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Sahi Prep Hai Toh Life Set Hai

TRIGONOMETRY

(Minimum & Maximum)

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Agenda

Rem Maxima & Minima → (35-40) min

Rem Identities → (45-50) min

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If $x \geq 0$

$x < x^2$ if $x > 1$

$x = x^2$ if $x = 0, 1$

$x > x^2$ $0 < x < 1$

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$$0 \le \theta \le 90^\circ$$

$$0 \le \sin\theta, \cos\theta \le 1$$

$$\sin\theta \ge \sin^2\theta \ge \sin^3\theta \ge \cdots \sin^n\theta$$

$$\cos\theta \ge \cos^2\theta \ge \cos^3\theta \ge \cdots \cos^m\theta$$

$$\sin\theta + \cos\theta \ge \sin^2\theta + \cos^2\theta$$

$$\sin\theta + \cos\theta \ge 1$$

gwp

$$\sin^2\theta \ge \sin^n\theta \quad [n \ge 2]$$

$$\cos^2\theta \ge \cos^m\theta \quad [m \ge 2]$$

$$\sin^2\theta + \cos^2\theta \ge \sin^n\theta + \cos^m\theta$$

gwp

$$\sin^n\theta + \cos^m\theta \le 1$$

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$$\max(\sin^n\theta + \cos^m\theta) = 1 \qquad [m, n \geq 2]$$

$$(0 \leq \theta \leq 90)$$

eg $\max(\sin^{10}\theta + \cos^{14}\theta) \longrightarrow 1$

$\max(\sin^6\theta + \cos^4\theta) \longrightarrow 1$

Eg. $\max(\sin^6\theta + \cos^{10}\theta)$ → 1

Eg. $\max(\sin^{20}\theta + \cos^{40}\theta)$ → 1

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$$\sin\theta + \cos\theta \geq 1$$

$$(0 \leq \theta \leq 90)$$

eg If $0 \leq \theta \leq 90^\circ$

$\sin\theta + \cos\theta$

A > 1

B ≥ 1

C < 1

D ≤ 1

If $0 < \theta < 90$

$\sin\theta + \cos\theta$

A > 1

B ≥ 1

C < 1

D ≤ 1

Eg. If $0 \leq \theta \leq 90$

$\min (\sin \theta + \cos \theta)$

→ 1

Eg. If $0 < \theta < 90$

$\sin \theta + \cos \theta = ?$

(a) < 1 (b) > 1

(c) ≥ 1 (d) 0

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Eg. min (sin θ + cos θ)

$$-\sqrt{1^2+1^2}$$

$$-\sqrt{2}$$

$$a\sin\theta + b\cos\theta$$

$$\text{Min} = -\sqrt{a^2+b^2}$$

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Q3. Find the minimum and maximum value of :

$$Y = \sin^4\theta + \cos^4\theta$$

$Y_{max} = 1$

$$Y = 1 - 2\sin^2\theta\cos^2\theta$$

$$Y_{min} = 1 - (2\sin^2\theta\cos^2\theta)_{max}$$

$$= 1 - 2\left(\frac{1}{2}\right)^2$$

$$= 1 - \frac{1}{2} = \frac{1}{2}$$

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Q4. Find the minimum and maximum value of :

$Y = \sin^6\theta + \cos^6\theta$

$Y_{max} = 1$

$$Y_{min} = 1 - 3\sin^2\theta\cos^2\theta$$

$$= 1 - (3\sin^2\theta\cos^2\theta)_{max}$$

$$= 1 - 3\left(\frac{1}{4}\right)$$

$$= \frac{1}{4}$$

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Q5. $A = \sin^2\theta + \cos^4\theta$

Which of the following statement is true?

$A_{max} = 1$

a. $\frac{1}{4} \le A \le \frac{1}{2}$

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

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

d. $\frac{3}{4} \le A \le \frac{3}{2}$

$$A = \sin^2\theta + \cos^2\theta \cdot \cos^2\theta$$

$$= \sin^2\theta + \cos^2\theta\,(1 - \sin^2\theta)$$

$$= \sin^2\theta + \cos^2\theta - \sin^2\theta\cos^2\theta$$

$$= 1 - \sin^2\theta\cos^2\theta$$

$$A_{min} = 1 - \left(\tfrac{1}{2}\right)^2 = 3/4$$

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Q6. Find the minimum and maximum value of:

