \sin^{100} w$

B. $\sin x . \sin y . \sin z . \sin w$

C. 4

D. 3

Answer: C

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25. 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. -3

Answer: C

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26. If $1 + \sin x + \sin^2 x + \sin^3 x + \infty$ is equal to `4+2sqrt(3),0

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

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

C. $\frac{\pi}{3}$ or $\frac{\pi}{6}$

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

Answer: D

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27. The value of expression $\left(2\sin^2 91^0 - 1\right)\left(2\sin^2 92^0 - 1\right)\left(2\sin^2 180^0 - 1\right)$ is equal to 0 (b) 1 (c) 2^{90} (d) $2^{90} - 90$

A. 0

B. 1

C. 2^{90}

D. $2^{90} - 90$

Answer: A

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28. If $\sin A = \sin^2 B$ and $2\cos^2 A = 3\cos^2 B$ then the triangle ABC is

A. right angled

B. obtuse angled

C. ospsceles

D. equilateral

Answer: B

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29. If $\sin\theta + \cos\theta = \frac{1}{5}$ and $0 \leq \theta < \pi$ then $\tan\theta$ is

A. $-4/3$

B. $-3/4$

C. $3/4$

D. $4/3$

Answer: A

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30. If $\pi < \alpha < \frac{3\pi}{2} <$ then $\sqrt{\frac{1-\cos\alpha}{1+\cos\alpha}} + \sqrt{\frac{1+\cos\alpha}{1-\cos\alpha}}$ is equal to

A. $\frac{2}{\sin\alpha}$

B. $-\frac{2}{\sin\alpha}$

C. $\frac{1}{\sin\alpha}$

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

Answer: B

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31. If $0 < \alpha < \frac{\pi}{6}$ then $\alpha(\cos ec\alpha)$ is

A. less than $\pi/6$

B. greater than $\pi/6$

C. less than $\pi/3$

D. greater than $\pi/3$

Answer: C

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32. The least value of $2\sin^2\theta + 3\cos^2\theta$ is

A. 1

B. 2

C. 3

D. 5

Answer: B

Watch Video Solution

33. The greatest value of $\sin^4\theta + \cos^4\theta$ is

A. $1/2$

B. 1

C. 2

D. 3

Answer: B

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34. If $f(x) = \sin^6 x + \cos^6 x,$ then range of $f(x)$ is $\left[\frac{1}{4}, 1\right]$ (b) $\left[\frac{1}{4}, \frac{3}{4}\right]$ (c) $\left[\frac{3}{4}, 1\right]$ (d) none of these

A. $\left[\frac{1}{4}, 1\right]$

B. $\left[\frac{1}{4}, \frac{3}{4}\right]$

C. $\left[\frac{3}{4}, 1\right]$

D. None of these

Answer: A

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35. The minimum value of $a\tan^2 x + b\cot^2 x$ equals the maximum value of $a\sin^2\theta + b\cos^2\theta$ where $a > b > 0$. The $\frac{a}{b}$ is 2 (b) 4 (c) 6 (d) 8

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36. Range of $f(\theta) = \cos^2\theta\left(\cos^2\theta + 1\right) + 2\sin^2\theta$ is

A. $\left[\frac{3}{4}, 1\right]$

B. $[3/16, 1]$

C. $[3/4, 7/4]$

D. $[7/4, 2]$

Answer: D

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37. If `0

A. 4

B. 3

C. 5

D. 6

Answer: A

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38. If $\theta_i > 0$ for $1 \leq \theta \leq n$ and $\theta_1 + \theta_2 + \theta_3 + ... + \theta_n = \pi$then the greatest value of sum $\sin\theta_1 + \sin\theta_2 + \sin\theta_3 + \ldots + \sin\theta_n$ is equal to

A. n

B. $n\sin\left(\frac{\pi}{n}\right)$

C. π

D. None of these

Answer: B

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39. The set of values of $\lambda \in R$ such that $\sin^2\theta + \cos\theta = \lambda\cos^2\theta$ holds for some θ, is $(-\infty, 1]$ (b) $(-\infty, -1]$ φ (d) $[-1, \infty)$

A. $(-\infty, 1]$

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

C. ϕ

D. $[-1, \infty)$

Answer: D

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40. Let $A = \sin^8\theta + \cos^{14}\theta$, then $A_{\max}$ is

A. 1

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

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

D. None of these

Answer: A

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41. Minimum value of $y = 256\sin^2 x + 324\cos ec^2 x \, \forall x \in R$ is

A. 432

B. 504

C. 576

D. 776

Answer: C

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42. If a and b are positive quantities, $(a > b)$ find minimum positive value of $(a\sec\theta - b\tan\theta)$

