CDS-AFCAT 2 2024

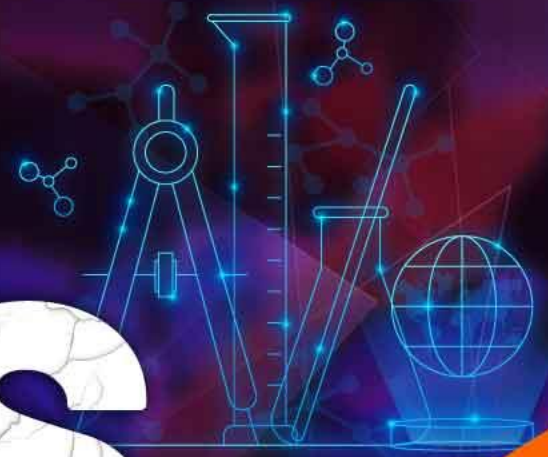
SSBCrack EXAMS

LIVE

MATHS

TRIGONOMETRY

CLASS 1



NAVJYOTI SIR

11 June 2024 Live Classes Schedule

8:00AM	11 JUNE 2024 DAILY CURRENT AFFAIRS	RUBY MA'AM

SSB INTERVIEW LIVE CLASSES

9:00AM	OVERVIEW OF SRT & SDT	ANURADHA MA'AM

AFCAT 2 2024 LIVE CLASSES

4:00PM	MATHS - TRIGONOMETRY - CLASS 1	NAVJYOTI SIR
5:30PM	ENGLISH - FILL IN THE BLANKS - CLASS 2	ANURADHA MA'AM

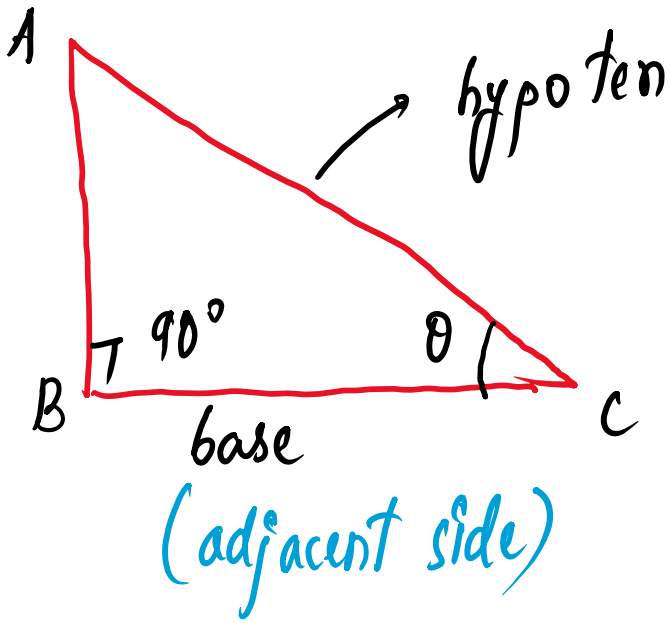
NDA 2 2024 LIVE CLASSES

11:30AM	GK - BIOSPHERE RESERVES & NATIONAL PARKS	RUBY MA'AM
2:30PM	GS - CHEMISTRY - CLASS 2	SHIVANGI MA'AM
5:30PM	ENGLISH - FILL IN THE BLANKS - CLASS 2	ANURADHA MA'AM
6:30PM	MATHS - BINOMIAL THEOREM - CLASS 2	NAVJYOTI SIR

CDS 2 2024 LIVE CLASSES

11:30AM	GK - BIOSPHERE RESERVES & NATIONAL PARKS	RUBY MA'AM
2:30PM	GS - CHEMISTRY - CLASS 2	SHIVANGI MA'AM
4:00PM	MATHS - TRIGONOMETRY - CLASS 1	NAVJYOTI SIR
5:30PM	ENGLISH - FILL IN THE BLANKS - CLASS 2	ANURADHA MA'AM