$$Y = \sin^2\theta + 6\sin\theta + 5$$

$$Y = \sin^2\theta + 6\sin\theta + 9 - 9 + 5$$

$$Y = (\sin\theta + 3)^2 - 4$$

$$Y_{max} = 4^2 - 4 = 12$$

$$Y_{min} = 2^2 - 4 = 0$$

$$(a+b)^2 = a^2 + 2ab + b^2$$

$$(a-b)^2 = a^2 - 2ab + b^2$$

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Q7. Find the minimum and maximum value of:

$$B = \sin^2\theta - \sin\theta - 1$$

$$B = \sin^2\theta - \sin\theta + \frac{1}{4} - \frac{1}{4} - 1$$

$$= \left(\sin\theta - \frac{1}{2}\right)^2 - \frac{5}{4}$$

$$B_{min} = 0 - \frac{5}{4} = -\frac{5}{4}$$

$$B_{max} = \frac{9}{4} - \frac{5}{4} = 1$$

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Q8. Find the minimum and maximum value of:

$C = \sin^2\theta + \cos\theta$

$$C = 1 - \cos^2\theta + \cos\theta$$

$$C = -[\cos^2\theta - \cos\theta - 1]$$

$$= -\left[\cos^2\theta - \cos\theta + \frac{1}{4} - \frac{1}{4} - 1\right]$$

$$= -\left[\left(\cos\theta - \frac{1}{2}\right)^2 - \frac{5}{4}\right]$$

$$= \frac{5}{4} - \left(\cos\theta - \frac{1}{2}\right)^2$$

$C_{Min} = \frac{5}{4} - \frac{9}{4} = -1$

$C_{Max} = \frac{5}{4} - 0 = \frac{5}{4}$

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Q9. Find the minimum value of:

$$\sin^2 A + \text{cosec}^2 A + \sec^2 B + \cos^2 B + \tan^2 C + \cot^2 C$$

V. Imp

90 sec

$\min (\sin^2 A + \text{cosec}^2 A) \longrightarrow 2$

$\min (\sec^2 B + \cos^2 B) \longrightarrow 2$

$\min (\tan^2 C + \cot^2 C) \longrightarrow 2$

$\min (\sin^2 A + \text{cosec}^2 A + \sec^2 B + \cos^2 B + \tan^2 C + \cot^2 C)$

$\longrightarrow 6$

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Q10. Find the minimum value of:

$$\sin^2 A + \cos^2 A + \tan^2 A + \text{cosec}^2 B + \sec^2 B + \cot^2 B$$

90sec

$1 + \tan^2 A + 1 + \cot^2 B + 1 + \tan^2 B + \cot^2 B$

$\sec^2 A + 2 + 2\cot^2 B + \tan^2 B$

$1 + 2 + 2\sqrt{2 \cdot 1}$

$3 + 2\sqrt{2}$

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Q11. Find the minimum value of:

$$\sin^2 A + \cos^2 A + \tan^2 A + \cot^2 A + \sec^2 A + \operatorname{cosec}^2 A$$

PYQ

SSC

$$1 + \tan^2 A + \cot^2 A + 1 + \tan^2 A + 1 + \cot^2 A$$

$$3 + 2(\tan^2 A + \cot^2 A)$$

$$3 + 2 - 2$$

$$= 7$$

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TRIGONOMETRIC IDENTITIES

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$$\cos 2\theta = \cos^2\theta - \sin^2\theta$$

$$= 1 - 2\sin^2\theta$$

$$= 2\cos^2\theta - 1$$

* $1 + \cos 2\theta = 2\cos^2\theta$

$$= \frac{\cos^2\theta - \sin^2\theta}{1} = \frac{\cos^2\theta - \sin^2\theta}{\cos^2\theta + \sin^2\theta}$$

* $1 - \cos 2\theta = 2\sin^2\theta$

$$= \frac{1 - \tan^2\theta}{1 + \tan^2\theta}$$

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$$\sin 2\theta = 2\sin\theta\cos\theta$$

eg $\sin 40^\circ \longrightarrow 2\sin 20^\circ \cos 20^\circ$

$2\sin 7^\circ \cos 7^\circ \longrightarrow \sin 14^\circ$

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Eg39. $8 \cos 10^\circ \cos 20^\circ \cos 40^\circ$