A. 2ab

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

C. a-b

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

Answer: B

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43. If $y = (\sin x + \cos ecx)^2 + (\cos x + \sec x)^2$ then the minimum value of y, $\forall x \in R$, is

A. 7

B. 3

C. 9

D. 0

Answer: C

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44. 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. None of these

Answer: D

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45. If the equation $cof^4x - 2\cos ec^2x + a^2 = 0$ has at least one solution, then the sum of all possible integral values of a is equal to a. 4 b. 3 c. 2 d. 0

A. 4

B. 3

C. 2

D. 0

Answer: D

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46. If $\cos^2 x - (c-1)\cos x + 2c \geq 6$ for every $x \in R$, then the true set of values of c is $(2, \infty)$ (b) $(4, \infty)$ (c) $(-\infty, -2)$ (d) $(-\infty, -4)$

A. $[2, \infty)$

B. $[4, \infty)$

C. (-oo,-2]`

D. (-oo,-4]`

Answer: B

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47. If the inequality $\sin^2 x + a\cos x + a^2 > 1 + \cos x$ holds for any $x \in R,$ then the largest negative integral value of a is -4 (b) 3 (c) -2 (d) -1

A. -4

B. -3

C. -2

D. -1

Answer: B

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48. If $\frac{3\pi}{4} < \alpha < \pi$, then $\sqrt{2\cot\alpha + \frac{1}{\sin^2\alpha}}$ is equal to

A. $1 + \cot\alpha$

B. $-1 - \cot\alpha$

C. $1 - \cot\alpha$

D. $-1 + \cot\alpha$

Answer: B

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49. The value of $\frac{\sec\theta}{\sqrt{1-\cos^2 x}} + \frac{\cos x}{\sqrt{1+\cot^2\theta}}$ for $\theta \in \left(\pi, \frac{3\pi}{2}\right)$ is

A. 0

B. -2

C. 2

D. 1

Answer: B

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50. The minimum value of the function

$$f(x) = \frac{\sin x}{\sqrt{1-\cos^2 x}} + \frac{\cos x}{\sqrt{1-\sin^2 x}} + \frac{\tan x}{\sqrt{1-\sec^2 x - 1}} + \frac{\cot x}{\sqrt{1-\cos ec^2 x}}$$

whenever it is defined is

A. 4

B. -2

C. 0

D. 2

Answer: B

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51. If $\left|\cos\theta\left\{\sin\theta+\sqrt{\sin^2\theta+\sin^2\alpha}\right\}\right| \leq k$, then the value of k

A. $\sqrt{1+\cos^2\alpha}$

B. $\sqrt{1+\sin^2\alpha}$

C. $\sqrt{2+\sin^2\alpha}$

D. $\sqrt{2+\cos^2\alpha}$

Answer: B

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

Answer: D

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

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

B. $k > 4$

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

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

Answer: C

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54. The value of $\frac{\cos\pi}{7} + \frac{\cos(2\pi)}{7} + \frac{\cos(3\pi)}{7} + \frac{\cos(4\pi)}{7} + \frac{\cos(5\pi)}{7} + \frac{\cos(6\pi)}{7} + \frac{\cos(7\pi)}{7}$

is 1 (b) -1 (c) 0 (d) none of these

A. 1

B. -1

C. 0

D. None of these

Answer: B

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55. The numerical value of $\frac{\tan\pi}{3}+2\frac{\tan(2\pi)}{3}+4\frac{\tan(4\pi)}{3}+8\frac{\tan(8\pi)}{3}$ is equal to $-5\sqrt{3}(b)-\frac{5}{\sqrt{3}}$ (c) $5\sqrt{3}$ (d) $\frac{5}{\sqrt{3}}$

A. $-5\sqrt{3}$

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

C. $5\sqrt{3}$

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

Answer: A

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56. The expression $3\left[\sin^4\left(\frac{3}{2}\pi-\alpha\right)+\sin^4(3\pi+\alpha)\right]-2\left[\sin^6\left(\frac{1}{2}\pi+\alpha\right)+\sin^6(5\pi-\alpha)\right]$ is equal to

A. 0

B. 1

C. 3

D. None of these

Answer: B

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57. The value of the expression $\log_{10}(\tan 6^\circ) + \log_{10}(\tan 12^\circ) + \log_{10}(\tan 18^\circ) + \ldots + \log_{10}(\tan 84^\circ)$ is

A. -1

B. 0

C. 1

D. 2

Answer: B

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Exercise Multiple

1. If $0 \leq \theta \leq \pi$ and $81^{\sin^2\theta} + 81^{\cos^2\theta} = 30$ is

A. 30°

B. 60°

C. 120°

D. 150°

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

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2. Suppose ABCS (in order) is a quadrilateral inscribed in a circle. Which of the following is/are always true? $\sec B = \sec D$ (b) $\cot A + \cot C = 0$ $\cos ecA = \cos ecC$ (d) $\tan B + \tan D = 0$

A. $\sec B = \sec B$

B. $\cot A + \cot C = 0$

C. $\cos ecA = \cos ecC$

D. $\tan B + \tan D = 0$

Answer: B::C::D

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3. Which of the following is/are correct ?