INTRODUCTION



$\sin\theta = \frac{\text{perp.}}{\text{hypotenuse}}$

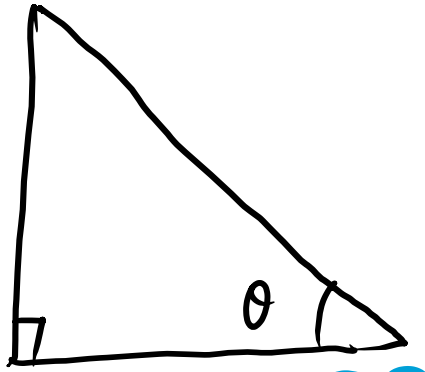
1. $\sin\theta = \frac{BC}{AC} = \frac{\text{Perpendicular}}{\text{Hypotenuse}}$
2. $\cos\theta = \frac{AB}{AC} = \frac{\text{Base}}{\text{Hypotenuse}}$
3. $\tan\theta = \frac{BC}{AB} = \frac{\text{Perpendicular}}{\text{Base}}$
4. $\text{cosec}\,\theta = \frac{1}{\sin\theta} = \frac{AC}{BC} = \frac{\text{Hypotenuse}}{\text{Perpendicular}}$
5. $\sec\theta = \frac{1}{\cos\theta} = \frac{AC}{AB} = \frac{\text{Hypotenuse}}{\text{Base}}$
6. $\cot\theta = \frac{1}{\tan\theta} = \frac{AB}{BC} = \frac{\text{Base}}{\text{Perpendicular}}$

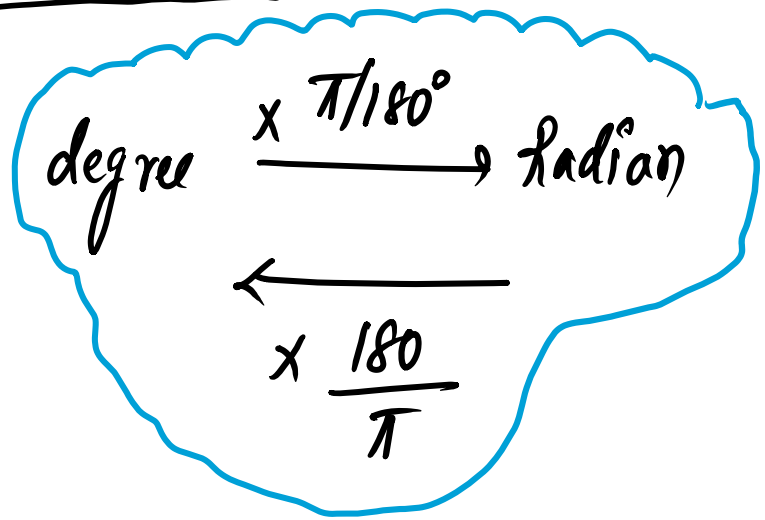
INTRODUCTION

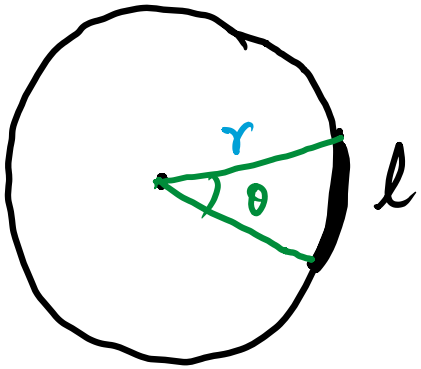
If the measure of an angle is given in degree. To convert it into radian, the angle should be multiplied by $\frac{\pi}{180^\circ}$ and to convert an angle from radian to degree put 180° at the place of π.

