



India's Number 1 Education App

## MATHS

### BOOKS - CENGAGE MATHS (ENGLISH)

#### TRIGONOMETRIC FUNCTIONS

##### Illustration

1. Find the length of the chord which subtends an angle of  $120^\circ$  at the centre of the circle of radius 6 cm.



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2. If the angles of a triangle are  $30^\circ$  and  $45^\circ$  and the included side is  $(\sqrt{3} + 1) \text{ cm}$  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  $(\sqrt{3} + 1)$  units apart. If these chords subtend, at the centre, angles of  $\frac{90^\circ}{k}$  and  $\frac{180^\circ}{k}$ , where  $k > 0$ , then find the value of  $k$ .



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5. find the height of the regular pyramid with each edge measuring 1 cm.

Also,

(i) if  $\alpha$  is angle between any edge and face not containing that edge, then

$$\text{prove that } \cos \alpha = \frac{1}{\sqrt{3}}$$

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



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6. By geometrical interpretation, prove that

$$\sin(\alpha + \beta)s \in \alpha \cos \beta + \sin \beta \cos \alpha$$

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



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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  $\theta$  is acute angle.



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



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10. if  $0 < \alpha < \beta < \gamma < \frac{\pi}{2}$ , 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  $2(\sin^6 x + \cos^6 x) - 3(\sin^4 x + \cos^4 x) + 1 = 0$ .



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



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



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



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15.

If

$$(\sec A + \tan A)(\sec B + \tan B)(\sec C + \tan C) = (\sec A - \tan A)(\sec B - \tan B), \text{ prove that value of each side is } \pm 1.$$



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



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



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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  $\theta$ , 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 cm 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.



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



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  $31^\circ$ , find the diameter of the moon.



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



**28.** about to only mathematics



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

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



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**30.** Find the reference angles corresponding to each of the following angles. It may help if you sketch  $\theta$  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  $\theta$ . Find the values of the six trigonometric functions of  $\theta$ .



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



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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  $a^2 - 6 \sin x - 5a \leq 0$ ,  $\forall x \in R$ .



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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? (a)  $\sin 3$  (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 greatest? (a)  $\cos ec 1$  (b)  $\cos ec 2$  (c)  $\cos ec 4$  (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.



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



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  $\theta$ , which of the following is/are always positive?

(a)  $\cos(\cos \theta)$  (b)  $\cos(\sin \theta)$  (c)  $\sin(\cos \theta)$  (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  $f(x) = \frac{1}{4 \cos x - 3}$ .



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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  $f(x) = \frac{1}{5 \sin x - 6}$



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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  $x$  and  $\tan^2 y$ .



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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?

$$(\tan x)^{\ln(\cos x)} < (\cot x)^{\ln(\cos x)} \quad \forall x \in \left(\frac{\pi}{4}, \frac{\pi}{2}\right)$$

$$(\sin x)^{\ln(\sec x)} > (\cos x)^{\ln(\cos x)} \quad \forall x \in \left(0, \frac{\pi}{4}\right) \quad \left(\sec \frac{\pi}{3}\right)^{\ln(\tan x)} >$$

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



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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:

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



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



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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  $\tan 1^\circ \tan 2^\circ \tan 89^\circ = 1$



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



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**59.** Find the value of

$$\cos^2 \cdot \frac{\pi}{16} + \cos^2 \cdot \frac{3\pi}{16} + \cos^2 \cdot \frac{5\pi}{16} + \cos^2 \cdot \frac{7\pi}{16}.$$



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**60.**

If

$$\sin(120^\circ - \alpha) = \sin(120^\circ - \beta), \quad 0 < \alpha, \beta < \pi, \text{ then find the relation between } \alpha \text{ and } \beta.$$



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**61.** Find the sign of the values of  $\tan 113^\circ - \cos 107^\circ = a$  and

$$\tan 107^\circ - \cos 105^\circ = b$$



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**62.** In triangle ABC prove that

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

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



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## Example

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



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2. 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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3. 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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4. 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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5. Let  $A = \sin x + \cos x$ . Then find the value of  $\sin^4 x + \cos^4 x$  in terms of  $A$ .



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



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



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9. For each natural number  $n \leq 2$ , prove that  $\sin x_1\cos x_2 + \sin x_2\cos x_3 + \dots + \sin x_n\cos x_1 \leq \frac{n}{2}$  (where  $x_1, x_2, \dots, x_n$  are arbitrary real numbers).