A. $(\tan x)^{\ln(\sin x)} > (\cot x)^{\ln(\sin x)}, \forall x \in (0, \pi/4)$

B. $4^{\ln \cos ecx} < 5^{\ln \cos ecx}, \forall x \in (0, \pi/2)$

C. $(1/2)^{\ln(\cos x)} < (1/3)^{\ln(\cos x)}, \forall x \in (0, \pi/2)$

D. $2^{\ln(\tan x)} < 2^{\ln(\tan x)}, \forall x \in (0, \pi/2)$

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

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4. If $3\tan A + 4 = 0$, then the value of $2\cot A - 5\cos A + \sin A$ is equal to

A. $\frac{23}{10}$ if $\frac{\pi}{2} < A < \pi$

B. $\frac{23}{10}$ if $\frac{3\pi}{2} < A < 2\pi$

C. $\frac{-53}{10}$ if $\frac{\pi}{2} < A < \pi$

D. $-\frac{53}{10}$ if $\frac{3\pi}{2} < A < 2\pi$

Answer: A::D

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5. A circle centred at 'O' has radius 1 and contains the point A. Segment AB is tangent to the circle at A and $\angle AOB = \theta$. If point C lies on OA and BC bisects the angle ABO then OC equals

A. $\sec\theta(\sec\theta - \tan\theta)$

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

C. $\frac{1}{1+\sin\theta}$

D. $\frac{1-\sin\theta}{\cos^2\theta}$

Answer: A::B::D

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6. $(a+2)\sin\alpha(2a-1)\cos\alpha=(2a+1)$ if $\tan\alpha$ is

A. $3/4$

B. $4/3$

C. $2a/\left(a^2+1\right)$

D. $2a/\left(a^2-1\right)$

Answer: B::D

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7. Leg $f(x)=\log\left((\log)_{1/3}\left((\log)_{\frac{1}{3}}\left((\log)_7(\sin x+a)\right)\right)\right)$ be defined for every real value of x, then the possible value of a is 3 (b) 4 (c) 5 (d) 6

A. 3

B. 4

C. 5

D. 6

Answer: A::B::C

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8. If $b > 1, \sin t > 0, \cos t > 0$ and $\log_b(\sin t) = x,$ then $\log_b(\cos t)$ is equal to

A. $\frac{1}{2}\log_b\left(1 - b^{2x}\right)$

B. $2\log\left(1 - b^{x/2}\right)$

C. $\log_b \sqrt{1 - b^{2x}}$

D. $\sqrt{1 - x^2}$

Answer: A::C

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9. Which of the following is possible in ΔABC?

A. $\cos A + \cos B + \cos C = \frac{3}{2}$

B. $\cos A \cos B \cos C = 0$

C. $\sin A + \sin B + \sin C = \sqrt{2} + 1$

D. $\sin A \sin B \sin C = -\frac{3}{8}$

Answer: A::B::C

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10. If $2\sec^2\alpha - \sec^4\alpha - 2\cos ec^2\alpha + \cos ec^4\alpha = \frac{15}{4}$ then $\tan\alpha =$

A. $1/\sqrt{2}$

B. $1/2$

C. $1/22\sqrt{2}$

D. $-1/\sqrt{2}$

Answer: A::D

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11. If $\cot\theta + \tan\theta = x$ and $\sec\theta - \cos\theta = y$, then

A. $x \sin\theta . \cos\theta = 1$

B. $\sin^2\theta = y\cos\theta$

C. $\left(x^2 y\right)^{1/3} + \left(xy^2\right)^{1/3} = 1$

D. $\left(x^2 y\right)^{2/3} - \left(xy^2\right)^{2/3} = 1$

Answer: A::B::D

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12. If $x = \sec\phi - \tan\phi$ and $y = \operatorname{cosec}\phi + \cot\phi$, 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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13. The value of $f(\alpha) = \sqrt{\cos ec^2\alpha - 2\cot\alpha} + \sqrt{\cos ec^2\alpha + 2\cot\alpha}$ can be $2\cot\alpha$ (b) $-2\cot\alpha$ (c) 2 (d) -2