(a) $\tan 80^\circ$

(b) $\cot 10^\circ$

(c) $\tan 80^\circ$ or $\cot 10^\circ$

(d) None of these

$$Y = \frac{8 \cos 10 \cos 20 \cos 40 \cdot \sin 10}{\sin 10}$$

$$= \frac{2 \sin 10 \cos 10 \cdot 4 \cos 20 \cos 40}{\sin 10}$$

$$= \frac{2 \sin 20 \cos 20 \cdot 2 \cos 40}{\sin 10}$$

$$= \frac{2 \sin 40 \cos 40}{\sin 10} = \frac{\sin 80}{\sin 10} = \frac{\cos 10}{\sin 10}$$

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Ans. (c)

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Eg40. Find $\tan\theta\,(1+\sec 2\theta)(1+\sec 4\theta)(1+\sec 8\theta)$

(a) $\tan 4\theta$

(b) $\tan 8\theta$

(c) $2\tan 8\theta$

(d) $2\tan 4\theta$

$$\frac{\sin\theta}{\cos\theta}\left[1+\frac{1}{\cos 2\theta}\right]\left[1+\frac{1}{\cos 4\theta}\right]\left[1+\frac{1}{\cos 8\theta}\right]$$

$$\frac{\sin\theta}{\cos\theta}\left[\frac{1+\cos 2\theta}{\cos 2\theta}\right]\left[\frac{1+\cos 4\theta}{\cos 4\theta}\right]\left[\frac{1+\cos 8\theta}{\cos 8\theta}\right]$$

$$\frac{\sin\theta}{\cos\theta}\cdot\frac{2\cos^2\theta}{\cos 2\theta}\cdot\frac{2\cos^2 2\theta}{\cos 4\theta}\cdot\frac{2\cos^2 4\theta}{\cos 8\theta}$$

$$= \frac{(2\sin\theta\cos\theta)\cdot(2\cos 2\theta)(2\cos 4\theta)}{\cos 8\theta} = \frac{\sin 8\theta}{\cos 8\theta}$$

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Ans. (b)

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Eg41. Find $\cot\theta - \tan\theta - 2\tan 2\theta$

(a) 4 cot 4θ (b) 0

(c) 2 cot 4θ (d) cot 4θ

9 sec

$$\frac{\cos\theta}{\sin\theta} - \frac{\sin\theta}{\cos\theta} - 2\tan 2\theta$$

$$2\left(\frac{\cos^2\theta - \sin^2\theta}{2\sin\theta\cos\theta}\right) - 2\frac{\sin 2\theta}{\cos 2\theta}$$

$$\frac{2\cos 2\theta}{\sin 2\theta} - 2\frac{\sin 2\theta}{\cos 2\theta}$$

$$= \frac{2\cdot 2}{2}\left[\frac{\cos^2 2\theta - \sin^2 2\theta}{\sin 2\theta\cos 2\theta}\right] = 4\frac{\cos 4\theta}{\sin 4\theta}$$

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Ans. (a)

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Eg42. For any real values of θ, $\sqrt{\frac{\sec\theta - 1}{\sec\theta + 1}} = ?$

(a) $\cot\theta - \operatorname{cosec}\theta$
(b) $\sec\theta - \tan\theta$
(c) $\operatorname{cosec}\theta - \cot\theta$
(d) $\tan\theta - \sec\theta$

$$\sqrt{\frac{\sec\theta - 1}{\sec\theta + 1} \times \frac{\sec\theta - 1}{\sec\theta - 1}} = \frac{\sec\theta - 1}{\tan\theta}$$

$$= \operatorname{cosec}\theta - \cot\theta$$

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Ans. (c)

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Eg43. The value of the expression:

$\sin^2 1° + \sin^2 11° + \sin^2 21° + \sin^2 31° + \sin^2 41° + \sin^2 45° + \sin^2 49° + \sin^2 59° + \sin^2 69° + \sin^2 79° + \sin^2 89°$ is

(a) 0

(b) $5\frac{1}{2}$

(c) 5

(d) $4\frac{1}{2}$

$\sin^2 1 + \sin^2 11 + \cdots \sin^2 41 + \sin^2 45 + \sin^2 49 + \sin^2 59 + \cdots \sin^2 89$

$5 + \frac{1}{2} = 5\frac{1}{2}$

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Ans. (b)

gradeup **Eg44.** The value of the expression $(1+\sec 22^\circ + \cot 68^\circ)(1-\operatorname{cosec} 22^\circ + \tan 68^\circ)$ is

