TRIGONOMETRY

1. Fundamental Trigonometric Identities

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

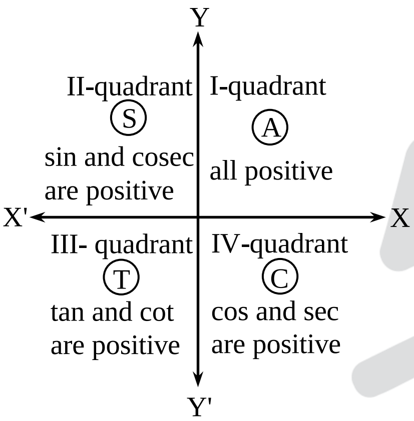
(ii) $1 + \tan^2\theta = \sec^2\theta$

(iii) $1 + \cot^2\theta = \text{cosec}^2\theta$

2. Sign of Trigonometrical Ratios or Functions

A crude aid to memorise the signs of trigonometrical ratio in different quadrant is

"All Silver Tea Cups"



3. Trigonometric Ratios of Allied Angles

Allied angles → / Trigonometrical Ratio ↓	$(-\theta)$	$(90° - \theta)$ or $\left(\frac{\pi}{2} - \theta\right)$	$(90° + \theta)$ or $\left(\frac{\pi}{2} + \theta\right)$	$(180° - \theta)$ or $(\pi - \theta)$	$(180° + \theta)$ or $(\pi + \theta)$	$(270° - \theta)$ or $\left(\frac{3\pi}{2} - \theta\right)$	$(270° + \theta)$ or $\left(\frac{3\pi}{2} + \theta\right)$	$(360° - \theta)$ or $(2\pi - \theta)$
$\sin\theta$	$-\sin\theta$	$\cos\theta$	$\cos\theta$	$\sin\theta$	$-\sin\theta$	$-\cos\theta$	$-\cos\theta$	$-\sin\theta$
$\cos\theta$	$\cos\theta$	$\sin\theta$	$-\sin\theta$	$-\cos\theta$	$-\cos\theta$	$-\sin\theta$	$\sin\theta$	$\cos\theta$
$\tan\theta$	$-\tan\theta$	$\cot\theta$	$-\cot\theta$	$-\tan\theta$	$\tan\theta$	$\cot\theta$	$-\cot\theta$	$-\tan\theta$

4. Sum and Difference Formulae

(i) $\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$

(ii) $\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$

(iii) $\tan(A \pm B) = \dfrac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$

(iv) $\cot(A \pm B) = \dfrac{\cot A . \cot B \mp 1}{\cot B \pm \cot A}$

(v) $\sin(A + B).\sin(A - B) = \sin^2 A - \sin^2 B = \cos^2 B - \cos^2 A$

(vi) $\cos(A + B).\cos(A - B) = \cos^2 A - \sin^2 B = \cos^2 B - \sin^2 A$

(vii) $\tan(A + B + C) = \dfrac{\tan A + \tan B + \tan C - \tan A \tan B \tan C}{1 - \tan A \tan B - \tan B \tan C - \tan C \tan A}$

(viii) sin (A + B + C) = sinA cosB cosC + cosA sinB cosC + cosA cosB sinC – sinA sinB sinC

(ix) cos (A + B + C) = cosA cosB cosC – cosA sinB sinC – sinA cosB sinC – sinA sinB cosC

5. Formulae for Product into Sum or Difference Conversion

(i) 2sinA cosB = sin(A + B) + sin (A – B)

(ii) 2cosA sinB = sinb(A + B) – sin (A – B)

(iii) 2cosA cosB = cos(A + B) + cos(A – B)

(iv) 2sinA sinB = cos(A – B) – cos(A + B)

(v) $\sin C + \sin D = 2 \sin\left(\dfrac{C+D}{2}\right).\cos\left(\dfrac{C-D}{2}\right)$

(vi) $\sin C - \sin D = 2 \cos\left(\dfrac{C+D}{2}\right).\sin\left(\dfrac{C-D}{2}\right)$

(vii) $\cos C + \cos D = 2 \cos\left(\dfrac{C+D}{2}\right).\cos\left(\dfrac{C-D}{2}\right)$

