

MATHS

BOOKS - CHHAYA PUBLICATION MATHS (BENGALI ENGLISH)

TRIGONOMETRIC RATIOS OF ASSOCIATED ANGLES

Illustrative Examples

1. State which of the following is the value of $\cot(-870^\circ)$?



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2. Find the value of (i) $\sec\left(-\frac{31\pi}{4}\right)$



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3. If $\sin 49^\circ = \frac{3}{4}$ find the value of $\sin 581^\circ$.

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4. Express $\csc(-1565^\circ)$ in terms of the ratio of a positive angle less than 45° .

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5. If $\theta = 160^\circ$, find the sign of $(\sin \theta + \cos \theta)$

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6. Find the value of $\cos 200^\circ \sin 160^\circ + \sin(-340^\circ) \cos(-380^\circ)$.

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7. Simplify :

$$\frac{\sec(270^\circ - A)\sec(90^\circ - A) - \tan(270^\circ - A)\tan(90^\circ + A)}{\cot A + \tan(180^\circ + A) + \tan(90^\circ + A) + \tan(360^\circ - A) + \cos 180^\circ}$$



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8. If $4\theta = 11\pi$ find the value of $\frac{\sin(-\theta) + \cos(-\theta)}{\sec\theta + \tan(-\theta)}$.



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9. If $\tan\theta = -\frac{4}{3}$, find the value of $(\sin\theta + \cos\theta)$.



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10. If n is an integer, find the value of $\cos\left[n\pi + (-1)^n \frac{\pi}{6}\right]$.



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11. Find the sum to n terms of the following series:

$$\cos \alpha + \cos(\pi - \alpha) + \cos(2\pi + \alpha) + \dots \quad \left(0 < \alpha < \frac{\pi}{2}\right).$$



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12. Solve: $\sin \theta + \sqrt{3} \cos \theta = 1$ ($0 < \theta < 360^\circ$).



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13. Show that, $\cot 1^\circ \cot 2^\circ \cot 3^\circ \dots \cot 87^\circ \cot 88^\circ \cot 89^\circ = 1$



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14. A, B, C, D are the four angles, taken in order of a cyclic quadrilateral.

Prove that, $\cot A + \cot B + \cot C + \cot D = 0$



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15. If $\tan(\alpha - \beta) = 1$, $\sec(\alpha + \beta) = \frac{2}{\sqrt{3}}$, find positive magnitude of α and β .



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16. If $\tan 17^\circ = x$, find the value of $\frac{\tan 163^\circ - \tan 107^\circ}{1 + \tan 163^\circ \tan 107^\circ}$.



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Exercise Multiple Choice Type Questions 1 Mark

1. If $\sin \theta = -\frac{1}{2}$, then $\theta =$

A. 30°

B. 120°

C. 150°

D. 210°

Answer: D



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2. $\sin(\alpha - 540^\circ) =$

A. $\sin \alpha$

B. $-\sin \alpha$

C. $\cos \alpha$

D. $-\cos \alpha$

Answer: B



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3. If $\tan 35^\circ = 0.7$, then $\tan(-665^\circ) =$

A. 0.7

B. 0.007

C. $\frac{10}{7}$

D. $\frac{100}{7}$

Answer: D



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4. State which of the following is the value of $\cot(-870^\circ)$?

A. $\sqrt{3}$

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

C. $-\frac{1}{\sqrt{3}}$

D. $-\sqrt{3}$

Answer: A



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5. Which of the following is the value of $\cos(-1170^\circ)$?

- A. 1
- B. -1
- C. 0
- D. $-\frac{1}{2}$

Answer: C



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6. Which of the following is the value of $\sec(-945^\circ)$?

- A. $\sqrt{2}$
- B. $-\sqrt{2}$
- C. 2
- D. -2

Answer: B



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7. Which of the following is the value of $\cos\left(\frac{5\pi}{2} - \frac{19\pi}{3}\right)$?