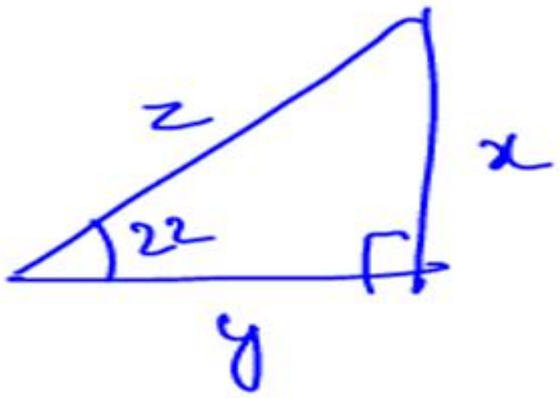
(a) 0

(b) 1

(c) −1

(d) 2

$(1+\sec 22 + \tan 22)(1-\operatorname{cosec} 22 + \cot 22)$



$$\left(1+\frac{z}{y}+\frac{x}{y}\right)\left(1-\frac{z}{x}+\frac{y}{x}\right)$$

$$\left(\frac{y+x+z}{y}\right)\left(\frac{x-z+y}{x}\right) = \frac{(x+y)^2-z^2}{xy}$$

$$\frac{x^2+y^2+2xy-z^2}{xy}$$

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Ans. (d)

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Eg45. For how many integral values of 'x', $\sin\phi = \frac{(3x-2)}{4}$, where $0° \le \phi \le 90°$

(a) 2

(b) 3

(c) 0

(d) 1

$$0 \le \sin\phi \le 1$$

$$0 \le \frac{3x-2}{4} \le 1$$

$$0 \le 3x-2 \le 4$$

$$2 \le 3x \le 6$$

$$\frac{2}{3} \le x \le 2$$

$x = 1, 2$

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Ans. (a)

Eg46. The expression $\frac{\tan 57^\circ + \cot 37^\circ}{\tan 33^\circ + \cot 53^\circ}$ is equal to:

(a) $\tan 33^\circ \cot 57^\circ$
(b) $\tan 57^\circ \cot 37^\circ$
(c) $\tan 33^\circ \cot 53^\circ$
(d) $\tan 53^\circ \cot 37^\circ$

$\frac{>1 \quad >1}{<1 \quad <1}$

$\frac{>2}{<2}$ (>1)

$$\frac{\tan 57 + \cot 37}{\cot 57 + \tan 37}$$

$$\frac{\tan 57 + \cot 37}{\frac{1}{\tan 57} + \frac{1}{\cot 37}} = \tan 57 \cot 37$$

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Ans. (b)

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Eg47. The value of :

152 ($\sin 30° + 2\cos^2 45° + 3\sin 30° + 4\cos^2 45° + \ldots\ldots\ldots\ldots 17\sin 30° + 18\cos^2 45°$) is:

(a) an integer but not a perfect square

(b) a rational number but not an integer

(c) a perfect square

(d) irrational

$$152\left[\frac{1}{2} + 2\cdot\frac{1}{2} + 3\cdot\frac{1}{2} + \cdots 18\cdot\frac{1}{2}\right]$$

$$152\cdot\frac{1}{2}\left[1+2+3+\cdots 18\right]$$

$$76\left[\frac{18\cdot 19}{2}\right] = 76\cdot 9\cdot 19$$

$$19\cdot 4\cdot 9\cdot 19$$

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Ans. (c)

$$1+2+3+\cdots\cdots n = \frac{n(n+1)}{2}$$

gradeup **Eg48.** If $29\tan\theta = 31$.
Find the value of $\dfrac{1+2\sin\theta\cos\theta}{1-2\sin\theta\cos\theta}$

(a) 810 (b) 900 (c) 540 (d) 490

$$\frac{\sin^2\theta+\cos^2\theta+2\sin\theta\cos\theta}{\sin^2\theta+\cos^2\theta-2\sin\theta\cos\theta}$$

$$\Rightarrow \frac{(\sin\theta+\cos\theta)^2}{(\sin\theta-\cos\theta)^2} = \left(\frac{\tan\theta+1}{\tan\theta-1}\right)^2$$

$$= \left(\frac{\frac{31}{29}+1}{\frac{31}{29}-1}\right)^2 \Rightarrow 30^2 = 900$$

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Ans. (b)

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Eg49. If $x \cos\theta - \sin\theta = 1$

Find $x^2 - (1 + x^2)\sin\theta$.

