



## MATHS

### BOOKS - SAI MATHS (TELUGU ENGLISH)

#### TRIGONOMETRIC RATIOS

#### Problems

1. If  $A = \sin^3 \theta + \cos^4 \theta$ , then for all values of  $\theta$ ,  $A$  lies in the interval

A.  $[1, 2]$

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

C.  $\left[\frac{1}{2}, \frac{3}{4}\right]$

D.  $\left[\frac{3}{4}, \frac{19}{16}\right]$

**Answer: B**



2. If  $\sin \theta + \cos \theta = p$  and  $\tan \theta + \cot \theta = q$  then  $q(p^2 - 1) =$

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

B. 2

C. 1

D. 3

**Answer: B**



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3.  $\tan \frac{\pi}{5} + 2 \tan \frac{2\pi}{5} + 4 \cot \frac{4\pi}{5} =$

A.  $\cot \frac{\pi}{5}$

B.  $\cot \frac{2\pi}{5}$

C.  $\cot \frac{3\pi}{5}$

D.  $\cot \frac{4\pi}{5}$

**Answer: A**

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4. If  $\cos x = \tan y$ ,  $\cot y = \tan z$ ,  $\cot z = \tan x$  then  $\sin x =$

A.  $\frac{\sqrt{5} + 1}{4}$

B.  $\frac{\sqrt{5} - 1}{4}$

C.  $\frac{\sqrt{5} + 1}{2}$

D.  $\frac{\sqrt{5} - 1}{2}$

**Answer: D**

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5.  $\tan 81^\circ - \tan 63^\circ - \tan 27^\circ + \tan 90^\circ$  equals to

A. 6

B. 0

C. 2

D. 4

**Answer: D**



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6. If  $x$  and  $y$  are angles such that

$\cos x + \cos y = \frac{3}{2}$  and  $\sin x + \sin y = \frac{3}{4}$ , then  $\sin(x + y)$  equals to

A.  $\frac{2}{5}$

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

C.  $\frac{3}{5}$

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

**Answer: D**



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7. The period of  $f(x) = \cos\left(\frac{x}{2}\right) + \sin\left(\frac{x}{2}\right)$  is

A.  $2\pi$

B.  $4\pi$

C.  $8\pi$

D.  $12\pi$

**Answer: D**



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8.  $\sin \theta + \cos \theta = p$ ,  $\sin^3 \theta + \cos^3 \theta = q \Rightarrow p(p^2 - 3) =$

A.  $q$

B.  $2q$

C.  $-q$

D.  $-2q$

**Answer: D**



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9. If  $\tan(\pi \cos \theta) = \cot(\pi \sin \theta)$ , then prove that

$$\cos\left(\theta - \frac{\pi}{4}\right) = \pm \frac{1}{2\sqrt{2}}$$

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

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

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

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

**Answer: A**



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10.  $3 \sin x + 4 \cos x = 5 \Rightarrow 6 \tan \frac{x}{2} - 9 \tan^2 \frac{x}{2} =$

A. 0

B. 1

C. 3

D. 4

**Answer: B**



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11. The minimum value of  $27 \tan^2 \theta + 3 \cot^2 \theta$  is

A. 15

B. 18

C. 24

D. 30

**Answer: B**



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12.  $\cos 36^\circ - \cos 72^\circ =$

A. 1

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

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

D.  $\frac{1}{8}$

**Answer: B**



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13. If  $A, B, C$  are angles of a triangle then prove that

$$\cot A \cot B + \cot B \cot C + \cot C \cot A = 1$$



A.  $-1$

B.  $0$

C.  $1$

D.  $2$

**Answer: C**



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14. If  $f: \mathbb{R} \rightarrow \mathbb{R}$  is defined by  $f(x) = 7 + \cos(5x + 3)$  for  $x \in \mathbb{R}$ , then the period of  $f$  is

A.  $2\pi$

B.  $\pi$

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

D.  $\frac{2\pi}{5}$

**Answer: D**



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15.  $\cos A = \frac{3}{4} \Rightarrow 32 \sin\left(\frac{A}{2}\right) \sin\left(\frac{5A}{2}\right) =$

A. 7

B. 8

C. 13

D. 11

Answer: D



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16. If  $f(x) = \sin^6 x + \cos^6 x$  for  $x \in R$ , then  $f(x)$  lies in the interval

A.  $\left[\frac{7}{8}, \frac{5}{4}\right]$

B.  $\left[\frac{1}{2}, \frac{5}{8}\right]$

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

D.  $\left[\frac{1}{4}, \frac{1}{2}\right]$

**Answer: C**



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17. The period of  $\left(\tan \theta - \frac{1}{3}\tan^3 \theta\right)\left(\frac{1}{3} - \tan^2 \theta\right)$ , when  $\tan^2 \theta \neq \frac{1}{3}$  is

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

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

C.  $\pi$

D.  $2\pi$

**Answer: A**



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18.  $a \sin^2 \theta + b \cos^2 \theta = c \Rightarrow \tan^2 \theta =$