(viii) $\cos C - \cos D = 2\sin\left(\dfrac{C+D}{2}\right).\sin\left(\dfrac{D-C}{2}\right)$

6. Trigonometrical Ratios of Multiple Angles

(i) $\sin 2\theta = 2 \sin\theta \cos\theta = \dfrac{2\tan\theta}{1+\tan^2\theta}$

(ii) $\cos 2\theta = \cos^2\theta - \sin^2\theta = 2\cos^2\theta - 1 = 1 - 2\sin^2\theta = \dfrac{1-\tan^2\theta}{1+\tan^2\theta}$

(iii) $\tan 2\theta = \dfrac{2\tan\theta}{1-\tan^2\theta}$

(iv) $\sin 3\theta = 3\sin\theta - 4\sin^3\theta$

(v) $\cos 3\theta = 4\cos^3\theta - 3\cos\theta$

(vi) $\tan 3\theta = \dfrac{3\tan\theta - \tan^3\theta}{1-3\tan^2\theta}$

(vii) $\sin(\theta/2) = \sqrt{\dfrac{1-\cos\theta}{2}}$

(viii) $\cos(\theta/2) = \sqrt{\dfrac{1+\cos\theta}{2}}$

(ix) $\tan(\theta/2) = \sqrt{\dfrac{1-\cos\theta}{1+\cos\theta}} = \left|\dfrac{1-\cos\theta}{\sin\theta}\right| = \left|\dfrac{\sin\theta}{1+\cos\theta}\right|$

(x) $\sqrt{1+\sin 2A}$ = |sin θ + cos θ|

(xi) $\sqrt{1-\sin 2A}$ = |sin θ – cos θ|

7. Some Useful Identities

(i) $\tan(A+B+C) = \dfrac{\tan A + \tan B + \tan C - \tan A \tan B \tan C}{1 - \tan A \tan B - \tan B \tan C - \tan A \tan C}$

(ii) tan θ = cot θ – 2 cot 2θσ

(iii) tan 3θ = tan θ.tan(60° – θ).tan (60° + θ)

(iv) $\tan(A+B) - \tan A - \tan B = \tan A.\tan B.\tan(A+B)$

(v) sin θ sin(60°– θ) sin(60° + θ) = $\frac{1}{4}$ sin3θ

(vi) cosθ cos(60°– θ) cos(60° + θ) = $\frac{1}{4}$ cos3θ

8. Sine, Cosine and Tangent of some Angles less than 90º

	15º	18º	$\left(22\frac{1}{2}\right)^\circ$	36º
sin	$\frac{\sqrt{3}-1}{2\sqrt{2}}$	$\frac{\sqrt{5}-1}{4}$	$\frac{1}{2}\sqrt{2-\sqrt{2}}$	$\frac{\sqrt{10-2\sqrt{5}}}{4}$
cos	$\frac{\sqrt{3}+1}{2\sqrt{2}}$	$\frac{\sqrt{10+2\sqrt{5}}}{4}$	$\frac{1}{2}\sqrt{2+\sqrt{2}}$	$\frac{\sqrt{5}+1}{4}$
tan	$2-\sqrt{3}$	$\frac{\sqrt{25-10\sqrt{5}}}{5}$	$\sqrt{2}-1$	$\sqrt{5-2\sqrt{5}}$

SOLVED EXAMPLES

Ex.1 The value of the expression

$$1 - \frac{\sin^2 y}{1+\cos y} + \frac{1+\cos y}{\sin y} - \frac{\sin y}{1-\cos y} \text{ is equal to}$$

(A) 0 (B) 1

(C) sin y (D) cos y

Sol. Taking L.C.M.