(a) 2 (b) 1 (c) –1 (d) 0

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Ans. (b)

Eg50. If $0 < \theta < 90°$

$\text{cosec}\ \theta = \cot^2 \theta$

then $\text{cosec}^4 \theta - 2\ \text{cosec}^3 \theta + \cot^2 \theta = ??$

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

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Ans. (a)

Eg51. If $\sin\theta = a\cos\phi$; $\cos\theta = b\sin\phi$

Find the value of : $(a^2 - 1)\cot^2\phi + (1 - b^2)\cot^2\theta$

a $\frac{a^2+b^2}{a^2}$

b $\frac{a^2+b^2}{b^2}$

c $\frac{a^2-b^2}{b^2}$

d $\frac{a^2-b^2}{a^2}$

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Ans. (d)

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PRACTICE QUESTIONS

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MAXIMA & MINIMA

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Q1. Find minimum and maximum value of the following :

(a) $\sin 2\theta$

(b) $3 \sin \theta$

(c) $5 \sin 4\theta$

(d) $3 \sin^2 \theta$

(e) $5 \sin^3 \theta$

(f) $3 \sin^2 \theta - 8$

(g) $5 \sin^3\theta - 4$

(h) $10 - \sin^2\theta$

(i) $1 + \cos 2\theta$

(j) $4 + \sin\theta + \cos\phi$

(k) $5 \sin^2\theta + 4 \cos^2\phi$

(l) $\sec^2\theta + 4$

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Ans.

	Min	Max
(a)	-1	1
(b)	-3	3
(c)	-5	5
(d)	0	3
(e)	-5	5
(f)	-8	-5
(g)	-9	1
(h)	9	10
(i)	0	2
(j)	2	6
(k)	0	9
(l)	5	∞

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Q2. Find minimum and maximum value of the following

(a) $3 \sin\theta + \cos\theta$

(b) $5 \sin\theta + 12 \cos\theta - 8$

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Ans.

(a) Min = $-\sqrt{10}$ **Max =** $\sqrt{10}$

(b) Min = – 21 **Max = 5**

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Q3. Find minimum and maximum value of the following

(a) $-3\sin^2\theta - 4\cos^2\theta$

(b) $3\sin^2\theta - 4\cos^2\theta + 8$

(c) $\frac{1}{2}\sin^2\theta + \frac{1}{3}\cos^2\theta$

(d) $-5\,(2\sin^2\theta + 3\cos^2\theta)$

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Ans.

	Min	Max
(a)	-4	-3
(b)	4	11
(c)	1/3	1/2
(d)	-15	-10

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Q4. Find minimum and maximum value of the following.

(a) $4 \sin^2 \theta + 9 \operatorname{cosec}^2 \theta$

(b) $8 \cos^2 \theta + 18 \sec^2 \theta$

(c) $12 \sin^2 \theta + 3 \operatorname{cosec}^2 \theta$

(d) $4 \sec^2 \theta + 9 \cos^2 \theta$

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Ans.

	Min	Max
(a)	13	∞
(b)	26	∞
(c)	12	∞
(d)	12	∞

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Q5. Find minimum value of the following

(a) $4\tan^2\theta + 9\cot^2\theta$

(b) $18\sin^2\theta + 2\operatorname{cosec}^2\theta$

(c) $72\cos^2\theta + 18\sec^2\theta$

(d) $18\tan^2\theta + 8\cot^2\theta$

(e) $6\sin^2\theta + 150\operatorname{cosec}^2\theta$

(f) $14\cos^2\theta + 56\sec^2\theta$

(g) $4\sin^2\theta + 9\,\text{cosec}^2\theta + 5$

(h) $\cos^2\theta + \sec^2\theta$

(i) $4\,\text{cosec}^2\theta + 4\sin^2\theta$

(j) $\tan^{10}\theta + \cot^{10}\theta$

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Ans.

(a) 12

(b) 12

(c) 72

(d) 24

(e) 156

(f) 70

(g) 18

(h) 2

(i) 8

(j) 2

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Q6. Find minimum value of the following

(a) $4\sec^2\theta + 25\ \mathrm{cosec}^2\theta$

(b) $100\sec^2\theta + 9\ \mathrm{cosec}^2\theta$

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Ans.

(a) 49

(b) 169

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TRIGONOMETRIC IDENTITIES

Q. If $p = \sqrt{\frac{1-\sin x}{1+\sin x}}$, $q = \frac{1-\sin x}{\cos x}$, $r = \frac{\cos x}{1+\sin x}$ then which of the following is/are correct?