$\theta \rightarrow 30^\circ, 60^\circ, 45^\circ$

(radian measure)







θ (in radian) $= \frac{\text{length of arc}}{\text{radius}} = \left(\frac{l}{r}\right)$

$360^\circ = \frac{2\pi r}{r} \Rightarrow 180^\circ = \pi$

$30^\circ \longrightarrow 30^\circ \times \frac{\pi}{180^\circ} = \frac{\pi}{6}$

$60^\circ \longrightarrow \frac{\pi}{3}$

$90^\circ \longrightarrow \frac{\pi}{2}$

$45^\circ \longrightarrow \frac{\pi}{4}$

$135^\circ \longrightarrow 180^\circ - 45^\circ$

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

$(\pi \equiv 180^\circ)$

$120^\circ \longrightarrow 180^\circ - 60^\circ$ or, $90^\circ + 30^\circ$

$\pi - \frac{\pi}{3}$ | $\frac{\pi}{2} + \frac{\pi}{6}$

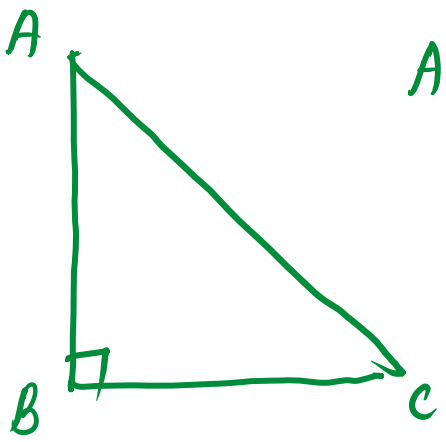
$= \frac{2\pi}{3}$, | $\frac{3\pi + \pi}{6} = \frac{4\pi}{6}$

$= \frac{2\pi}{3}$,

1. $\operatorname{cosec}\theta = \dfrac{1}{\sin\theta} \Rightarrow \sin\theta \operatorname{cosec}\theta = 1$
2. $\sec\theta = \dfrac{1}{\cos\theta} \Rightarrow \cos\theta \sec\theta = 1$
3. $\cot\theta = \dfrac{1}{\tan\theta} \Rightarrow \tan\theta \cot\theta = 1$

Reciprocals

4. $\tan\theta = \dfrac{\sin\theta}{\cos\theta}$ and $\cot\theta = \dfrac{\cos\theta}{\sin\theta}$
5. $\cos^2\theta + \sin^2\theta = 1$
6. (i) $1 + \tan^2\theta = \sec^2\theta$
   (ii) $\sec^2\theta - \tan^2\theta = 1$
7. (i) $1 + \cot^2\theta = \operatorname{cosec}^2\theta$
   (ii) $\operatorname{cosec}^2\theta - \cot^2\theta = 1$



$AC^2 = AB^2 + BC^2$

1) $\left(\dfrac{AC}{AC}\right)^2 = \left(\dfrac{AB}{AC}\right)^2 + \left(\dfrac{BC}{AC}\right)^2$

2)

3)

	0°	30°	45°	60°	90°
$\sin\theta$	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1
$\cos\theta$	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0
$\tan\theta$	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	n.d. (∞)
$\operatorname{cosec}\theta$	∞	2	$\sqrt{2}$	$\frac{2}{\sqrt{3}}$	1
$\sec\theta$	1	$\frac{2}{\sqrt{3}}$	$\sqrt{2}$	2	∞
$\cot\theta$	∞	$\sqrt{3}$	1	$\frac{1}{\sqrt{3}}$	0