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



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1. Two sides of a parallelogram are 12 cm and 8 cm. If one of the interior angles is  $135^\circ$ , 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 coins of radii 1 unit each are kept so that they touch each other and also the sides of the triangle. The area of the triangle is  $2\sqrt{3}(b)6+4\sqrt{3}12+(7\sqrt{3})/4(d)3+(7\sqrt{3})/4`$



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5. A polygon of nine sides, each of length 2, is inscribed in a circle. Prove that the radius of the circle is  $\cos ec 20^\circ$ .



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



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7. If angle C of triangle ABC is  $90^\circ$ , 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

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



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## Concept Application Exercises 2 2

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



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



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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 prove that  
 $(\sec \theta - \tan \theta)(\sec \phi - \tan \phi)(\sec \Psi - \tan \Psi) = \cot \theta. \cot \phi. \cot \Psi$



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**6.** If:  $\frac{x}{a} \cos \theta + \frac{y}{b} s \int h \eta = \tan \frac{dx}{a} s \int h \eta - \frac{y}{b} \cos \theta = 1$ , Prove that :  
 $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 2$



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



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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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### Concept Application Exercises 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  $72^\circ$  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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**Concept Application Exercises 2 4**

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



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**2.** Find the reference angle  $\theta'$  for the following angles in standard 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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## Concept Application Exercises 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  $n \in N$ ) ? (i)  $\sin \theta = \frac{n+1}{n}$

(ii)  $\sin \theta = \frac{n^2 + 1}{n + 1}$  (iii)  $\sec \theta = \frac{n+2}{n-1}$  (iv)  $\sec \theta = \frac{n}{\sqrt{n^2 + 1}}$

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

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

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

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

**Answer: C**



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



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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  $f(x) = \frac{1}{2|\cos x| - 3}$



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11. Find the range 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  $(\sin \theta + \cos e\theta)^2 + (\cos \theta + \sec \theta)^2 \geq 9$ .



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



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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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## Concept Application Exercises 2 6

1. Prove that:  $\tan 720^\circ - \cos 270^\circ - \sin 150^\circ \cos 120^\circ = \frac{1}{4}$



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## Concept Application Exercises 2 7

1. Find the value of the expression

$$\sec 610^\circ \cos ec 160^\circ - \cot 380^\circ \tan 470^\circ$$



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## Concept Application Exercises 2 8

1. 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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## Concept Application Exercises 2 9

1. 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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## Concept Application Exercises 2 10

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



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## Concept Application Exercises 2 11

1. Prove that:  $s \in^2 \frac{\pi}{18} + s \in^2 \frac{\pi}{9} + s \in^2 \frac{7\pi}{18} + s \in^2 \frac{4\pi}{9} = 2$



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## Concept Application Exercises 2 12

1.

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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## Concept Application Exercises 2 13

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



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## Concept Application Exercises 2 14

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



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## Exercises

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

A. 0

B. 1

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

D. 6

**Answer: C**



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

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

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

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

D. None of these

**Answer: B**



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**3.** If  $\sin x + \cos ex = 2$ , 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**