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

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

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

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

Answer: A



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

A. $x + y \neq 0$

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

C. $x = y$

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

Answer: B



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9. If $\tan \theta = \sec \theta = e^x$, then $\cos \theta$ equals-

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

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

C. $\frac{e^x - e^{-x}}{2}$

D. $\frac{e^x - e^{-x}}{e^x + e^{-x}}$

Answer: B



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Exercise Very Short Answer Type Questions 2 Marks

1. Find the values:

$$(i) \cot 660^\circ + \tan(-1050^\circ)$$



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2. Find the values:

$$(ii) \sin 135^\circ \cos 210^\circ \tan 240^\circ \cot 300^\circ \sec 330^\circ$$



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3. Find the values:

$$(iii) \sin 420^\circ \cos 390^\circ - \cos(-300^\circ) \sin(-330^\circ)$$



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4. Find the values:

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



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5. Find the values:

$$(v) \cos 24^\circ + \cos 55^\circ + \cos 125^\circ + \cos 204^\circ + \cos 300^\circ.$$



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6. If $\theta + \phi = 60^\circ$, show that, $\sin(120^\circ - \theta) = \cos(30^\circ - \phi)$.



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7. Solve $[0^\circ \leq \theta \leq 360^\circ]$:

$$(a) \sin \theta = \frac{1}{2}$$

A. `

B.

C.

D.

Answer: $210^\circ, 330^\circ$



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8. Solve $[0^\circ \leq \theta \leq 360^\circ]$:

(b) $\sec \theta = \frac{2}{\sqrt{3}}$



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9. Solve $[0^\circ \leq \theta \leq 360^\circ]$:

(c) $3 \tan^2 \theta = 1$



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10. Prove: (i) $\sin 45^\circ \cos 65^\circ + \sin 135^\circ \cos 115^\circ = 0$



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11. Prove: (ii) $\tan\left(\frac{\pi}{12}\right)\tan\left(\frac{5\pi}{12}\right)\tan\left(\frac{7\pi}{12}\right)\tan\left(\frac{11\pi}{12}\right) = 1$



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12.

Prove:

(iii)

$$\sec(270^\circ - \theta)\sec(90^\circ - \theta) - \tan(270^\circ - \theta)\tan(90^\circ + \theta) = -1$$



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13. Prove: (iv) $\cos 306^\circ + \cos 234^\circ + \cos 162^\circ + \cos 18^\circ = 0$.



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14. If $\tan \theta = \frac{5}{12}$ and $\sin \theta$ is negative, find $\cos \theta$.



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Exercise Short Answer Type Questions 4 Marks

1. Simplify:

$$(i) \frac{\cos \theta}{\sin(90^\circ + \theta)} + \frac{\sin(-\theta)}{\sin(180^\circ + \theta)} - \frac{\tan(90^\circ + \theta)}{\cot \theta}$$



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2. Simplify:

$$\frac{\cos(2\pi + \alpha) \operatorname{cosec}(\pi - \alpha) \tan\left(\frac{\pi}{2} + \alpha\right)}{\sec\left(\frac{\pi}{2} + \alpha\right) \sin\left(\frac{3\pi}{2} - \alpha\right) \cot(2\pi - \alpha)}$$



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3. If $\sin \theta = -\frac{3}{5}$ and θ lies in the third quadrant, find $\tan \theta$ and $\sec \theta$.

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4. If $\tan \theta = \frac{15}{8}$ and $\cos \theta$ is negative, find the value of $\frac{\sin(-\theta) - \cos \theta}{\tan(-\theta) + \sec(-\theta)}$.

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5. If θ lies in the fourth quadrant and $\sec \theta = \frac{5}{3}$ then find the value of $\frac{6 \tan \theta + 5 \cos \theta}{5 \cot \theta + \operatorname{cosec} \theta}$.

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6. Find the sum of n terms:

$$\sin \theta + \sin(\pi + \theta) + \sin(2\pi + \theta) + \sin(3\pi + \theta) + \dots$$

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7. If n is an integer, prove that,

$$(i) \cos(n\pi + \theta) = (-1)^n \cos \theta$$



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8. If n is an integer, prove that,

$$(ii) \tan\left\{\frac{n\pi}{2} + (-1)^n \frac{\pi}{4}\right\} = 1$$



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9. If n is an integer, prove that,

$$(iii) \sin\left\{n\pi + (-1)^n \cdot \frac{\pi}{6}\right\} = \frac{1}{2}.$$



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10. If n is an integer, prove that,

(iv) $\tan(n\pi + \alpha) = \tan \alpha$



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11. If A, B, C are the angles of a triangle, show that,