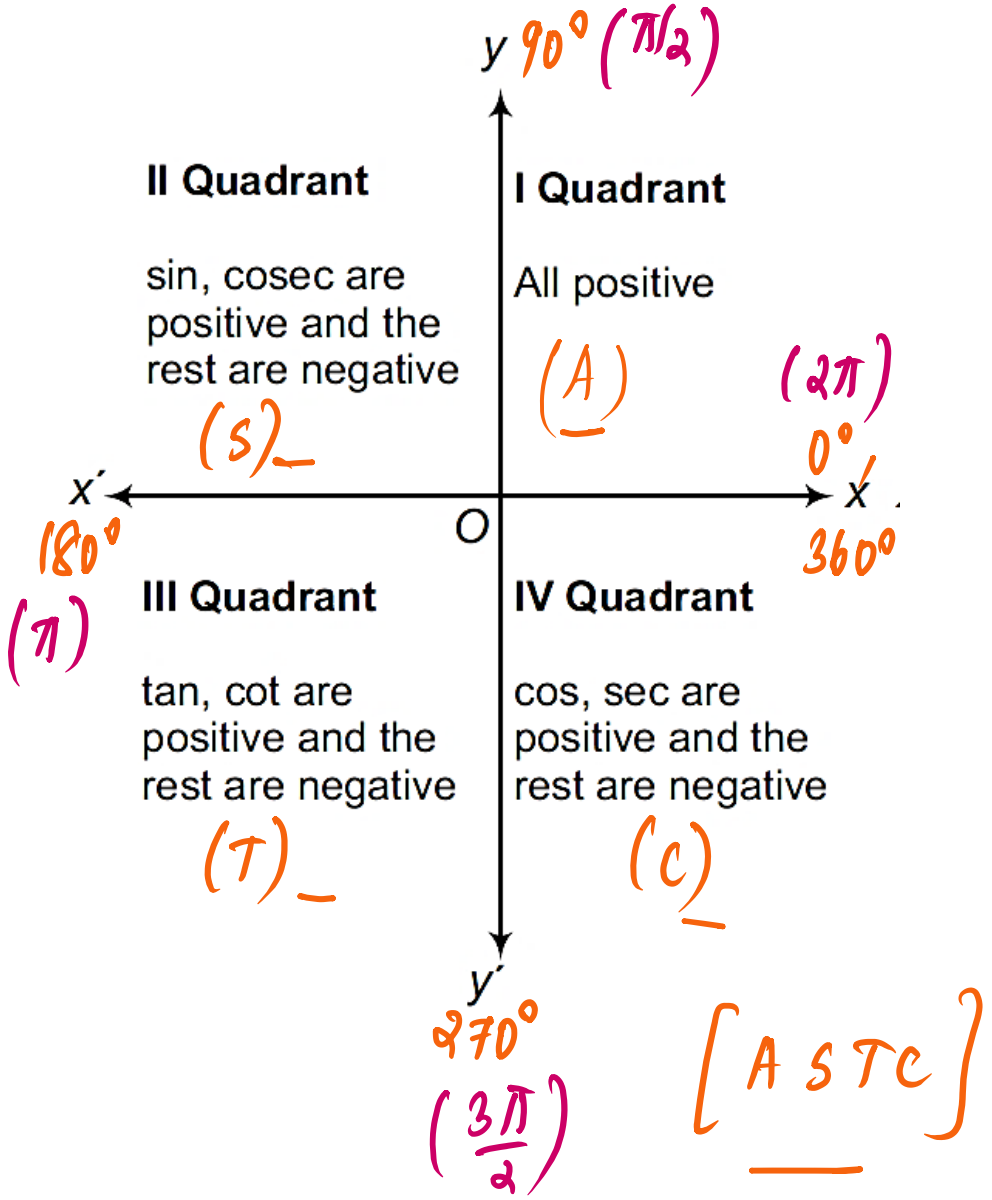
$\tan\theta = \frac{\sin\theta}{\cos\theta}$