**Watch Video Solution**

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**



**Watch Video Solution**

**9.** If  $\sec \alpha$  and  $\csc \alpha$  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**



**Watch Video Solution**

**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**



**Watch Video Solution**

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

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  
(a) 0 (b) 1 (c) 2 (d) 3

A. 0

B. 1

C. 2

D. 3

**Answer: C**



**Watch Video Solution**

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.  $3\sqrt{3}/2$

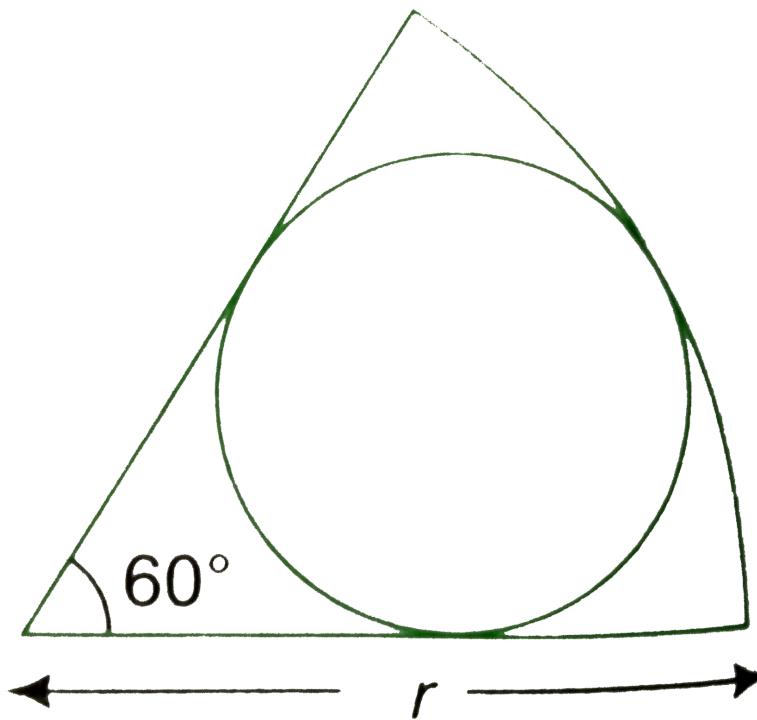
**Answer:** C



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

area 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  $\theta$  is the larger non-right angle in the triangle, then the value of

$$\cos \theta \text{ equal. } \frac{\sqrt{6} - \sqrt{2}}{4} \text{ (b) } \frac{4 + \sqrt{2}}{6} \text{ (c) } \frac{4 - \sqrt{2}}{3} \text{ (d) } \frac{4 - \sqrt{2}}{6}$$

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

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

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

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.  $15^\circ$

B.  $30^\circ$

C.  $45^\circ$

D.  $60^\circ$

**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**



**Watch Video Solution**

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  $\sin^2 \theta = \frac{x^2 + y^2}{2x} = 1$ , then  $x$  must be (a) -3 (b) -2 (c) 1 (d) none of

these

- A. -3
- B. -2
- C. 1

D. None of these

**Answer: C**



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22. If  $\sec^2 \theta = \frac{4xy}{(x+y)^2}$  is true if and only if (a)  $x + y \neq 0$  (b)  $x = y, x \neq 0$  (c)  $x = y$  (d)  $x \neq 0, y \neq 0$

A.  $x + y \neq 0$

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

C.  $x = y$

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

**Answer: B**



**Watch Video Solution**

**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



**Watch Video Solution**

**24.**

If

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

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

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

C. 4

D. 3

**Answer: C**



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**25. about to only mathematics**

A. positive

B. zero

C. negative

D. -3

**Answer: C**



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26. If  $1 + \sin x + \sin^2 x + \sin^3 x + \dots = \infty$  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

$(2 \sin^2 91^\circ - 1)(2 \sin^2 92^\circ - 1) \dots (2 \sin^2 180^\circ - 1)$  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**



**Watch Video Solution**

**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  $\alpha(\cos e\alpha)$  is

- A. less than  $\pi/6$
- B. greater than  $\pi/6$
- C. less than  $\pi/3$
- D. greater than  $\pi/3$

**Answer:** C



**Watch Video Solution**

**32.** The least value of  $2\sin^2\theta + 3\cos^2\theta$  is 1 (b) 2 (c) 3 (d) 5

- 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  $f(\theta) = \cos^2 \theta (\cos^2 \theta + 1) + 2 \sin^2 \theta$  is  $\left[\frac{3}{4}, 1\right]$  (b)  $\left[\frac{3}{16}, 1\right]$   
(c)  $\left[\frac{3}{4}, \frac{7}{4}\right]$  (d)  $\left[\frac{7}{4}, 2\right]$

A.  $[3/4, 1]$

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  $1 \leq i \leq n$  and  $\theta_1 + \theta_2 + \theta_3 + \dots + \theta_n = \pi$  then the greatest value of sum  $\sin \theta_1 + \sin \theta_2 + \sin \theta_3 + \dots + \sin \theta_n$  is equal to

A. n

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

C.  $\pi$

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  $\theta$ , is (a)  $(-\infty, 1]$  (b)  $(-\infty, -1]$  (c)  $\varphi$  (d)  $[-1, \infty)$