$$\left[1 - \frac{\sin^2 y}{1+\cos y}\right] + \left[\frac{1+\cos y}{\sin y} - \frac{\sin y}{1-\cos y}\right]$$

$$= \frac{1+\cos y - \sin^2 y}{1+\cos y} + \frac{1-\cos^2 y - \sin^2 y}{\sin y.(1-\cos y)}$$

$$= \frac{\cos y + \cos^2 y}{1+\cos y} + 0 = \cos y$$ **Ans.[D]**

Ex.2 If $A + B = \frac{\pi}{3}$ and cos A + cos B = 1 then

(A) $\cos (A - B) = \frac{1}{3}$

(B) $|\cos A - \cos B| = \sqrt{\frac{2}{3}}$

(C) $\cos (A - B) = -\frac{1}{3}$

(D) $|\cos A - \cos B| = \frac{1}{2\sqrt{3}}$

Sol. cos A + cos B = 1

so, $2\cos \frac{A+B}{2} . \cos \frac{A-B}{2} = 1$

or $2.\frac{\sqrt{3}}{2} . \cos \frac{A-B}{2} = 1$

$\therefore \cos \frac{A-B}{2} = \frac{1}{\sqrt{3}}$

$\therefore \cos (A - B) = 2 \cos^2\left(\frac{A-B}{2}\right) - 1$

$= \frac{2}{3} - 1 = -\frac{1}{3}$

$|\cos A - \cos B| = \left|2\sin\frac{A+B}{2}.\sin\frac{A-B}{2}\right|$

$= 2.\frac{1}{2}.\sqrt{1-\frac{1}{3}} = \sqrt{\frac{2}{3}}$ **Ans.[B, C]**

Ex.3 The value of tan 63º – cot 63º is equal to

(A) $\frac{2}{\sqrt{5}+1}.\sqrt{10-2\sqrt{5}}$

(B) $\frac{2}{\sqrt{5}+1}.\sqrt{10+2\sqrt{5}}$

(C) $\frac{\sqrt{5}+1}{4}.\sqrt{5-\sqrt{5}}$

(D) None of these

Sol. Value $= -\frac{\cos 126^o}{\frac{1}{2}\sin 126^o} = -2\cot 126^o$

$= -2\cot(90+36)^o = 2\tan 36^o$

$= \frac{4.\sin 18^o \cos 18^o}{\cos 36^o}$

$= \frac{4.\frac{\sqrt{5}-1}{4}.\sqrt{1-\left(\frac{\sqrt{5}-1}{4}\right)^2}}{\frac{\sqrt{5}+1}{4}}$

$= \frac{\sqrt{5}-1}{\sqrt{5}+1}\sqrt{10+2\sqrt{5}}$

$= \frac{\sqrt{(\sqrt{5}-1)^2(10+2\sqrt{5})}}{\sqrt{5}+1}$

$= \frac{2}{\sqrt{5}+1}.\sqrt{10-2\sqrt{5}}$ **Ans.[A]**

Ex.4 If $\sin(\theta+\alpha) = a$ and $\sin(\theta+\beta) = b$, then $\cos 2(\alpha-\beta) - 4ab\cos(\alpha-\beta)$ is equal to

(A) $1 - a^2 - b^2$ (B) $1 - 2a^2 - 2b^2$

(C) $2 + a^2 + b^2$ (D) $2 - a^2 - b^2$

Sol. $\sin(\theta+\alpha) = a$, $\sin(\theta+\beta) = b$

$\theta + \alpha = \sin^{-1} a$, $\theta + \beta = \sin^{-1} b$

$\therefore \alpha - \beta = \sin^{-1}a - \sin^{-1} b$

$= \frac{\pi}{2} - \cos^{-1} a - \frac{\pi}{2} + \cos^{-1} b$

$= \cos^{-1} b - \cos^{-1} a$

$= \cos^{-1}\left(ab + \sqrt{1-b^2}\sqrt{1-a^2}\right)$

$\cos(\alpha-\beta) = ab + \sqrt{(1-a^2-b^2+a^2b^2)}$

$\Rightarrow \cos^2(\alpha-\beta) = a^2b^2 + 1 - a^2 - b^2 + a^2b^2 + 2ab\sqrt{1-a^2-b^2+a^2b^2}$

$\therefore \cos 2(\alpha-\beta) - 4ab\cos(\alpha-\beta)$

$= 2\cos^2(\alpha-\beta) - 1 - 4ab\cos(\alpha-\beta)$

$= 2a^2b^2 + 2 - 2a^2 - 2b^2 + 2a^2b^2 + 4ab\sqrt{1-a^2-b^2+a^2b^2} - 1 - 4a^2b^2 - 4ab\sqrt{1-a^2-b^2+a^2b^2}$