$= \frac{1}{\sin\theta}$

$= \frac{1}{\cos\theta}$

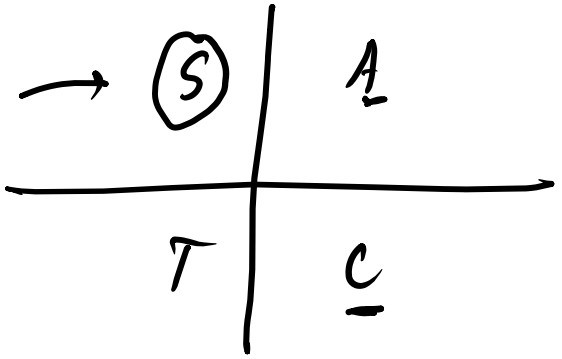
$\frac{1}{\tan\theta}$

TRIGONOMETRIC RATIOS IN DIFFERENT QUADRANT

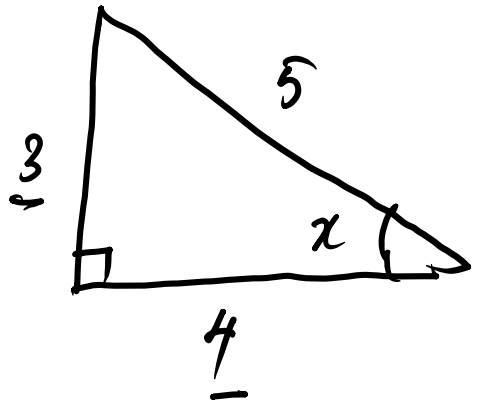


Q) If $\tan x = -\frac{3}{4}$ and x is in the second quadrant, then what is the value of $\sin x \cdot \cos x$?

(a) $\frac{6}{25}$ (b) $\frac{12}{25}$ (c) $-\frac{6}{25}$ (d) $-\frac{12}{25}$



$\frac{3}{4}$



$\sin x = \pm \frac{3}{5}$

$\cos x = -\frac{4}{5}$

$\sin x \cdot \cos x$

$= \left(\frac{3}{5}\right)\left(-\frac{4}{5}\right)$

$= -\frac{12}{25}$

Q) If $\tan x = -\frac{3}{4}$ and x is in the second quadrant, then what is the value of $\sin x \cdot \cos x$?

(a) $\frac{6}{25}$ (b) $\frac{12}{25}$ (c) $-\frac{6}{25}$ (d) $-\frac{12}{25}$

Ans: (d)

COMPLEMENTARY RATIOS

$\sin(90^\circ - \theta) = \cos\theta$

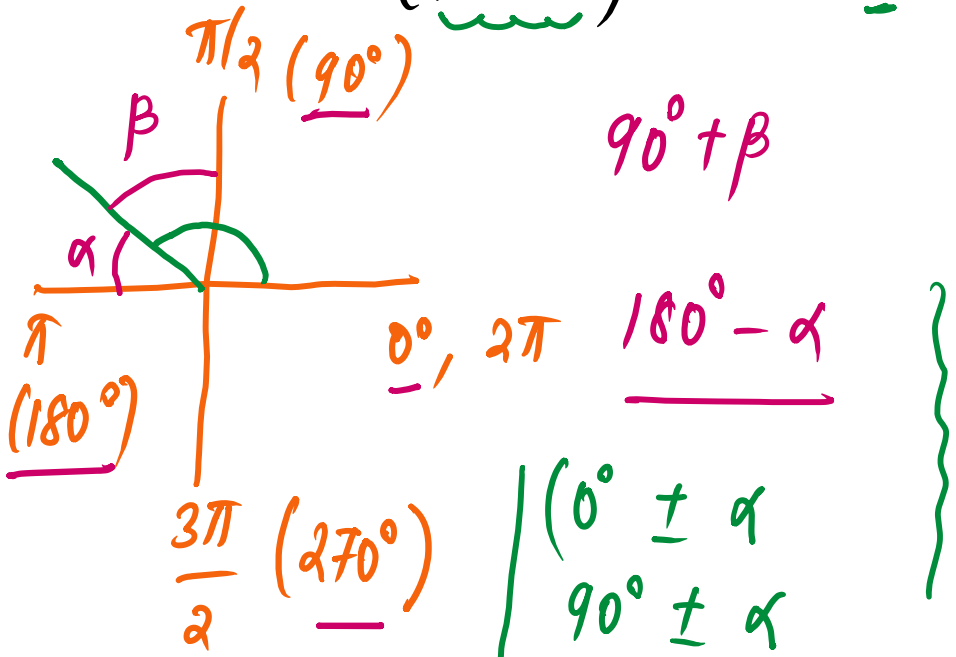
$\cos(90^\circ - \theta) = \sin\theta$

$\tan(90^\circ - \theta) = \cot\theta$

$\cot(90^\circ - \theta) = \tan\theta$

$\sec(90^\circ - \theta) = \operatorname{cosec}\theta$

$\operatorname{cosec}(90^\circ - \theta) = \sec\theta$



$90^\circ + \beta$

$180^\circ - \alpha$

$(0^\circ \pm \alpha$
$90^\circ \pm \alpha$
$180^\circ \pm \alpha$, $270^\circ \pm \alpha)$