A.  $(-\infty, 1]$

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

C.  $\varphi$

D.  $[-1, \infty)$

**Answer:** D



**Watch Video Solution**

**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 (b) 432  
(c) 504 (d) 776

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**



**Watch Video Solution**

**43.** If  $y = (\sin x + \cos ex)^2 + (\cos x + \sec x)^2$  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  $\cot^4 x - 2 \cos ec^2 x + a^2 = 0$  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 (a)  $(2, \infty)$  (b)  $(4, \infty)$  (c)  $(-\infty, -2)$  (d)  $(-\infty, -4)$

A.  $[2, \infty)$

B.  $[4, \infty)$

C.  $(-\infty, -2]$

D.  $(-\infty, -4]$

**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  
(a) -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)  $-1 - \cot \alpha$

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  $\frac{\sec \theta}{\sqrt{1 + \tan^2 \theta}} + \frac{\cos ec \theta}{\sqrt{1 + \cot^2 \theta}}$  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  
 $f(x) = \frac{\sin x}{\sqrt{1 - \cos^2 x}} + \frac{\cos x}{\sqrt{1 - \sin^2 x}} + \frac{\tan x}{\sqrt{\sec^2 x - 1}} + \frac{\cot x}{\sqrt{\csc^2 x - 1}}$   
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)  $\left(0, \frac{\pi}{4}\right)$

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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53. Th range of k for which the inequality

$$k \cos^2 x - k \cos x + 1 \geq 0 \quad \forall x \in (-\infty, \infty) \text{ is}$$

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. Find the value of

$$\cos(\pi)/7 + \cos(2\pi)/7 + \cos(3\pi)/7 + \cos(4\pi)/7 + \cos(5\pi)/7 + \cos(6\pi)/7 + \cos(7\pi)/7$$

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

$$\log_{10}(\tan 6^\circ) + \log_{10}(\tan 12^\circ) + \log_{10}(\tan 18^\circ) + \dots + \log_{10}(\tan 84^\circ)$$

is

A. -1

B. 0

C. 1

D. 2

**Answer: B**



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**Multiple Correct Answers Type**

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

A.  $30^\circ$

B.  $60^\circ$

C.  $120^\circ$

D.  $150^\circ$

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



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

- A.  $\sec B = \sec D$
- B.  $\cot A + \cot C = 0$
- C.  $\cos ec A = \cos ec C$
- D.  $\tan B + \tan D = 0$

**Answer: B::C::D**



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

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 the difference between the roots of the equation  $x^2 + ax + 1 = 0$  is less than  $\sqrt{5}$ , then the set of possible values of  $a$  is (1)  $(-3, 3)$  (2)  $(-3, \infty)$  (3)  $(3, \infty)$  (4)  $(-\infty, -3)$

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**



5. about to only mathematics

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**



6.  $(a + 2)\sin \alpha + (2a - 1)\cos \alpha = (2a + 1)$  if  $\tan \alpha$  is  $\frac{3}{4}$  (b)  $\frac{4}{3}$  (c)

$2a(a^2 + 1)$  (d)  $2a(a^2 - 1)$

A.  $3/4$

B.  $4/3$

C.  $2a / (a^2 + 1)$

D.  $2a / (a^2 - 1)$

**Answer: B::D**



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7. Let  $f(x) = \log_{1/3} \left( (\log)_{\frac{1}{3}} ((\log)_7 (\sin x + a)) \right)$  be defined for every real value of  $x$ , then the possible value(s) of  $a$  is (a) 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.  $\frac{1}{2} \log_b(1 - b^{2x})$

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  $\Delta ABC$ ?

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

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

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

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

**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  
A.  $2 \cot \alpha$  (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 the interval  
(a)  $\left(-\infty, -\frac{8}{3}\right)$  (b)  $\left(-\frac{12}{5}, \infty\right)$  (c)  $\left(-\frac{8}{3}, -\frac{12}{5}\right)$  (d)  
 $\left(-\frac{8}{3}, \infty\right)$

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

$$n_1 = \sin 15^\circ - \cos 15^\circ, n_2 = \cos 93^\circ + \sin 93^\circ, n_3 = \tan 27^\circ - \cot 27^\circ, n_4 =$$

$$n_1 < 0 \text{ (b) } n_2 < 0 \text{ (c) } n_3 < 0 \text{ (d) } n_4 < 0$$

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  $0 < \varphi \geq \frac{\pi}{2}$ , if  $x = \sum_{n=0}^{\infty} \cos^{2n} \varphi, y = \sum_{n=0}^{\infty} \sin^{2n} \varphi$ , then (a)

$$xyz = xz + y \text{ (b) } xyz = xy + z \text{ (c) } xyz = x + y + z \text{ (d) } xyz = yz + x$$