A. $2\cot\alpha$

B. $-2\cot\alpha$

C. 2

D. -2

Answer: A::B::C

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14. If $\frac{y+3}{2y+5} = \sin^2 x + 2\cos x + 1,$ then the value of y lies in

A. $\left(-\infty, -\frac{8}{3}\right]$

B. $\left[-\frac{12}{5}, \infty\right)$

C. $\left[-\frac{8}{3}, -\frac{12}{5}\right]$

D. $\left[-\frac{8}{3}, \infty\right)$

Answer: A::B

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

A. $\sin(\alpha + \beta + \gamma) = \sin\gamma\,\forall\gamma \in R$

B. $\cos\alpha\cos\beta = 1\,\forall\alpha, \beta \in R$

C. $(\cos\alpha + \cos\beta)^2 = 4 \forall \alpha, \beta \in R$

D. $\sin(\alpha + \beta + \gamma) = \sin\alpha + \sin\beta + \sin\gamma \forall a, b, \gamma \in R$

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

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16. Four numbers n_1, n_2, n_3 and n_4 are given as $n_1 = \sin 15^\circ - \cos 15^\circ, n_2 = \cos 93^\circ + \sin 93^\circ, n_3 = \tan 27^\circ - \cot 27^\circ, n$,Then

A. $n_1 < 0$

B. $n_2 < 0$

C. $n_3 < 0$

D. $n_4 < 0$

Answer: A::C::D

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17. For $0 < \phi < \pi/2, \quad \text{if} x = \sum_{n=0}^{\infty} \cos^{2n}\phi, y = \sum_{n=0}^{\infty} \sin^{2m}\phi, z = \sum_{n=0}^{\infty} \cos^{2n}\phi \sin^{2n}$,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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Exercise Comprehension

1. Let us consider the equation $\frac{\cos^4 x}{a} + \frac{\sin^4 x}{b} = \frac{1}{a+b}, x \in \left[0, \frac{\pi}{2}\right], a, b > 0$

the value of $\frac{\sin^8 x}{b^3} + \frac{\cos^8 x}{a^3}$ is

A. $\frac{\sin^4 x}{b} = \frac{\cos^4 x}{a}$

B. $\frac{\sin x}{a} = \frac{\cos x}{b}$

C. $\frac{\sin^4 x}{b^2} = \frac{\cos^4 x}{a^2}$

D. $\frac{\sin^2 x}{a} = \frac{\cos^2 x}{b}$

Answer: C

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2. Let us consider the equation $\frac{\cos^4 x}{a} + \frac{\sin^4 x}{b} = \frac{1}{a+b}, x \in \left[0, \frac{\pi}{2}\right], a, b > 0$

The value of $\sin^2 x$ in terms of a and b is

A. $\sqrt{ab}$

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

C. $\frac{b^2 - a^2}{a^2 + b^2}$

D. $\frac{a^2+b^2}{b^2-a^2}$

Answer: B

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3. Let us consider the equation $\frac{\cos^4 x}{a}+\frac{\sin^4 x}{b}=\frac{1}{a+b}, x \in \left[0, \frac{\pi}{2}\right], a, b>0$ the value of $\frac{\sin^8 x}{b^3}+\frac{\cos^8 x}{a^3}$ is

A. $\frac{1}{(a+b)^2}$

B. $\frac{1}{(a+b)^3}$

C. $\frac{1}{(a+b)^4}$

D. $\frac{1}{a^3+b^3}$

Answer: B

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4. α, β, γ and δ are angles in I,II,II and IV quadrants, respectively and none of them is an integral multiple of $\pi/2$. They form an increasing arithmetic progression.

Which of the following holds?

A. $\cos(\alpha - \delta) > 0$

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

C. $\cos(\alpha - \delta) < 0$

D. $\cos(\alpha - \delta) > 0$ or $\cos(\alpha - \delta) < 0$

Answer: A

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5. α, β, γ and δ are angles in I,II,II and IV quadrants, respectively and none of them is an integral multiple of $\pi/2$. They form an increasing arithmetic progression.

Which of the following does not hold?