(i) $\sin B \cos(C + A) + \cos B \sin(C + A) = 0$



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12. If A, B, C are the angles of a triangle, show that,

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



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13. If A, B, C are the angles of a triangle, show that,

(iii) $\frac{\cos A \cos C + \cos(A + B)\cos(B + C)}{\cos A \sin C - \sin(A + B)\cos(B + C)} = \cot C.$



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14. If A,B,C are the angles of a triangle, show that,

$$(iv) \frac{\tan(B+C) + \tan(C+A) + \tan(A+B)}{\tan(\pi - A) + \tan(2\pi - B) + \tan(3\pi - C)} = 1$$



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15. If A, B, C, D are the four angle taken in order of a cyclic quadrilateral,
prove that

$$(i) \tan A + \tan B + \tan C + \tan D = 0$$



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16. If A, B, C, D are the four angle taken in order of a cyclic quadrilateral,
prove that

(ii)

$$\cos(180^\circ - A) + \cos(180^\circ + B) + \cos(180^\circ + C) - \sin(90^\circ + D) = 0$$



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17. If A, B, C, D are the four angle taken in order of a cyclic quadrilateral, prove that

(iii) $\cos A + \cos B + \cos C + \cos D = 0$



18. If A, B, C, D are the four angle taken in order of a cyclic quadrilateral, prove that

(iv) $\tan(A + B) + \tan(C + D) = 0.$



19. Prove that, $\tan 1^\circ \tan 2^\circ \tan 3^\circ \dots \tan 87^\circ \tan 88^\circ \tan 89^\circ = 1.$



20.

Prove

that,

$$\tan^2\left(\frac{\pi}{6}\right) \cdot \tan^2\left(2\frac{\pi}{16}\right) \cdot \tan^2\left(3\frac{\pi}{16}\right) \cdot \tan^2\left(4\frac{\pi}{16}\right) \cdot \tan^2\left(5\frac{\pi}{16}\right) \cdot \tan^2\left(6\frac{\pi}{16}\right) \cdots$$



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21.

Show

that,

$$\tan 181^\circ \tan 182^\circ \tan 183^\circ \cdots \tan 267^\circ \tan 268^\circ \tan 269^\circ = 1.$$



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



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23. Find the minimum value of $2^{\sin^2 \theta} + 2^{\cos^2 \theta}$.



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Exercise Long Answer Type Questions 5 Marks

1. Prove that,

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



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2. Solve ($0^\circ \leq \theta \leq 360^\circ$) :

$$(i) \cos^2 \theta - \sin \theta = \frac{1}{4}$$



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3. Solve ($0^\circ \leq \theta \leq 360^\circ$) :

$$(ii) \cos \theta + \sqrt{3} \sin \theta = 2$$



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4. Solve ($0^\circ \leq \theta \leq 360^\circ$) :

(iii) $\tan \theta + \cot \theta = 2\sec \theta$



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5. (iv) $\tan^4 \theta - 4\tan^2 \theta + 3 = 0 (0 < \theta < 180^\circ)$



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6. Solve ($0^\circ \leq \theta \leq 360^\circ$) :

(v) $4\sin \theta \cos \theta = 1 - 2\sin \theta + 2\cos \theta.$



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7. If $\text{cosec}(\alpha - \beta) = \frac{2}{\sqrt{3}}$ and $\sec(\alpha + \beta) = \sqrt{2}$, find least positive values of α and β .



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8. If $\tan 25^\circ = a$, prove that, $\frac{\tan 155^\circ - \tan 115^\circ}{1 + \tan 155^\circ \tan 115^\circ} = \frac{1 - a^2}{2a}$



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9. Prove that the value of
$$\frac{\sin^3(2\pi - \theta)}{\cos^2\left(\frac{3\pi}{2} + \theta\right)} \cdot \frac{\cos^3(2\pi - \theta)}{\sin^3(2\pi + \theta)} \cdot \frac{\tan(\pi - \theta)}{\operatorname{cosec}^2(\pi - \theta)} \cdot \frac{\sec^2(\pi + \theta)}{\sin \theta}.$$
 Is independent of θ .