$= 1 - 2a^2 - 2b^2$ **Ans.[B]**

Ex.5 Prove that

$$\left(\frac{1}{\sec^2\alpha - \cos^2\alpha} + \frac{1}{\operatorname{cosec}^2\alpha - \sin^2\alpha}\right) \times \sin^2\alpha\cos^2\alpha = \frac{1-\sin^2\alpha\cos^2\alpha}{2+\sin^2\alpha\cos^2\alpha}$$

Sol. LHS $= \left(\frac{\cos^2\alpha}{1-\cos^4\alpha} + \frac{\sin^2\alpha}{1-\sin^4\alpha}\right)\sin^2\alpha\cos^2\alpha$

$$= \frac{\cos^4\alpha\sin^2\alpha}{(1-\cos^2\alpha)(1+\cos^2\alpha)} + \frac{\sin^4\alpha\cos^2\alpha}{(1-\sin^2\alpha)(1+\sin^2\alpha)}$$

$$= \frac{\cos^4\alpha\sin^2\alpha}{\sin^2\alpha(1+\cos^2\alpha)} + \frac{\sin^4\alpha\cos^2\alpha}{\cos^2\alpha(1+\sin^2\alpha)}$$

$$= \frac{\cos^4\alpha}{1+\cos^2\alpha} + \frac{\sin^4\alpha}{1+\sin^2\alpha}$$

$$= \frac{\cos^4\alpha(1+\sin^2\alpha)+\sin^4\alpha(1+\cos^2\alpha)}{(1+\cos^2\alpha)(1+\sin^2\alpha)}$$

$$= \frac{\cos^4\alpha+\sin^4\alpha+\sin^2\alpha\cos^2\alpha(\cos^2\alpha+\sin^2\alpha)}{1+(\sin^2\alpha+\cos^2\alpha)+\sin^2\alpha\cos^2\alpha}$$

$$= \frac{(\cos^2\alpha+\sin^2\alpha)^2-2\sin^2\alpha\cos^2\alpha+\sin^2\alpha\cos^2\alpha}{2+\sin^2\alpha\cos^2\alpha}$$

$$= \frac{1-\sin^2\alpha\cos^2\alpha}{2+\sin^2\alpha\cos^2\alpha} = \text{RHS}$$

Ex.6 If $\sec\alpha = 13/5$ $(0 < \alpha < \frac{\pi}{2})$, find the value of $\frac{2-3\cot\alpha}{4-9\sqrt{\sec^2\alpha-1}}$.

Sol. $\sec\alpha = \frac{13}{5} \Rightarrow \sec^2\alpha - 1 = \frac{169}{25} - 1$

$\Rightarrow \tan^2\alpha = \frac{144}{25} \Rightarrow \tan\alpha = \frac{12}{5}$

Now, the given expression is equal to

$$\frac{2-3\cot\alpha}{4-9\tan\alpha} = \frac{2-3.\frac{5}{12}}{4-9.\frac{12}{5}} = \frac{(24-15)5}{12(20-108)}$$

$$= \frac{-45}{12.88} = -\frac{15}{352}$$

Ex.7 If cos x = tan y, cos y = tan z and cos z = tan x, prove that sin x = sin y = sin z = 2 sin 18º.

Sol. $\cos^2x = \tan^2y = \sec^2y - 1 = \cot^2z - 1$

$$\Rightarrow 1 + \cos^2x = \cot^2z = \frac{\cos^2z}{1-\cos^2z}$$

$$= \frac{\tan^2x}{1-\tan^2x}$$

$$\Rightarrow 2 - \sin^2 x = \frac{\sin^{2`} x}{\cos^2 x - \sin^2 x} = \frac{\sin^{2`} x}{1 - 2\sin^2 x}$$

$$\Rightarrow (2 - \sin^2 x)(1 - 2\sin^2 x) = \sin^2 x$$

$$\Rightarrow 2\sin^4 x - 6\sin^2 x + 2 = 0$$

$$\Rightarrow \sin^4 x - 3\sin^2 x + 1 = 0$$

$$\Rightarrow \sin^2 x = \frac{3 \pm \sqrt{9-4}}{2} = \frac{1}{2}(3 \pm \sqrt{5})$$

then $\frac{1}{2}(3 + \sqrt{5}) > 1$,

so, $\sin^2 x = \frac{1}{2}(3 - \sqrt{5}) < 1$,

$$\sin x = \frac{\sqrt{5} - 1}{2} = 2 \sin 18^o$$

Similarly, $\sin y = 2 \sin 18^o$ and $\sin z = 2 \sin 18^o$.