A. $\sin(\beta+\gamma)=\sin(\alpha+\delta)$

B. $\sin(\beta-\gamma)=\sin(\alpha-\delta)$

C. $\tan 2(\alpha+\beta)=\tan(\beta+\delta)$

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

Answer: B

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6. α, β, γ and δ are angles in I,II,II and IV quadrants, respectively and none of them is an integral multiple of $\pi/2$. They form an increasing arithmetic progression.

if $\alpha+\beta+\gamma+\delta=\theta$ and $\alpha 70^\circ$, then

A. $400^\circ < \theta < 580^\circ$

B. $470^\circ < \theta < 650^\circ$

C. $680^\circ < \theta < 860^\circ$

D. $540^\circ < \theta < 900^\circ$

Answer: C

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7. In $\Delta ABC, BC = 1, \sin.\frac{A}{2} = x_1, \sin.\frac{B}{2} = x_2, \cos.\frac{A}{2} = x_3$ and $\cos.\frac{B}{2} =$

Length of side AC is equal to

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

B. 1

C. 2

D. can't be determined

Answer: B

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8. In $\Delta ABC, BC = 1, \sin. \frac{A}{2} = x_1, \sin. \frac{B}{2} = x_2, \cos. \frac{A}{2} = x_3$ and $\cos. \frac{B}{2} =$

If $\angle A = 90^\circ$, then area of ΔABC is

A. 1/2 sq. units

B. 1/3 sq. units

C. 1 sq. units

D. 2sq. Units

Answer: A

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9. Let $f(x) = \sin^6 x + \cos^6 x + k\left(\sin^4 x + \cos^4 x\right)$ for some real number k. Determine(a) all real numbers k for which $f(x)$ is constant for all values of x.

A. $-1/2$

B. $1/2$

C. $1/4$

D. $-3/2$

Answer: D

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10. Let $f(x) = \sin^6 x + \cos^6 x + k\left(\sin^4 x + \cos^4 x\right)$ for some real number k. Determine(a) all real numbers k for which $f(x)$ is constant for all values of x.

A. [-1,0]

B. $\left[0, \frac{1}{2}\right]$

C. $\left[-1, -\frac{1}{2}\right]$

D. None of these

Answer: C

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11. Let $f(x) = \sin^6 x + \cos^6 x + k(\sin^4 x + \cos^4 x)$ for some real number k. Determine(a) all real numbers k for which $f(x)$ is constant for all values of x.

A. 0

B. 1

C. infinite

D. None of these

Answer: A

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Exercise Matrix

1.

List I	List II
a. If $x = \sin\theta \mid \sin\theta \mid$ and $y = \cos\theta \mid \cos\theta \mid$ and $\frac{99\pi}{2} < \theta < 50\pi$, then $(y - x)$ is equal to	**p.** -1
b. $\dfrac{\sin(270^\circ + x)\cos^3(720^\circ - x) - \sin(270^\circ - x)\sin^3(540^\circ + x)}{\sin(90^\circ + x)\sin(-x) - \cos^2(180^\circ - x))} + \dfrac{\cot(270^\circ - x)}{\operatorname{cosec}^2(450^\circ + x)} =$	**q.** 0
c. $\sin(-870^\circ) + \operatorname{cosec}(-660^\circ) + \tan(-855^\circ) + 2\cot(840^\circ) + \cos(480^\circ) + \sec(900^\circ) =$	**r.** -2
d. $2\dfrac{\cos^3\left(\frac{\pi}{2} + x\right)\cot(3\pi + x)\sec(x - 3\pi)\operatorname{cosec}\left(\frac{3\pi}{2} - x\right)}{\cot x \tan^2(x - \pi)\sin(x - 2\pi)}$ is equal to	**s.** 1

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2. Match the following List I to List II

List I	List II
a. Suppose ABC is a triangle with three acute angles A, B and C. The point whose coordinates are $(\cos B - \sin A, \sin B - \cos A)$ can be in the	p. 1st quadrant
b. If $2^{\sin\theta} > 1$ and $3^{\cos\theta} < 1$, then $\theta \in$	q. 2nd quadran
c. For $\lvert\cos x + \sin x\rvert = \lvert\sin x\rvert + \lvert\cos x\rvert$, x belongs to	r. 3rd quadran
d. If $\sqrt{\frac{1-\sin A}{1+\sin A}} + \frac{\sin A}{\cos A} = \frac{1}{\cos A}$, for all permissible values of A, then A can belong to	s. 4th quadran

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3. For all real values of θ, choose the correct options.

List I	List II
a. $A = \sin^2\theta + \cos^4\theta$	p. $A \in [-1, 1]$
b. $A = 3\cos^2\theta + \sin^4\theta$	q. $A \in \left[\frac{3}{4}, 1\right]$
c. $A = \sin^2\theta - \cos^4\theta$	r. $A \in [2\sqrt{2}, \infty)$
d. $A = \tan^2\theta + 2\cot^2\theta$	s. $A \in [1, 3]$

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Exercise Numerical

1. The value of the expression $\frac{\tan^2 20^0 - \sin^2 20^0}{\tan^2 20^0 + \sin^2 20^0}$ is_____

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2. Suppose that for some angles $x and y$, the equations $\sin^2 x + \cos^2 y = \frac{3a}{2} and \cos^2 x + \sin^2 y = \frac{a^2}{2}$ hold simultaneously. the possible value of a is _____

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3. If $0 < x < \frac{\pi}{4}$ and $\cos x + \sin x = \frac{5}{4}$, then the value of $16(\cos x - \sin x)^2$ is _____ .