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10. If $\tan 15^\circ = 2 - \sqrt{3}$, then show that

$$2\tan 1095^\circ + \cot 975^\circ + \tan(-195^\circ) = 4 - 2\sqrt{3}.$$



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11. Prove that $\frac{\cos\left(2\pi r \pm \frac{\pi}{4}\right)}{\sin\left\{q\pi + (-1)^q \cdot \frac{\pi}{4}\right\}} = 1$ where p and q are integers.



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Sample Questions For Competitive Exams Multiple Correct Answers Type

1. If $\cos^2 \alpha - \sin \alpha = \frac{1}{4}$, then the value of α ($0^\circ \leq \alpha \leq 360^\circ$) will be-

A. 30°

B. 120°

C. 150°

D. 105°

Answer: A::C



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2. If n be an odd number then the value of $\cos(n\pi + \theta)$ will be-

A. $\sin \theta$

B. $\cos \theta$

C. $-\sin \theta$

D. $-\cos \theta$

Answer: D



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3. If $\cos \theta = \frac{1}{2}$, then the value of θ will be -

A. 420°

B. 60°

C. 300°

D. 330°

Answer: A::B::C



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4. If $0 < \theta < \pi$, then the value of $\sqrt{\frac{1 - \sin \theta}{1 + \sin \theta}} + \sqrt{\frac{1 + \sin \theta}{1 - \sin \theta}}$ will be-

- A. $2 \sec \theta$
- B. $-2 \sec \theta$
- C. $\sec \theta$
- D. $-\sec \theta$

Answer: A::B



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5. If $\tan \theta = -\frac{1}{\sqrt{5}}$, then the value of $\cos \theta$ will be -

- A. $-\frac{\sqrt{5}}{\sqrt{6}}$
- B. $\frac{1}{\sqrt{6}}$
- C. $\frac{\sqrt{5}}{\sqrt{6}}$
- D. $\frac{1}{2}$

Answer: A::C



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Sample Questions For Competitive Exams Integer Answers Type

1. The value of $-\tan 315^\circ$ is-



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2. If $3 \sin \theta + 5 \cos \theta = 5$, then the value of $5 \sin \theta - 3 \cos \theta$ will be-



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3. If $\sin x + \cos x = 2$, then the value of $\sin^n x + \cos^n x$ will be-



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4. The value of $3 \sin\left(\frac{\pi}{6}\right) \sec\left(\frac{\pi}{3}\right) - 4 \sin\left(5\frac{\pi}{6}\right) \cot\left(\frac{\pi}{4}\right)$ is-



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5. The value of

$\cos\left(\frac{3\pi}{2} + x\right) \cos(2\pi + x) \left\{ \cot\left(\frac{3\pi}{2} - x\right) + \cot(2\pi + x) \right\}$ is-



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Sample Questions For Competitive Exams Matrix Match Type

1. Find the value of $\tan 15^\circ$



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2. Find the value of $\cos 15^\circ$



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Sample Questions For Competitive Exams Comprehension Type

1. If A, B, C are three angles of $\triangle ABC$, then

(i) $\tan\left(\frac{A - B}{2}\right) =$

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

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

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

D. none of these

Answer: A



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2. If A, B, C are three angles of $\triangle ABC$, then

(ii) $\cos(A + B) + \sin C =$

A. $\sin(B + C) - \cos A$

B. $\sin(A + B) - \cos C$

C. $\sin(A + C) - \cos B$

D. none of these

Answer: B



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3. If A, B, C are three angles of $\triangle ABC$, then

(iii) $\sin(B + C) + \sin(C + A) + \sin(A + B) =$

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

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

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

D. $-(\sin A + \sin B + \sin C)$

Answer: C



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4. If A,B,C,D are the successive angles of a cyclic quadrilateral, then-

$$(i) \cos\left(\frac{A+C}{2}\right) + \cos\left(\frac{B+D}{2}\right) =$$

A. 1

B. -1

C. 0

D. 2

Answer: C



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5. If A,B,C,D are the successive angles of a cyclic quadrilateral, then-

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

A. 0

B. 1

C. -1

D. none of these

Answer: A



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6. If A, B, C, D are the successive angles of a cyclic quadrilateral, then-

(iii) $\cot A - \cot B + \cot C - \cot D =$

A. 1

B. 0

C. -1

D. 2

Answer: B



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Sample Questions For Competitive Exams Assertion Reason Type

1. Find the value of $\tan 75^\circ$



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2. Find the value of $\sin 105^\circ$



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