$(tr.)(\text{base angle} \pm \alpha) = \pm(tr)\alpha$

tr – any trig. ratio

base angle: $0^\circ, 90^\circ, 180^\circ, 270^\circ$

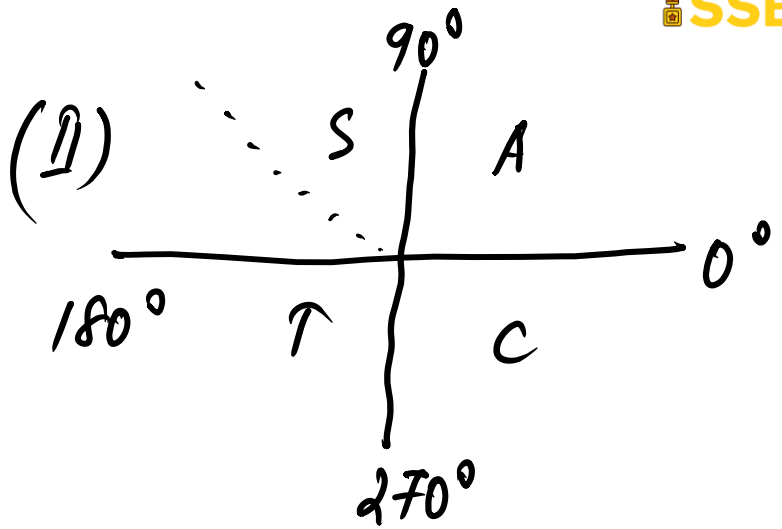
$90^\circ, 270^\circ \longrightarrow tr'$ – complementary

$180^\circ, 360^\circ \longrightarrow tr$

$\sin 135^\circ$

$= \sin(180^\circ - 45^\circ)$

$= +\sin 45^\circ = \frac{1}{\sqrt{2}}$



$\tan 120^\circ = \tan(90^\circ + 30^\circ)$

$= -\cot 30^\circ$

$= -\sqrt{3}$

→ Try to keep base angle as either 180° or 360°

— x —

Q) If $\text{cosec}\,2\theta = \sec(3\theta - 15°)$, then θ is equal to:

(a) 22° (b) 20°

(c) 25° (d) 21°

$\text{cosec}\,2\theta = \sec(90° - 2\theta) = \sec(3\theta - 15°)$

same (can be removed)

$90° - 2\theta = 3\theta - 15°$

$5\theta = 105°$

$\theta = 21°$

(OR) if $tr(\theta_1) = tr'(\theta_2)$, and tr' is complementary to tr, then $\theta_1 + \theta_2 = 90°$ ✓

$2\theta + 3\theta - 15° = 90°$

$5\theta = 105°$

$\theta = 21°$

Q) If $\text{cosec}2\theta = \sec(3\theta - 15°)$, then θ is equal to:

(a) $22°$ (b) $20°$

(c) $25°$ (d) $21°$

Ans: (d)

Q) If $\operatorname{cosec}\theta - \cot\theta = \frac{1}{\sqrt{3}}$, where $\theta \neq 0$, then what is the value of $\cos\theta$?

(a) 0 (b) $\frac{\sqrt{3}}{2}$

(c) $\frac{1}{2}$ (d) $\frac{1}{\sqrt{2}}$

$$\frac{1}{\sin\theta} - \frac{\cos\theta}{\sin\theta} = \frac{1}{\sqrt{3}}$$

$$\frac{1-\cos\theta}{\sin\theta} = \frac{1}{\sqrt{3}}$$

$$\sqrt{3} - \sqrt{3}\cos\theta = \sin\theta$$

$$\sin\theta + \sqrt{3}\cos\theta = \sqrt{3} \quad \text{— (1)}$$

Check for which value of $\cos\theta$, eqn (1) satisfies,

(a) $\cos\theta = 0 \Rightarrow \theta = 90^\circ$

$\sin\theta = 1$ (X)