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

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

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

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

**Answer: B**



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19. If  $\cos(x - y)$ ,  $\cos x$ ,  $\cos(x + y)$  are three distinct numbers which are in harmonic progression and  $\cos x \neq \cos y$ , then  $1 + \cos y =$

A.  $\cos^2 x$

B.  $-\cos^2 x$

C.  $\cos^2 x - 1$

D.  $\cos^2 x - 2$

**Answer: A**



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20. The period of  $\sin^4 x + \cos^4 x$  is

A.  $\frac{\pi^4}{2}$

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

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

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

**Answer: D**



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21.  $\frac{\cos x}{\cos(x - 2y)} = \lambda \Rightarrow \tan(x - y)\tan y =$

A.  $\frac{1 + \lambda}{1 - \lambda}$

B.  $\frac{1 - \lambda}{1 + \lambda}$

C.  $\frac{\lambda}{1 + \lambda}$

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

**Answer: B**



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22.  $\cos A \cos 2A \cos 4A \dots \cos^{2^{n-1}} A =$

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

B.  $\frac{2^n \sin 2^n A}{\sin A}$

C.  $\frac{2^n \sin A}{\sin 2^n A}$

D.  $\frac{\sin A}{2^n \sin 2^n A}$

**Answer: A**



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23.  $\sqrt{3} \csc 20^\circ - \sec 20^\circ$  is equal to

A. 2

B.  $2 \sin 20^\circ \csc 40^\circ$

C. 4

D.  $4 \sin 20^\circ \csc 40^\circ$

Answer: C



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24. If  $A = 35^\circ$ ,  $B = 15^\circ$  and  $C = 40^\circ$ , then

$$\tan A \cdot \tan B + \tan B \cdot \tan C + \tan C \cdot \tan A =$$

A. 0

B. 1

C. 2

D. 3

**Answer: B**

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25. If  $\tan \theta + \tan\left(\theta + \frac{\pi}{3}\right) + \tan\left(\theta + \frac{2\pi}{3}\right) = 3$ , then which of the following is equal to 1?

A.  $\tan 2\theta$

B.  $\tan 3\theta$

C.  $\tan^2 \theta$

D.  $\tan^5 \theta$

**Answer: B**

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26. If  
 $\alpha + \beta + \gamma = 2\theta$ , then  $\cos \theta + \cos(\theta - \alpha) + \cos(\theta - \beta) + \cos(\theta - \gamma) =$



A.  $4 \sin \frac{\alpha}{2} \cos \frac{\beta}{2} \sin \frac{\gamma}{2}$

B.  $\cos \frac{\alpha}{2} \cos \frac{\beta}{2} \cos \frac{\gamma}{2}$

C.  $4 \sin \alpha \sin \frac{\beta}{2} \sin \frac{\gamma}{2}$

D.  $\sin \alpha \sin \beta \sin \gamma$

**Answer: B**



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27. If ' $\theta$ ' lies in the first quadrant and  $5 \tan \theta = 4$ , then  $\frac{5 \sin \theta - 3 \cos \theta}{\sin \theta + 2 \cos \theta}$

is equal to

A.  $\frac{5}{14}$

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

C.  $\frac{1}{14}$

D. 0

**Answer: A**

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28. If  $\cos(A - B) = \frac{5}{3}$ ,  $\tan A \tan B = 2$ , then which one of the following is true ?

A.  $\sin(A + B) = \frac{1}{5}$

B.  $\sin(A + B) = -\frac{1}{5}$

C.  $\cos(A - B) = \frac{1}{5}$

D.  $\cos(A + B) = -\frac{1}{5}$

**Answer: D**

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29. The value of  $\frac{\tan 80^\circ - \tan 10^\circ}{\tan 70^\circ}$

A. 0

B. 1

C. 2

D. 3

**Answer: C**



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30.  $\sin A + \sin B = \sqrt{3}(\cos B - \cos A) \Rightarrow \sin 3A + \sin 3B =$

A. 0

B. 2

C. 1

D. -1

**Answer: A**



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31.  $\sin 120^\circ \cos 150^\circ - \cos 240^\circ \sin 330^\circ =$

A. 1

B. -1

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

D.  $-\frac{(\sqrt{3} + 1)}{4}$

**Answer: B**



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32.  $\operatorname{cosec}15^\circ + \sec 15^\circ =$

A.  $2\sqrt{2}$

B.  $\sqrt{6}$

C.  $2\sqrt{6}$

D.  $\sqrt{6} + \sqrt{2}$

**Answer: C**



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33. If  $5 \cos x + 12 \cos y = 13$ , then the maximum value of  $5 \sin x + 12 \sin y$  is

A. 12

B.  $\sqrt{120}$

C.  $\sqrt{20}$

D. 13

**Answer: B**



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34. If  $x = \tan 15^\circ$ ,  $y = \operatorname{cosec} 75^\circ$  and  $z = 4 \sin 18^\circ$  then,

A.  $x < y < z$

B.  $y < z < x$

C.  $z < x < y$

D.  $x < z < y$

**Answer: A**



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35. If  $\cos \theta - 4 \sin \theta = 1$ , then  $\sin \theta + 4 \cos \theta$  is equal to