A.  $xyz = xz + y$

B.  $xyz = xy + z$

C.  $xyz = x + y + z$

D.  $xyz = yz + x$

**Answer: B::C**



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### Linked Comprehension Type

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.  $\alpha, \beta, \gamma$  and  $\delta$  are angles in I, II, III 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.  $\alpha, \beta, \gamma$  and  $\delta$  are angles in I, II, III 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.  $\alpha, \beta, \gamma$  and  $\delta$  are angles in I, II, III 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

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

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

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

B. 1

C. 2

D. can't be determined

**Answer: B**



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8.

In

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

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

A. 1/2 sq. units

B.  $1/3$  sq. units

C. 1 sq. units

D.  $2\text{sq. Units}$

**Answer: A**



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**9.** 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.  $-1/2$

B.  $1/2$

C.  $1/4$

D.  $-3/2$

**Answer: D**



10. Let  $f(x) = \sin^6 x + \cos^6 x + k(\sin^4 x + \cos^4 x)$  for some real number  $k$ . Value of  $k$  for which  $f(x)$  is constant for all values of  $x$  is  $-\frac{1}{2}$

(b)  $\frac{1}{2}$  (c)  $\frac{1}{4}$  (d)  $-\frac{3}{2}$  All real numbers  $k$  for which the equation  $f(x) = 0$  has solution lie in  $[-1, 0]$  (b)  $\left[0, \frac{1}{2}\right]$  (c)  $\left[-1, -\frac{1}{2}\right]$  (d) none of these

Number of values of  $k$  for which  $f(x) = 0$  is an identity is (a) 0 (b) 1 (c) infinite (d) none of these

A.  $[-1, 0]$

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

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

D. None of these

**Answer: C**



11. Let  $f(x) = \sin^6 x + \cos^6 x + k(\sin^4 x + \cos^4 x)$  for some real number  $k$ . Value of  $k$  for which  $f(x)$  is constant for all values of  $x$  is  $-\frac{1}{2}$

(b)  $\frac{1}{2}$  (c)  $\frac{1}{4}$  (d)  $-\frac{3}{2}$  All real numbers  $k$  for which the equation  $f(x) = 0$  has solution lie in  $[-1, 0]$  (b)  $\left[0, \frac{1}{2}\right]$  (c)  $\left[-1, -\frac{1}{2}\right]$  (d) none of these

Number of values of  $k$  for which  $f(x) = 0$  is an identity is (a) 0 (b) 1 (c) infinite (d) none of these

A. 0

B. 1

C. infinite

D. None of these

**Answer: A**



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**Matrix Match Type**

**1. Match the following columns :**

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



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## 2. Match the following Column I to Column II

Column I	Column II
(A) If maximum and minimum values of $\frac{7 + 6 \tan \theta - \tan^2 \theta}{(1 + \tan^2 \theta)}$ for all real values of $\theta \sim \frac{\pi}{2}$ are $\lambda$ and $\mu$ respectively, then	(p) $\lambda + \mu = 2$
(B) If maximum and minimum values of $5 \cos \theta + 3 \cos\left(\theta + \frac{\pi}{3}\right) + 3$ for all real values of $\theta$ are $\lambda$ and $\mu$ respectively, then	(q) $\lambda - \mu = 6$
(C) If maximum and minimum values of $1 + \sin\left(\frac{\pi}{4} + \theta\right) + 2 \cos\left(\frac{\pi}{4} - \theta\right)$ for all real values of $\theta$ and $\lambda$ and $\mu$ respectively, then	(r) $\lambda + \mu = 6$  (s) $\lambda - \mu = 10$ <hr style="width: 20%; margin-left: auto; margin-right: 0;"/> (t) $\lambda - \mu = 14$



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3. For all real values of  $\theta$ , 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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### Numerical Value Type

1. The value of the expression  $\frac{\tan^2 20^\circ - \sin^2 20^\circ}{\tan^2 20^\circ + \sin^2 20^\circ}$  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  $3 \frac{\sin^4 t + \cos^4 t - 1}{\sin^6 t + \cos^6 t - 1}$  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  $f(\theta) = \frac{1}{1 + (\cot \theta)^x}$  and  $S = \sum_{\theta=1^\circ}^{89^\circ} f(\theta)$ , then the value of  $S$  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  $f(a) = (a^2 - a + 1) + \frac{8 \sin^2 a}{\sqrt{a^2 - a + 1}} + \frac{27 \cos e c^2 a}{\sqrt{a^2 - a + 1}}$ , 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  $p^2 \cos ec^2 \theta - q^2 \cot^2 \theta = 5$  then the value of  $\sqrt{81p^{-2} - q^{-2}}$  is \_\_\_\_\_