$1 + \sqrt{3}(0) \neq \sqrt{3}$

(b) $\cos\theta = \frac{\sqrt{3}}{2} \Rightarrow \theta = 30^\circ$

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

$\frac{1}{2} + \sqrt{3}\left(\frac{\sqrt{3}}{2}\right) \neq \sqrt{3}$

(c) $\cos\theta = \frac{1}{2} \Rightarrow \theta = 60^\circ$

$\sin\theta = \frac{\sqrt{3}}{2}$

$\frac{\sqrt{3}}{2} + \sqrt{3}\left(\frac{1}{2}\right) = \sqrt{3}$ (✓)

Q) If $\operatorname{cosec}\theta - \cot\theta = \frac{1}{\sqrt{3}}$, where $\theta \neq 0$, then what is the value of $\cos\theta$?

(a) 0

(b) $\frac{\sqrt{3}}{2}$

(c) $\frac{1}{2}$

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

Ans: (c)

Q) $\dfrac{(1+\cos\theta)^2+\sin^2\theta}{(\operatorname{cosec}^2\theta-1)\sin^2\theta}=$

(a) $\cos\theta(1+\sin\theta)$ (b) $2\cos\theta(1+\sec\theta)$

(c) $\sec\theta(1+\sin\theta)$ (d) $2\sec\theta(1+\sec\theta)$

$$\frac{1+\cos^2\theta+2\cos\theta+\sin^2\theta}{\cot^2\theta\cdot\sin^2\theta}$$

$$=\frac{2+2\cos\theta}{\cos^2\theta}=\frac{2(1+\cos\theta)}{\cos^2\theta}=2\left(\frac{1}{\cos^2\theta}+\frac{1}{\cos\theta}\right)=2\left(\sec^2\theta+\sec\theta\right)$$

$$=2\sec\theta(1+\sec\theta)$$

Q) $\dfrac{(1+\cos\theta)^2+\sin^2\theta}{(\operatorname{cosec}^2\theta-1)\sin^2\theta}=$

(a) $\cos\theta(1+\sin\theta)$

(b) $2\cos\theta(1+\sec\theta)$

(c) $\sec\theta(1+\sin\theta)$

(d) $2\sec\theta(1+\sec\theta)$

Ans: (d)

Q) What is the value of $\operatorname{cosec}(65^\circ + \theta) - \sec(25^\circ - \theta) + \tan^2 20^\circ - \operatorname{cosec}^2 70^\circ$?

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

Q) What is the value of $\operatorname{cosec}(65^\circ + \theta) - \sec(25^\circ - \theta) + \tan^2 20^\circ - \operatorname{cosec}^2 70^\circ$?

(a) 0 (b) 1 (c) 2 (d) –1

Ans: (d)

Q) The value of

$$\frac{(\cos 9^\circ + \sin 81^\circ)(\sec 9^\circ + \operatorname{cosec} 81^\circ)}{\sin 56^\circ \sec 34^\circ + \cos 25^\circ \operatorname{cosec}\ 65^\circ}$$

(a) 4 (b) $\frac{1}{2}$ (c) 2 (d) $\frac{1}{2}$

Q) The value of

$$\frac{(\cos 9^\circ + \sin 81^\circ)(\sec 9^\circ + \operatorname{cosec} 81^\circ)}{\sin 56^\circ \sec 34^\circ + \cos 25^\circ \operatorname{cosec}\ 65^\circ}$$

(a) 4 (b) $\frac{1}{2}$ (c) 2 (d) $\frac{1}{2}$

Ans: (c)

Q) If $b \tan\theta = a$, the value of $\dfrac{a\sin\theta - b\cos\theta}{a\sin\theta + b\cos\theta}$

(a) $\dfrac{a-b}{a^2+b^2}$

(b) $\dfrac{a+b}{a^2+b^2}$

(c) $\dfrac{a^2+b^2}{a^2-b^2}$

(d) $\dfrac{a^2-b^2}{a^2+b^2}$

Q) If $b \tan\theta = a$, the value of $\dfrac{a\sin\theta - b\cos\theta}{a\sin\theta + b\cos\theta}$