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4. The value of $3\dfrac{\sin^4 t + \cos^4 t - 1}{\sin^6 t + \cos^6 t - 1}$ is equal to _____

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5. If $\sin\theta - \cos\theta = 1$, then the value of $\sin^3\theta - \cos^3\theta$ is _____ .

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6. if $\sin\theta, \tan\theta, \cos\theta$ are in G.P. then $4\sin^2\theta - 3\sin^4\theta + \sin^6\theta =$ _____ .

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7. Let $f(\theta) = \dfrac{1}{1 + (o\hbar\eta)^x}$ and $S = \sum_{\theta=1^\circ}^{89^\circ} f(\theta)$, then the value of $\sqrt{5}$ is _____ .

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8. The minimum value of $\sqrt{(3s \in x - 4\cos x - 10(3\sin x + 4\cos x - 1))}$ is _____

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9. If $a \in (0,1) and f(a) = \left(a^2 - a + 1\right) + \frac{8\sin^2 a}{\sqrt{a^2 - a + 1}} + \frac{27\cos ec^2 a}{\sqrt{a^2 - a + 1}}$, then the least value of $\frac{f(a)}{2}$ is_____

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10. Minimum value of $\frac{\sec^4 \alpha}{\tan^2 \beta} + \frac{\sec^4 \beta}{\tan^2 \alpha}$, where `alpha!=pi/2,beta!=pi/2,0

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11. If $p\cos ec\theta + q\cot\theta = 2$ and $p^2\cos ec^2\theta - q^2\theta = 5$ then the value of $\sqrt{81p^{-2}}$ is_____

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Jee Main Previous Year

1. Prove that : $\frac{\tan A}{1-\cot A} + \frac{\cot A}{1-\tan A} = 1 + \sec A \quad \text{cosec} A$

A. $\sin A\cos A + 1$

B. $\sec + \cos ec + 1$

C. $\tan A + \cot A$

D. $\sec A + \cos ecA$

Answer: B

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2. Let $f_K(x) = \frac{1}{k}\left(s \in^k x + \cos^k x\right)$ where $x \in R$ and $k \geq 1$. Then $f_4(x) - f_6(x)$ equals (1) $\frac{1}{6}$ (2) $\frac{1}{3}$ (3) $\frac{1}{4}$ (4) $\frac{1}{12}$

A. $\frac{1}{6}$

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

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

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

Answer: D

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Jee Advanced Previous Year

1. Let

$P = \{\theta : \sin\theta - \cos\theta = \sqrt{2}\cos\theta\}$ and $Q = \{\theta : \sin\theta + \cos\theta = \sqrt{2}\sin\theta\}$

be two sets. Then

A. $p \subset Q$ and $Q - P = \phi$

B. $Q \not\subset P$

C. $P \not\subset Q$

D. P=Q

Answer: D

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

Answer: A::B

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Single Correct Answer Type

1. The circular wire of diameter 10 cm is cut and placed along the circumference of a circle of diameter 1 meter. The angle subtended by the wire at the centre of circle is equal to

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

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

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

D. $\frac{\pi}{10}$ radian

Answer: C

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

A. 0

B. 1

C. $\cos\theta - \sin\theta$

D. $\cos\theta + \sin\theta$

Answer: D

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3. If $\theta \in (\pi/4, \pi/2)$ and $\sum_{n=1}^{\infty} \frac{1}{\tan^n\theta} = \sin\theta + \cos\theta$, then the value of $\tan\theta$ is

A. $\sqrt{3}$

B. $\sqrt{2}+1$

C. $2+\sqrt{3}$

D. $\sqrt{2}$

Answer: A

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4. The value of $\frac{\tan^2 20^\circ - \sin^2 20^\circ}{\tan^2 20^\circ . \sin^2 20^\circ}$ is

A. $1/2$

B. 1

C. 2

D. none of these

Answer: B

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5. If $15\sin^4\alpha + 10\cos^4\alpha = 6$, then the value of $8\cos ec^6\alpha + 27\sec^6\alpha$ is

A. 150

B. 175

C. 225

D. 250

Answer: D

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6. In ΔABC, if $\sin A + \sin B + \sin C = 1 + \sqrt{2}$ and $\cos A + \cos B + \cos C = \sqrt{2}$ then the triangle is