A.  $\pm 1$

B. 0

C.  $\pm 2$

D.  $\pm 4$

**Answer: D**



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36. If  $\frac{\tan 3A}{\tan A} = a$  then  $\frac{\sin 3A}{\sin A}$  is equal to

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

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

C.  $\frac{a}{a+1}$

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

**Answer: B**



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

A.  $\cot B$

B.  $\cot 2B$

C.  $\tan 2B$

D.  $\tan B$

**Answer: D**



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**38.** If  $A + B = C$  then  $\cos^2 A + \cos^2 B + \cos^2 C - 2 \cos A \cos b \cos C$  is equal to

A. 1

B. 2

C. 0

D. 3

**Answer: A**



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39.  $\tan 9^\circ - \tan 27^\circ - \tan 63^\circ + \tan 81^\circ =$

A. 4

B. 3

C. 2

D. 1

**Answer: A**



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40. In  $\Delta ABC$ ,  $\cos\left(\frac{B + 2C + 3A}{2}\right) + \cos\left(\frac{A - B}{2}\right) =$

A.  $-1$

B. 0

C. 1

D. 2

**Answer: B**



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**41.** The value of the series

$\cos 12^\circ + \cos 84^\circ + \cos 132^\circ + \cos 156^\circ$  is,

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

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

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

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

**Answer: D**



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**42.** For  $x \in \mathbb{R}$ ,  $3 \cos(4x - 5) + 4$  lies in the interval

A. [1, 7]

B. [4, 7]

C. [0, 7]

D. [2, 7]

**Answer: A**



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**43.**  $\cos \alpha \sin(\beta - \gamma) + \cos \beta \sin(\gamma - \alpha) + \cos \gamma \sin(\alpha - \beta)$  is equal to

A. 0

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

C. 1

D.  $4 \cos \alpha \cos \beta \cos \gamma$

**Answer: A**



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44. The value of  $\cos \frac{2\pi}{15} \cos \frac{4\pi}{15} \cos \frac{8\pi}{15} \cos \frac{14\pi}{15}$  is

A.  $\frac{1}{16}$

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

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

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

**Answer: A**



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45. If  $A + B + C = 270^\circ$  then  $\cos 2A + \cos 2B + \cos 2C$  is equal to

A.  $4 \sin A \sin B \sin C$

B.  $4 \cos A \cos B \cos C$

C.  $1 - 4 \sin A \sin B \sin C$

$$D. 1 - 5 \cos A \cos B \cos C$$

**Answer: C**



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**46.** If  $\sin 6\theta = 32 \cos^5 \theta \sin \theta - 32 \cos^3 \theta \sin \theta + 3x$  then  $x$  is equal to

A.  $\cos \theta$

B.  $\cos 2\theta$

C.  $\sin \theta$

D.  $\sin 2\theta$

**Answer: D**



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47. If  $\cos(\alpha + \beta) = \frac{4}{5}$ ,  $\sin(\alpha - \beta) = \frac{5}{13}$  and  $\alpha, \beta$  between 0 and  $\frac{\pi}{4}$ , then  $\tan 2\alpha$  is equal to

A.  $\frac{56}{33}$

B.  $\frac{33}{56}$

C.  $\frac{16}{65}$

D.  $\frac{60}{61}$

**Answer: A**



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48.  $\cos^2 76^\circ + \cos^2 16^\circ$  is equal to

A. 0

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

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

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

**Answer: D**



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49.  $\sum_{k=1}^3 \cos^2(2k - 1)\frac{\pi}{12}$  is equal to

A. 0

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

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

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

**Answer: D**



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50.  $\frac{\sin 5\theta}{\sin \theta}$  is equal to

A.  $16 \cos^4 \theta - 12 \cos^2 \theta + 1$

B.  $16 \cos^4 \theta + 12 \cos^2 \theta + 1$

C.  $16 \cos^4 \theta - 12 \cos^2 \theta - 1$

D.  $16 \cos^4 \theta + 12 \cos^2 \theta - 1$

**Answer: A**

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51. If  $\cos ec\theta = \frac{p+q}{p-q}$ , then  $\cot\left(\frac{\pi}{4} + \frac{\theta}{2}\right)$  is equal to

A.  $\sqrt{\frac{p}{q}}$

B.  $\sqrt{\frac{q}{p}}$

C.  $\sqrt{pq}$

D.  $pq$

**Answer: B**

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52.  $\cos^2\left(\frac{\pi}{6} + \theta\right) - \sin^2\left(\frac{\pi}{6} - \theta\right)$  is equal to

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

B. 0

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

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

**Answer: A**



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53. If  $A, B, C, D$  are angles of a cyclic quadrilateral, then  $\cos A + \cos B + \cos C + \cos D$  is equal to

A. 0

B. 1

C.  $-1$

D.  $4$

**Answer: A**

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54. If  $\tan \theta + \cot \theta = 2$ , then  $\sin \theta$  is equal to

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

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

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

D.  $1$

**Answer: A**

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