Ex.8 Given $\tan 15° = 2 - \sqrt{3}$, find $\tan 7\frac{1}{2}°$.

Sol. We know that

$$\tan\left(\frac{A}{2}\right) = \frac{\pm\sqrt{1 + \tan^2 A} - 1}{\tan A} \quad ...(1)$$

Putting A = 15° we have, from equation (1),

$$\tan 7\frac{1}{2}° = \frac{\pm\sqrt{1 + (2 - \sqrt{3})^2} - 1}{2 - \sqrt{3}}$$

$$= \frac{\pm\sqrt{8 - 4\sqrt{3}} - 1}{2 - \sqrt{3}}$$

Now $\tan 7\frac{1}{2}°$ is positive, so we must take the positive sign.

Hence, $\tan 7\frac{1}{2}° = \frac{+(\sqrt{6} - \sqrt{2}) - 1}{2 - \sqrt{3}}$

$$= (\sqrt{6} - \sqrt{2} - 1)(2 + \sqrt{3})$$

$$= \sqrt{6} - \sqrt{3} + \sqrt{2} - 2 = (\sqrt{3} - \sqrt{2})(\sqrt{2} - 1)$$

Ex.9 Prove that $\frac{\cos 3\theta + \cos 3\phi}{2\cos(\theta - \phi) - 1} = (\cos\theta + \cos\phi)\cos(\theta + \phi) - \sin(\theta + \phi)(\sin\theta + \sin\phi)$

Sol. LHS = $\frac{2\cos\left(\frac{3\theta + 3\phi}{2}\right)\cos\left(\frac{3\theta - 3\phi}{2}\right)}{2\left(2\cos^2\frac{\theta - \phi}{2} - 1\right) - 1}$

$$= \frac{2\cos\left(\frac{3\theta+3\phi}{2}\right)\left(4\cos^3\left(\frac{\theta-\phi}{2}\right)-3\cos\left(\frac{\theta-\phi}{2}\right)\right)}{4\cos^2\left(\frac{\theta-\phi}{2}\right)-3}$$

$$= 2\cos\left(\frac{3\theta+3\phi}{2}\right)\cos\left(\frac{\theta-\phi}{2}\right)$$

$$\text{RHS} = 2\cos\left(\frac{\theta+\phi}{2}\right)\cos\left(\frac{\theta-\phi}{2}\right)\cos(\theta+\phi) - 2\sin\left(\frac{\theta+\phi}{2}\right)\cos\left(\frac{\theta-\phi}{2}\right)\sin(\theta+\phi)$$

$$= 2\cos\left(\frac{\theta-\phi}{2}\right)\left[\cos\left(\frac{\theta+\phi}{2}\right)\cos(\theta+\phi) - \sin\left(\frac{\theta+\phi}{2}\right)\sin(\theta+\phi)\right]$$

$$= 2\cos\left(\frac{\theta-\phi}{2}\right)\cos\left(\frac{3\theta+3\phi}{2}\right) = \text{LHS}$$

Ex.10 Prove that $4\sin 27^o = (5+\sqrt{5})^{1/2} - (3-\sqrt{5})^{1/2}$

Sol. $\sin 54^o = \cos 36^o = \frac{\sqrt{5}+1}{4}$

$$\Rightarrow \cos 54^o = \sqrt{1-\left(\frac{\sqrt{5}+1}{4}\right)^2} = \frac{1}{4}\sqrt{10-2\sqrt{5}}$$

$$\Rightarrow 1 - 2\sin^2 27^o = \frac{1}{4}\sqrt{10-2\sqrt{5}}$$

$$\Rightarrow 2\sin^2 27^o = 1 - \frac{1}{4}\sqrt{10-2\sqrt{5}}$$

$$\Rightarrow 16\sin^2 27^o = 8 - 2\sqrt{10-2\sqrt{5}}$$

$$= [(5+\sqrt{5})^{1/2} - (3-\sqrt{5})^{1/2}]^2$$

$$\Rightarrow 4\sin 27^o = (5+\sqrt{5})^{1/2} - (2-\sqrt{5})^{1/2} \qquad [\because \sin 27^o \text{ is positive}]$$