A. equilateral

B. isosceles

C. right angled

D. right angle isosceles

Answer: D

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7. If $\frac{\sin^2 x - 2\cos^2 x + 1}{\sin^2 x + 2\cos^2 x - 1} = 4$, then the value of $2\tan^2 x$ is

A. 3

B. 4

C. 5

D. 6

Answer: C

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8. If $\sin\theta, \tan\theta, \cos\theta$ are in G.P. then $4\sin^2\theta - 3\sin^4\theta + \sin^6\theta =$ _ _ _ _

A. -1

B. 2

C. 1

D. none of these

Answer: C

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9. If $\tan\theta - \cot\theta = a$ and $\sin\theta + \cos\theta = b\left(b^2 - 1\right)^2\left(a^2 + 4\right)$ is equal to

A. 2

B. -4

C. ± 4

D. 4

Answer: D

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10. The least value of $18\sin^2\theta + 2\cos ec^2\theta - 3$ is

A. -15

B. -12

C. 0

D. 9

Answer: D

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11. If

$\tan^2\alpha\tan^2\beta+\tan^2\beta\tan^2\gamma+\tan^2\gamma\tan^2\alpha+2\tan^2\alpha\tan^2\beta\tan^2\gamma=1$

then $\sin^2\alpha+\sin^2\beta+\sin^2\gamma$ =

A. 0

B. 1

C. 1

D. none of these

Answer: C

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12. If x, y, z be all positive acute angles then the least value of $\tan x(\cot y + \cot z) + \tan y(\cot z + \cot x) + \tan z(\cot x + \cot y)$ is

A. 2

B. 4

C. 6

D. 8

Answer: C

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13. Three circles each of radius 1, touch one another externally and they lie between two parallel lines. The minimum possible distance between

the lines is

A. $2+\sqrt{3}$

B. $3+\sqrt{3}$

C. 4

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

Answer: A

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14. If $\frac{\cos\alpha}{\cos A}+\frac{\sin\alpha}{\sin A}+\frac{\sin\beta}{\sin A}=1$, where α and β do not differ by an even multiple of π, prove that $\frac{\cos\alpha\cos\beta}{\cos^2 A}+\frac{\sin\alpha\sin\beta}{\sin^2 A}=$

A. -2

B. -1

C. 1

D. 2

Answer: B

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15. Consider angles $\alpha = \left(2n + \frac{1}{2}\right)\pi \pm A$ and $\beta = m\pi + (-1)^m\left(\frac{\pi}{2} - A\right)$ where n, m $\in$ I. Which of the following is not true ?

A. α and β are always the same angles

B. α and β are co-terminal angles

C. $\sin\alpha = \sin\beta$ but $\cos\alpha \neq \cos\beta$

D. none of these

Answer: A

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16. Which of the following is true ?

A. $\sin 765^\circ = -\frac{1}{\sqrt{2}}$

B. $\cos\left(-\frac{15\pi}{4}\right) = -1$

C. $\frac{\tan(13\pi)}{3} = \frac{1}{\sqrt{3}}$

D. $\cos ec(-1410^\circ) = 2$

Answer: D

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17. If the angle A of a triangle ABC is given by the equation 5 cos A + 3 = 0, then sin A and tan A are the roots of the equation

A. $15x^2 - 8x - 16 = 0$

B. $15x^2 - 8\sqrt{2}x + 16 = 0$

C. $15x^2 - 8x + 16 = 0$

D. $15x^2 + 8x - 16 = 0$

Answer: D

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18. Which of the following is greatest ?

A. tan 1

B. $\tan^2 1$

C. cot 1

D. $\cot^2 1$

Answer: B

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19. The number of value/values of x for which sin $y = x^2 - 2x$ si possible is

A. 0

B. 1

C. infinite

D. none of these

Answer: C

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20. Which of the following is not correct ?

A. $\cos(\cos 1) > \cos(\sin 1)$

B. $\sin(\cos 1) < \sin(\sin 1)$

C. $\cos(\cos 2) > \sin(\cos 2)$

D. none of these

Answer: D

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21. If $\sin^4\alpha + \cos^4\beta + 2 = 4\sin\alpha\cos\beta, 0 \leq \alpha, \frac{\pi}{2}$, then $(\sin\alpha + \cos\beta)$ is equal to

A. $\sqrt{2}$

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

C. 2

D. 1

Answer: C

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22. Number of ordered pairs (a, x) satisfying the equation $\sec^2(a+2)x + a^2 - 1 = 0; \ -\pi < x < \pi$ is

A. 2

B. 1

C. 3

D. infinite

Answer: C

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23. Find the range of $y = \sin^3 x - 6\sin^2 x + 11\sin x - 6$.