1) $p = q = r$ 2) $p^2 = qr$

Select the correct answer using the code given below:

A. 1 only

B. 2 only

C. Both 1 and 2

D. Neither 1 nor 2

Ans. C

Q. $\sin^2 37° + \sin^2 53° + \sin 30° - \tan 45° = ?$

A. ¼ B. 1 C. ½ D. 3/2

Ans. C

Q. If $3\tan x = \cot x\,; 0 < x < 90^{\circ}$, then the value of $\cos^2\frac{3x}{2} - 2\cos^4\frac{3x}{2} + 2\cos^6\frac{3x}{2}$ is:

A. ½ B. ¼ C. 0 D. 1

Ans. B

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Q. Consider the following

1) $\sin 1^\circ > \sin 1^\circ$ **2)** $\cos 1^\circ < \cos 1^\circ$ **3)** $\tan 1^\circ > \tan 1^\circ$

Which of the above are not correct?

A. 1 and 2 only **B. 2 and 3 only**

C. 1 and 3 only **D. 1, 2 and 3**

Ans. D

Q. If $0 < \theta < 90°, 0 < \phi < 90°$ and $\cos\theta < \cos\phi$, then which one of the following is correct?

A. $\theta < \phi$

B. $\theta > \phi$

C. $\theta + \phi = 90°$

D. No conclusion can be drawn

Ans. B

Q. Let $\sin(A+B) = \frac{\sqrt{3}}{2}$ and $\cos B = \frac{\sqrt{3}}{2}$,

where A, B are acute angles. What is $\tan(2A-B)$ equal to?

A. ½ B. $\sqrt{3}$ C. $\frac{1}{\sqrt{3}}$ D. 1

Ans. C

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

A. 0 B. 1 C. 2 D. 3

Ans. A

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Q. If a and b are positive, then the relation $\sin(\theta) = \frac{2a+3b}{3b}$ is

A. not possible

B. possible only if a = b

C. possible if a > b

D. possible if a < b

Ans. A

Q. If $\tan\theta=\frac{p}{q}$, then what is $\frac{p\sec\theta-q\,coses\,\theta}{p\sec\theta+q\,cosec\,\theta}$ equal to ?

A. $\frac{p-q}{p+q}$ B. $\frac{q^2-p^2}{q^2+p^2}$ C. $\frac{p^2-q^2}{q^2+p^2}$ D. 1

Ans. C

Q. If $\cos 1^0 = p$ and $\cos 89^0 = q$, then which one of the following is correct ?

A. p is close to zero and q is close to 1

B. $p < q$

C. $p = q$

D. p is close to 1 and q is close to zero

Ans. D

Q. What is cosec $(75° + \theta) - \sec(15° - \theta) - \tan(55° + \theta) + \cot(35° - \theta)$ equal to?

A. -1 B. 0 C. 1 D. 3/2

Ans. B

Q. If $\cos\theta \geq \frac{1}{2}$ in the first quadrant, then which one of the following is correct ?

A. $\theta \leq \pi/3$

B. $\theta \geq \pi/3$

C. $\theta \leq \pi/6$

D. $\theta \geq \pi/6$

Ans. B

Q. For what value of θ, is ($\sin\theta$ + $\operatorname{cosec}\theta$) = 2.5

where $0 < \theta \leq 90°$?

A. 30° B. 45° C. 60° D. 90°

Ans. A

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Q. If $0 \leq x \leq \pi / 2$, then which one of the following is correct ?

(a) $\sin^2 x < ½$ and $\cos^2 x > ½$

(b) $\sin^2 x > ½$ and $\cos^2 x < ½$

(c) $\sin^2 x < ½$ and $\cos^2 x < ½$

(d) At least one of $\sin^2 x$, $\cos^2 x$ is less than 1.

Ans. D

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Q. *ABC* is a triangle right angled at *B* and $AB:BC=3:4$.

What is $\sin A+\sin B+\sin C$ equal to?

A. 2 B. $\frac{11}{5}$ C. $\frac{12}{5}$ D. 3

Ans. C

Q. If $\tan x = 1, 0 < x < 90°$, then what is the value of $2 \sin x \cos x$?

A. $\frac{1}{2}$ B. 1 C. $\frac{\sqrt{3}}{2}$ D. $\sqrt{3}$

Ans. B

Q. What is the value of tan 1° tan 2° tan 3° ..... Tan 89°?

A. 0 B. 1 C. 2 D. ∞

Ans. B

Q. Consider the following for real numbers α, β, γ and δ ?

1) $\sec \alpha = ¼$

2) $\tan \beta = 20$

3) $\operatorname{cosec} \gamma = 1/2$

4) $\cos \delta = 2$

How many of the above statements are not possible?