EXERCISE

Q.1 If $\sin x + \sin^2 x = 1$, then $\cos^8 x + 2\cos^6 x + \cos^4 x = ...$

(A) 0 (B) – 1

(C) 2 (D) 1

Q.2 If $\sin\theta = \frac{1}{\sqrt{2}}$ and $\frac{\pi}{2} < \theta < \pi$. Then the value of $\frac{\sin\theta + \cos\theta}{\tan\theta}$ is

(A) 0 (B) 1

(C) $\frac{1}{\sqrt{2}}$ (D) $\sqrt{2}$

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

(A) 0 (B) 1 (C) 3 (D) $\sin 4\alpha + \cos 6\alpha$

Q.4 If $\frac{\pi}{2} < \alpha < \pi$, $\pi < \beta < \frac{3\pi}{2}$; $\sin\alpha = \frac{15}{17}$ and $\tan\beta = \frac{12}{5}$, the value of $\sin(\beta - \alpha)$ is

(A) $\frac{-21}{221}$ (B) $\frac{21}{221}$

(C) $\frac{-171}{221}$ (D) $\frac{171}{221}$

Q.5 $\frac{\tan^2 2\theta - \tan^2\theta}{1 - \tan^2 2\theta \tan^2\theta} =$

(A) $\tan 3\theta / \tan\theta$ (B) $\cot 3\theta / \cot\theta$

(C) $\tan 3\theta \tan\theta$ (D) $\cot 3\theta \cot\theta$

Q.6 If $\tan A = 1/3$ and $\tan B = 1/7$ then the value of $2A + B$ is

(A) 30º (B) 60º

(C) 45º (D) 145º

Q.7 $\cos 20^\circ \cos 100^\circ + \cos 100^\circ \cos 140^\circ - \cos 140^\circ \cos 200^\circ =$

(A) 0 (B) 3/4

(C) –3/4 (D) – 4/3

Q.8 $2\sin\left(\frac{5\pi}{12}\right)\sin\left(\frac{\pi}{12}\right) =$

(A) $-\frac{1}{2}$ (B) $\frac{1}{2}$

(C) $\frac{1}{4}$ (D) $\frac{1}{6}$

Q.9 $\frac{\cos 12^\circ - \sin 12^\circ}{\cos 12^\circ + \sin 12^\circ} + \frac{\sin 147^\circ}{\cos 147^\circ} =$

(A) 1 (B) –1

(C) 0 (D) None

Q.10 If m sin θ = n sin (θ + 2α), then tan (θ + α) cot α =

(A) $\frac{1-n}{1+n}$ (B) $\frac{m+n}{m-n}$

(C) $\frac{m-n}{m+n}$ (D) None

Q.11 $\left(\frac{\cos A + \cos B}{\sin A - \sin B}\right)^n + \left(\frac{\sin A + \sin B}{\cos A - \cos B}\right)^n$ when n is odd, is

(A) $2 \cot^n \left(\frac{A-B}{2}\right)$ (B) zero

(C) $2 \tan^n \left(\frac{A-B}{2}\right)$ (D) None

Q.12 $2 \sin^2\beta + 4 \cos(\alpha + \beta) \sin\alpha \sin\beta + \cos 2(\alpha + \beta)$ is equal to

(A) sin 2α (B) cos 2β

(C) cos 2α (D) sin 2β

Q.13 If tanβ = cosθ.tanα, then $\tan^2\left(\frac{\theta}{2}\right) =$

(A) $\frac{\sin(\alpha+\beta)}{\sin(\alpha-\beta)}$ (B) $\frac{\cos(\alpha-\beta)}{\cos(\alpha+\beta)}$ (C) $\frac{\sin(\alpha-\beta)}{\sin(\alpha+\beta)}$ (D) $\frac{\cos(\alpha+\beta)}{\cos(\alpha-\beta)}$