A. $[-24, 2]$

B. $[-24, 0]$

C. $[0, 24]$

D. $[-24, 24]$

Answer: B

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24. Let $f(x) = a\sin x + c$, where a and c are real numbers and a>0. Then $f(x) < 0,\ \forall x \in R$ if

A. $c < -a$

B. $c > -a$

C. $-a < c < a$

D. $c < a$

Answer: A

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25. Find sum of maximum and minimum values of the function $f(x) = \sin^2 x + 8\cos x - 7$

A. -4

B. -5

C. 4

D. 5

Answer: B

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26. $\theta_1, \theta_2, \theta_3$ are angles of 1^{st} quadrant if $\tan\theta_1 = \cos\theta_1, \tan\theta_2 = \cos ec\theta_2, \cos\theta_3 = \theta_3$. Which of the following is not true ?

A. $\theta_1 < \theta_2$

B. $\theta_1 < \theta_3$

C. $\theta_3 < \theta_1$

D. $\theta_3 < \theta_2$

Answer: C

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27. The value of $2\cos 10^\circ + \sin 100^\circ + \sin 1000^\circ + \sin 10000^\circ$ is

A. 0

B. $\sin 10^\circ$

C. $\cos 10^\circ$

D. -1

Answer: C

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28. The two legs of a right triangle are $\sin\theta + \sin\left(\frac{3\pi}{2} - \theta\right)$ and $\cos\theta - \cos\left(\frac{3\pi}{2} - \theta\right)$ The length of its hypotenuse is hypotenuse is

A. 1

B. 2

C. $\sqrt{2}$

D. none of these

Answer: C

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29. In cyclic quadrilateral ABCD (none of these being 90°), which of the following is not true ?

A. tan A cot C = -1

B. sec B cos D = -1

C. cosec B sin D = 1

D. none of these

Answer: D

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30. If $x = \sin 130^\circ \cos 80^\circ$, $y = \sin 80^\circ \cos 130^\circ$, $z = 1 + xy$, which one of the following is true ?

A. $x > 0, y > 0, z > 0$

B. $x > 0, y < 0, 0 < z < 1$

C. $x > 0, y < 0, z > 1$

D. $x < 0, y < 0, 0 < z < 1$

Answer: B

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

A. 4

B. 6

C. 8

D. 12

Answer: C

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32. Value of expression $\sin\left(\frac{\pi}{9}\right)+\sin\left(\frac{2\pi}{9}\right)+\sin\left(\frac{3\pi}{9}\right)+\ldots+\sin\left(\frac{17\pi}{9}\right)=$

A. 0

B. -1

C. 1

D. $-3/2$

Answer: A

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33. $\cos^2 73^\circ+\cos^2 47^\circ-\sin^2 43^\circ+\sin^2 107^\circ$ is equal to

A. $1/2$

B. $3/4$

C. 1

D. none of these

Answer: C

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34. The expression

$$\frac{\tan\left(x-\frac{\pi}{2}\right).\cos\left(\frac{3\pi}{2}+x\right)-\sin^3\left(\frac{7\pi}{2}-x\right)}{\cos\left(x-\frac{\pi}{2}\right).\tan\left(\frac{3\pi}{2}+x\right)}$$ simplifies to

A. $\left(1+\cos^2 x\right)$

B. $\sin^2 x$

C. $-\left(1+\cos^2 x\right)$

D. $\cos^2 x$

Answer: B

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35. The value of $\frac{\sin 300^\circ . \tan 330^\circ . \sec 420^\circ}{\tan 135^\circ . \sin 210^\circ . \sec 315^\circ}$ is

A. -1

B. 1

C. $\sqrt{2}$

D. $\sqrt{3}$

Answer: C

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36. If the bisector of angle A of the triangle ABC makes an angle θ with BC, then $\sin\theta =$

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

B. $\left|\sin\left(\frac{B}{2}-C\right)\right|$

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

D. $\cos\left(\frac{B}{2}-C\right)$

Answer: C

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37. The median AD of a ΔABC is perpendicular to AB, than $\tan A + 2\tan B =$

A. tan A + tan B = 0

B. 2 tan A + tan B = 0

C. tan A + 2tan B = 0

D. none of these

Answer: C

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38. The maximum value of $1+\sin\left(\frac{\pi}{6}+\theta\right)+2\cos\left(\frac{\pi}{3}-\theta\right)$ for real values of θ is

A. 3

B. 5

C. 4

D. none of these

Answer: C

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