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Archives Jee Main

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

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

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

C.  $\tan A + \cot A$

D.  $\sec A + \cos ec A$

**Answer: B**



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2. Let  $f_K(x) = \frac{1}{k}(s \in^k x + \cos^k x)$  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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**Archives Jee Advanced Single Correct Answer Type**

1.

Let

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

be two sets. Then

A.  $P \subset Q$  and  $Q - P = \emptyset$

B.  $Q \not\subset P$

C.  $P \not\subset Q$

D.  $P = Q$

**Answer: D**



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Archives Jee Advanced Multiple Correct Answers Type

1. If  $\frac{\sin^4 x}{2} + \frac{\cos^4 x}{3} = \frac{1}{5}$  then

A.  $\tan^2 x = \frac{2}{3}$

$$\text{B. } \frac{\sin^8 x}{8} + \frac{\cos^8 x}{27} = \frac{1}{125}$$

$$\text{C. } \tan^2 x = \frac{1}{3}$$

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

**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

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

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

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

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

**Answer: C**



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**2.** about to only mathematics

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  $\frac{\tan^2 20^\circ - \sin^2 20^\circ}{\tan^2 20^\circ \cdot \sin^2 20^\circ}$  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  $8 \cos^6 \alpha + 27 \sec^6 \alpha$  is

A. 150

B. 175

C. 225

D. 250

**Answer:** D



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6.

In

$\Delta ABC$ ,

if

$$\sin A + \sin B + \sin C = 1 + \sqrt{2} \text{ and } \cos A + \cos B + \cos C = \sqrt{2}$$

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

$$4\sin^2 \theta - 3\sin^4 \theta + \sin^6 \theta = \underline{\quad} - \underline{\quad} - \underline{\quad} -$$

A. -1

B. 2

C. 1

D. none of these

**Answer: C**



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

A. 2

B. -4

C.  $\pm 4$

D. 4

**Answer: D**



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10. The least value of  $18 \sin^2 \theta + 2 \cos e c^2 \theta - 3$  is (a) -15 (b) -12 (c) 0 (d) 9

A. -15

B. -12

C. 0

D. 9

**Answer: D**



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11.

If

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

$$\text{then } \sin^2 \alpha + \sin^2 \beta + \sin^2 \gamma =$$

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  $\alpha$  and  $\beta$  do not differ by an even multiple of  $\pi$ , 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  $n, m \in \mathbb{I}$ . Which of the following is not true?

A.  $\alpha$  and  $\beta$  are always the same angles

B.  $\alpha$  and  $\beta$  are co-terminal angles

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

D. none of these

**Answer: C**



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

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

$\tan \theta_1 = \cos \theta_1, \tan \theta_2 = \cos e c \theta_2, \cos \theta_3 = \theta_3$ . 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

- 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  $90^\circ$ ), which of the following is not true?

- A.  $\tan A \cot C = -1$
- B.  $\sec B \cos D = -1$
- C.  $\operatorname{cosec} B \sin D = 1$

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

$$\sin\left(\frac{\pi}{9}\right) + \sin\left(\frac{2\pi}{9}\right) + \sin\left(\frac{3\pi}{9}\right) + \dots + \sin\left(\frac{17\pi}{9}\right) =$$

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

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

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

B.  $\sin^2 x$

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

D.  $\cos^2 x$

**Answer:** B



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**35.** The value of  $\frac{\sin 300^\circ \cdot \tan 330^\circ \cdot \sec 420^\circ}{\tan 135^\circ \cdot \sin 210^\circ \cdot \sec 315^\circ}$  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  $\theta$  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. In a  $\Delta ABC$ , if median AD is perpendicular to AB, then  $\tan A + 2\tan B$  is equal to

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

B.  $2 \tan A + \tan B = 0$

C.  $\tan A + 2\tan B = 0$

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  $\theta$  is

A. 3

B. 5

C. 4

D. none of these

**Answer: C**



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