A. one B. two C. three D. four

Ans. C

Q. If $\frac{x}{a}-\frac{y}{b}\tan\theta=1$ and $\frac{x}{a}\tan\theta+\frac{y}{b}=1$, then the value of $\frac{x^2}{a^2}+\frac{y^2}{b^2}$ is:

A. $2\sec^2\theta$

B. $\sec^2\theta$

C. $\cos^2\theta$

D. $2\cos^2\theta$

Ans. D

Q.If $0 < x < 45°$ and $45° < y < 90°$, then which one of the following is correct?

A. $\sin x = \sin y$

B. $\sin x < \sin y$

C. $\sin x > \sin y$

D. $\sin x \leq \sin y$

Ans. B

Q. If $0 \leq \theta \leq \frac{\pi}{2}$ *and* $p = \sec^2\theta$ One of the following is correct?

A. p < 1

B. p = 1

C. p > 1

D. p ≥ 1

Ans. D

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Q. If $p = \tan^2 x + \cot^2 x$, then which one of the following is correct ?

A. $p \leq 2$

B. $p \geq 2$

C. $p < 2$

D. $p > 2$

Ans. B

Q. Consider the following statements:

1) sin66° is less than cos66°.

2) sin26° is less than cos26°.

Which of the above statements is/are correct?

A. 1 only

B. 2 only

C. Both 1 and 2

D. Neither 1 nor 2

Ans. B

Q. If $\tan A + \cot A = 6$, then $\tan^4 A + \cot^4 A$ is equal to

A. 110

B. 1191

C. 180

D. 1154

Ans. D

Q. Consider the following statements:

1) If $\frac{\cos\theta}{1-\sin\theta}+\frac{\cos\theta}{1+\sin\theta}=4$, where $0<\theta<90°$,

then $\theta = 60°$.

2) If $3\tan\theta+\cot\theta = 5\,\text{cosec}\,\theta$, where $0<\theta<90°$,

then $\theta = 60°$.

Which of the statements given above is/are correct?

A. 1 only

B. 2 only

C. Both 1 and 2

D. Neither 1 nor 2

Ans. C

Q. Consider the following statements:

1) $\cos^2\theta = 1 - \frac{p^2 + q^2}{2pq}$, where p, q are non-zero real numbers, is possible only when p = q.

2) $\tan^2\theta = \frac{4pq}{(p+q)^2} - 1$, where p, q are non-zero real numbers, is possible only when p = q.

Which of the statements given above is/are correct?

A. 1 only

B. 2 only

C. Both 1 and 2

D. Neither 1 nor 2

Ans. C

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Q. Consider the following statements:

1) There exists at least one value of x between 0 and $\frac{\pi}{2}$ which satisfies the equation $\sin^4 x - 2\sin^2 x - 1 = 0$.

2) sin 1.5 is greater than cos 1.5.

Which of the above statements is/are correct?

A. 1 only

B. 2 only

C. Both 1 and 2

D. Neither 1 nor 2

Ans. B

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Q. If $\cos A = \tan B, \cos B = \tan C$ and $\cos C = \tan A$, then sinA is equal to

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

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

C. $\frac{\sqrt{3}-1}{4}$

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

Ans. B

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Q. If $\sin x + \cos x = \frac{3}{\sqrt{5}}; 0 < x < \pi$ the,

the value of $(\tan 2x + \cot 2x)$ is:

A. 25/12

B. 5/12

C. 9/5

D. 4/5

Ans. A

Q. If $A = \tan 13^\circ . \tan 27^\circ$ and $B = 2 \cot 63^\circ . \cot 77^\circ$, then

A. A = 2B

B. B = 2A

C. A = B

D. 2B = -A

Ans. B

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Q. What is the value of

$\text{cosec}^2 68^\circ + \sec^2 56^\circ - \cot^2 34^\circ - \tan^2 22^\circ$ **?**

A. 0

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

C. 1

D. 2

Ans. D

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Q. What is $\frac{\cot A + \operatorname{cosec} A - 1}{\cot A - \operatorname{cosec} A + 1}$ equal to?

A. $\frac{1+\cos A}{\sin A}$

B. $\frac{1-\cos A}{\sin A}$

C. $\frac{1+\sin A}{\cos A}$

D. $\frac{1-\sin A}{\cos A}$

Ans. A

Q.The expression $\sin^2 x + \cos^2 x - 1 = 0$ is satisfied by how many values of x?