(a) $\dfrac{a-b}{a^2+b^2}$

(b) $\dfrac{a+b}{a^2+b^2}$

(c) $\dfrac{a^2+b^2}{a^2-b^2}$

(d) $\dfrac{a^2-b^2}{a^2+b^2}$

Ans: (d)

TRIGONOMETRIC FORMULAE

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

(ii) $\sin(A-B) = \sin A \cos B - \cos A \sin B$

(iii) $\cos(A+B) = \cos A \cos B - \sin A \sin B$

(iv) $\cos(A-B) = \cos A \cos B + \sin A \sin B$

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

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

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

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

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

(viii) $\cot(A-B) = \dfrac{\cot A \cot B - 1}{\cot B - \cot A}$

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

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

Q) If $\operatorname{cosec}\theta - \cot\theta = \frac{1}{\sqrt{3}}$, where $\theta \neq 0$, then what is the value of $\cos\theta$?

(a) 0 (b) $\frac{\sqrt{3}}{2}$

(c) $\frac{1}{2}$ (d) $\frac{1}{\sqrt{2}}$

(same question, using identity)

$$\frac{1}{\sin\theta} - \frac{\cos\theta}{\sin\theta} = \frac{1}{\sqrt{3}}$$

$$\frac{1-\cos\theta}{\sin\theta} = \frac{1}{\sqrt{3}}$$

$$\frac{2\sin^2\theta/2}{2\sin\theta/2\cos\theta/2} = \frac{1}{\sqrt{3}}$$

$$\tan\frac{\theta}{2} = \frac{1}{\sqrt{3}}$$

$$\tan\frac{\theta}{2} = \tan 30^\circ$$

$$\Rightarrow \frac{\theta}{2} = 30^\circ$$

$$\theta = 60^\circ$$

$$\cos\theta = \cos 60^\circ = \frac{1}{2}$$

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

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

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

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

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

(Half-angle)

TRIGONOMETRIC FORMULAE

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

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

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

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

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

(v) $\cot 2\theta = \dfrac{\cot^2\theta - 1}{2\cot\theta}$

Q) What is $\sqrt{2+\sqrt{2+\sqrt{2+2\cos 4A}}}$ equal to?

(a) $\cos A$ (b) $\cos(2A)$

(c) $2\cos(A/2)$ (d) $\sqrt{2\cos A}$

Q) What is $\sqrt{2+\sqrt{2+\sqrt{2+2\cos 4A}}}$ equal to?

(a) $\cos A$ (b) $\cos(2A)$

(c) $2\cos(A/2)$ (d) $\sqrt{2\cos A}$

Ans: (c)

TRIGONOMETRIC FORMULAE

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

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

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

(iv) $\cot 3\theta = \dfrac{\cot^3\theta - 3\cot\theta}{3\cot^2\theta - 1} = \dfrac{3\cot\theta - \cot^3\theta}{1 - 3\cot^2\theta}$

$\sin 3\theta = 3\sin\theta - 4\sin^3\theta$

$\cos 3\theta = 4\cos^3\theta - 3\cos\theta$

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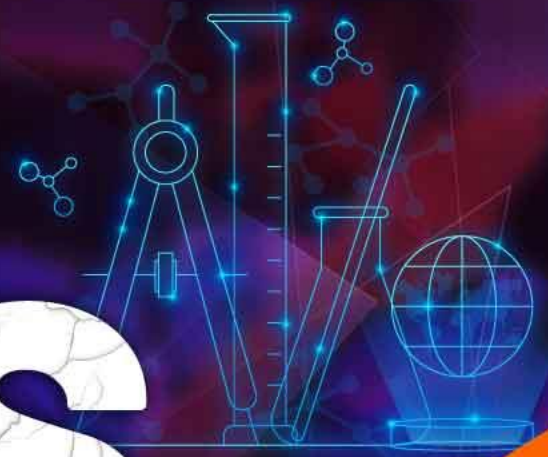

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