Q.14 $\frac{1-\cos 4\alpha}{\sec^2 2\alpha - 1} + \frac{1+\cos 4\alpha}{\operatorname{cosec}^2 2\alpha - 1}$ is equal to

(A) 0 (B) 2

(C) 1 (D) 4

Q.15 $\cos^2\left(\frac{\pi}{16}\right) + \cos^2\left(\frac{3\pi}{16}\right) + \cos^2\left(\frac{5\pi}{16}\right) + \cos^2\left(\frac{7\pi}{16}\right)$ is equal to

(A) 0 (B) 1 (C) 2 (D) 3

Q.16 If sin A = $\frac{336}{625}$, where 450° < A < 540°, then sin $\frac{A}{4}$ is

(A) 3/5 (B) – 3/5

(C) 4/5 (D) – 4/5

Q.17 cot 5° – tan 5° – 2 tan 10° – 4 tan 20° – 8 cot 40° is equal to

(A) 0 (B) 8 tan 40°

(C) 8 tan 80° (D) None of these

Q.18 If 0º < θ < 180º then $\sqrt{2+\sqrt{2+\sqrt{2+\sqrt{2+\ldots\ldots\ldots\ldots+\sqrt{2(1+\cos\theta)}}}}}$ there being n number of 2's, is equal to

(A) $2\cos\frac{\theta}{2^n}$ (B) $2\cos\frac{\theta}{2^{n-1}}$

(C) $2\cos\frac{\theta}{2^{n+1}}$ (D) None of these

Q.19 The sign of the product sin2 sin3 sin5 is

(A) Negative (B) Positive

(C) 0 (D) None of these

Q.20 $\frac{\cos 20^\circ + 8\sin 70^\circ \sin 50^\circ \sin 10^\circ}{\sin^2 80^\circ}$ is equal to

(A) 1 (B) 2

(C) $\frac{3}{4}$ (D) None of these

Q.21 It is known that $\sin\beta = \frac{4}{5}$ and $0 < \beta < \pi$ then the value of $\frac{\sqrt{3}\sin(\alpha+\beta) - \frac{2}{\cos\pi/6}\cos(\alpha+\beta)}{\sin\alpha}$ is

(A) Independent of α for all β in (0, π)

(B) $\frac{5}{13}$ for $\tan\beta < 0$

(C) $\frac{3(7+24\cot\alpha)}{15}$ for $\tan\beta > 0$

(D) None of these

Q.22 The value of the expression $\cos\frac{\pi}{7}\cos\frac{2\pi}{7}\cos\frac{10\pi}{7} - \sin\frac{\pi}{14}\sin\frac{3\pi}{14}\sin\frac{5\pi}{14}$ is

(A) 0 (B) $-\frac{1}{4}$

(C) $\frac{1}{4}$ (D) $-\frac{1}{8}$

Q.23 $\frac{\sin 7x + 6\sin 5x + 17\sin 3x + 12\sin x}{\sin 6x + 5\sin 4x + 12\sin 2x} =$

(A) cos x (B) 2 cos x

(C) sin x (D) 2 sin x

Q.24 If product of sin 1° sin 3° sin 5°…. sin 89° $= \frac{1}{2^n}$ then n equals

(A) 44 (B) $\frac{89}{2}$

(C) 45 (D) None

Q.25 If $x \in \left(\pi, \frac{3\pi}{2}\right)$ then $4\cos^2\left(\frac{\pi}{4} - \frac{x}{2}\right) + \sqrt{4\sin^4 x + \sin^2 2x}$ equals

(A) 2 (B) –2

(C) 3 (D) – 3

Q.26 $1 + \text{cosec}\,\frac{\pi}{4} + \text{cosec}\,\frac{\pi}{8} + \text{cosec}\,\frac{\pi}{16}$ equals

(A) $\cot\frac{\pi}{8}$ (B) $\cot\frac{\pi}{16}$

(C) $\cot\frac{\pi}{32}$ (D) None

ANSWER KEY

EXERCISE

Q.No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Ans.	D	A	B	D	C	C	C	B	C	B	B	C	C	B	C
Q.No.	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**				
Ans.	C	A	A	A	B	D	B	B	B	A	C				