A. Only one value of x

B. Two value of x

C. infinite values of x

D. No value of x

Ans. C

Q. If α is the angle of first quadrant such that $\text{cosec}^4 \alpha = 17 + \cot^4 \alpha$, then what is the value of $\sin \alpha$?

(a) 1/3

(b) 1/4

(c) 1/9

(d) 1/16

Ans. A

Q. If $x+(1/x)=2\cos\alpha$, then what is the value of $x^2+(1/x^2)$?

A. $4\cos^2\alpha$

B. $4\cos^2\alpha-1$

C. $2\cos^2\alpha-2\sin^2\alpha$

D. $\cos^2\alpha-\sin^2\alpha$

Ans. C

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Q. If $\sin\theta \cos\theta = \frac{1}{2}$, then what is $\sin^6\theta + \cos^6\theta$ equal to ?

A. 1 B. 2 C. 3 D. $\frac{1}{4}$

Ans. D

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Q. If $3\sin\theta + 2\cos\theta = 3$ then, what is $3\cos\theta - 2\sin\theta$?

A. ± 3 B. ± 2 C. $\pm 3\sqrt{2}$ D. ± 4

Ans. B

Q. If $\sin\theta + \cos\theta = \frac{1+\sqrt{3}}{2}$ where $0 < \theta < \frac{\pi}{2}$, then what is $\tan\theta + \cot\theta$ equal to?

A. $\frac{\sqrt{3}}{4}$ B. $\frac{1}{\sqrt{3}}$ C. $\sqrt{3}$ D. $\frac{4}{\sqrt{3}}$

Ans. D

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Q. If $\sin x + \cos x = c$ then $\sin^6 x + \cos^6 x$ is equal to

A. $\frac{1+6c^2-3c^4}{16}$

B. $\frac{1+6c^2-3c^4}{4}$

C. $\frac{1+6c^2+3c^4}{16}$

D. $\frac{1+6c^2+3c^4}{4}$

Ans. B

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Q. If $\sin^2 x + 2\sin x = 1$, then $(\cos^4 x + 5\cos^2 x)$ equals to:

A. $2(2 + \sin x)$

B. $2(2 - \sin x)$

C. $4(1 - \sin x)$

D. $(1 + \sin x)/2$

Ans. A

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Q. If $2y \cos\theta = x \sin\theta$ and $2x \sec\theta - y \operatorname{cosec}\theta = 3$, then what is $x^2 + 4y^2$ equal to ?

A. 1 B. 2 C. 4 D. 8

Ans. C

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Q. If $\sin x + \cos x = p$ and $\sin^3 x + \cos^3 x = q$, then what is $p^3 - 3p$ equal to?

A. 0 B. -2q C. 2q D. 4q

Ans. B

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Q. Consider the following equations :

1) $\cos ec^2 x + \sec^2 x = \cos ec^2 x \sec^2 x$

2) $\sec^2 x + \tan^2 x = \sec^2 x \tan^2 x$

3) $\cos ec^2 x + \tan^2 x = \cot^2 x + \sec^2 x$

Which of the above statements are correct ?

A. 1 and 2 only **B. 2 and 3 only**

C. 1 and 3 only **D. 1, 2 and 3**

Ans. C

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Q. Consider the following statements:

1) If $45° < \theta < 60°$, then

$\sec^2\theta + cosec^2\,\theta = \alpha^2$ for some real number $\alpha > 1$.

2) If $0° < \theta < 45°$, then $\frac{1+\cos\theta}{1-\cos\theta} = x^2$ for some real number $x > 2$.

3) If $0° < \theta < 45°$, then $\frac{\cos\theta}{1-\tan\theta} + \frac{\sin\theta}{1-\cot\theta} \geq 2$

What is the number of true statements?

A. Zero B. One C. Two D. Three

Ans. C

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Direction: Consider the following for the next three questions.

$\sin\theta + \cos\theta = \sqrt{2}$ **and** $\sin\phi + \cos\phi = 1$. **where θ & Φ > 0**

Q. What is $(\theta + \phi)$**?**

A. $90°$

B. $120°$

C. $135°$

D. $75°$

Ans. C

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Q. Which of the following is correct in respect of the equation $3 - \tan^2\theta = \alpha(1 - 3\tan^2\theta)$?

Given that α is a real number).

(a) $\alpha \in \left[\frac{1}{3}, 3\right]$ **(b)** $\alpha \in \left[-\infty, \frac{1}{3}\right] \cup (3, \infty)$

(c) $\alpha \in \left(-\infty, \frac{1}{3}\right) \cup (3, \infty)$ **(d) None of these**

Ans. B