

Multiple and Sub-multiple Trigonometric function of 2A

(2A के गुणक तथा उपगुणक त्रिकोणमितीय फलन)

$$\sin 2A = 2 \sin A \cdot \cos A = \frac{2 \tan A}{1 + \tan^2 A}$$

$$\sin A = 2 \sin \frac{A}{2} \cos \frac{A}{2} = \frac{2 \tan \frac{A}{2}}{1 + \tan^2 \frac{A}{2}}$$

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

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

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

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

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

$$1 + \cos A = 2 \cos^2 \frac{A}{2}$$

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

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

$$\cot 2A = \frac{\cot^2 A - 1}{2 \cot A}$$

Trigonometric function of 3A

(3A के त्रिकोणमितीय फलन)

$$\left\{ \begin{array}{l} \cancel{\text{✍}} \quad \underline{\sin 3A} = \underline{3 \sin A} - 4 \sin^3 A \\ \cancel{\text{✍}} \quad \cos 3A = 4 \cos^3 A - 3 \cos A \\ \cancel{\text{✍}} \quad \tan 3A = \left(\frac{3 \tan A - \tan^3 A}{1 - 3 \tan^2 A} \right) \\ \cancel{\text{✍}} \quad \cot 3A = \left(\frac{\cot^3 A - 3 \cot A}{3 \cot^2 A - 1} \right) \end{array} \right.$$

$$\boxed{2\theta}$$

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

$\cdot \boxed{\cos 2\theta}$

- $\rightarrow \cos^4\theta - \sin^4\theta$
- $\rightarrow \cos^2\theta - \sin^2\theta$
- $\rightarrow 1 - 2\sin^2\theta$
- $\rightarrow 2\cos^2\theta - 1$
- $\rightarrow \boxed{\frac{1 - \tan^2\theta}{1 + \tan^2\theta}}$

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

1. If $2(\cos^2\theta - \sin^2\theta) = 1$ (θ is a positive acute angle), then $\cot\theta$ is equal to :

(a) $-\sqrt{3}$

(b) $\frac{1}{\sqrt{3}}$

(c) 1

✓ (d) $\sqrt{3}$

$\rightarrow 2 \times \cos 2\theta = 1$

$\Rightarrow \cos 2\theta = \frac{1}{2}$

$\cos 2\theta = \cos 60^\circ$

~~$\theta = 60^\circ$~~ 30°

$\cot 30^\circ = \sqrt{3}$

2. The value of $\sec^2\theta - \frac{\sin^2\theta - 2\sin^4\theta}{2\cos^4\theta - \cos^2\theta}$ is :

- ☒ (a) 1
(c) - 1

- (b) 2
(d) 0


$$\begin{aligned} & \sec^2\theta - \frac{\sin^2\theta(1-2\sin^2\theta)}{\cos^2\theta(2\cos^2\theta-1)} \\ &= \sec^2\theta - \tan^2\theta \frac{\cancel{\cos 2\theta}}{\cancel{\cos 2\theta}} \\ &= 1 \end{aligned}$$

3. Simplify the following expression

$$\frac{\sin \theta - 2 \sin^3 \theta}{2 \cos^3 \theta - \cos \theta}$$

✓ SSC CGL 21/07/2023 (Shift-03)

✓ (a) $\tan \theta$

(b) $\sin \theta$

(c) $\sec \theta$

(d) $\cos \theta$


$$\begin{aligned} &= \frac{\sin \theta (1 - 2 \sin^2 \theta)}{\cos \theta (2 \cos^2 \theta - 1)} \\ &= \tan \theta \end{aligned}$$

4. Evaluate the following:

$$\sqrt{2 + \sqrt{2 + \sqrt{2 + 2\cos 8\theta}}}$$

SSC CGL 27/07/2023 (Shift-3)

(a) ~~$2\cos\theta$~~

(b) $2\cos 2\theta$

(c) $\sin 2\theta$

(d) $\cos 2\theta$

→ Ans = $2\cos\theta$

$$\sqrt{2 + \sqrt{2 + \sqrt{2 + 2\cos 40\theta}}}$$

$$= \boxed{2\cos 5\theta}$$

$$0. \sqrt{2 + \sqrt{2 + 2\cos 4\theta}}$$

$$= \boxed{2\cos\theta}$$

$$0. \sqrt{2 + \sqrt{2 + \sqrt{2 + 2\cos 8\theta}}}$$

$$= 2\cos\theta$$

$$0. \sqrt{2 + \sqrt{2 + \sqrt{2 + \sqrt{2 + 2\cos 32\theta}}}}$$

$$= \underline{2\cos 2\theta}$$

5. $\frac{2 \tan A}{1 + \tan^2 A} = ?$

SSC CGL 20/07/2023 (Shift-02)

(a) $\cos 2A$

(b) $\sin A$

(c) $\cos A$

☒ (d) $\sin 2A$

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

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

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

• $\cos 2\theta \begin{cases} \rightarrow 2\cos^2\theta - 1 \\ \rightarrow 1 - 2\sin^2\theta \end{cases}$

6. The value of $\frac{\sin 4\theta}{(1 - \cos 4\theta)}$ is:

✓ SSC CHSL 01/06/2022 (Shift- 03)

(a) $\cot \theta$

✓ (b) $\cot 2\theta$

(c) $\tan \theta$

(d) $\tan 2\theta$

$$\rightarrow \frac{2 \sin 2\theta \cdot \cos 2\theta}{(1 - (1 - 2\sin^2 2\theta))} = \frac{\cancel{2} \sin \cancel{2}\theta \cdot \cos 2\theta}{\cancel{1} - \cancel{1} + \cancel{2} \sin^2 2\theta}$$
$$= \frac{\cos 2\theta}{\sin 2\theta} = \cot 2\theta$$

m-1

$$\# \cos 15^\circ = \cos(45^\circ - 30^\circ)$$

$$= \cos 45^\circ \cos 30^\circ + \sin 45^\circ \sin 30^\circ$$

$$= \frac{1}{\sqrt{2}} \times \frac{\sqrt{3}}{2} + \frac{1}{\sqrt{2}} \cdot \times \frac{1}{2}$$

$$\cos 15^\circ = \frac{\sqrt{3} + 1}{2\sqrt{2}}$$

$$\frac{n-2}{\#} \quad \cos 2\theta = 2\cos^2\theta - 1$$

$$\Rightarrow \cos 30^\circ = 2\cos^2 15^\circ - 1$$

$$\Rightarrow \frac{\sqrt{3}}{2} + 1 = 2\cos^2 15^\circ$$

$$\Rightarrow \frac{\sqrt{3} + 2}{2} = 2\cos^2 15^\circ$$

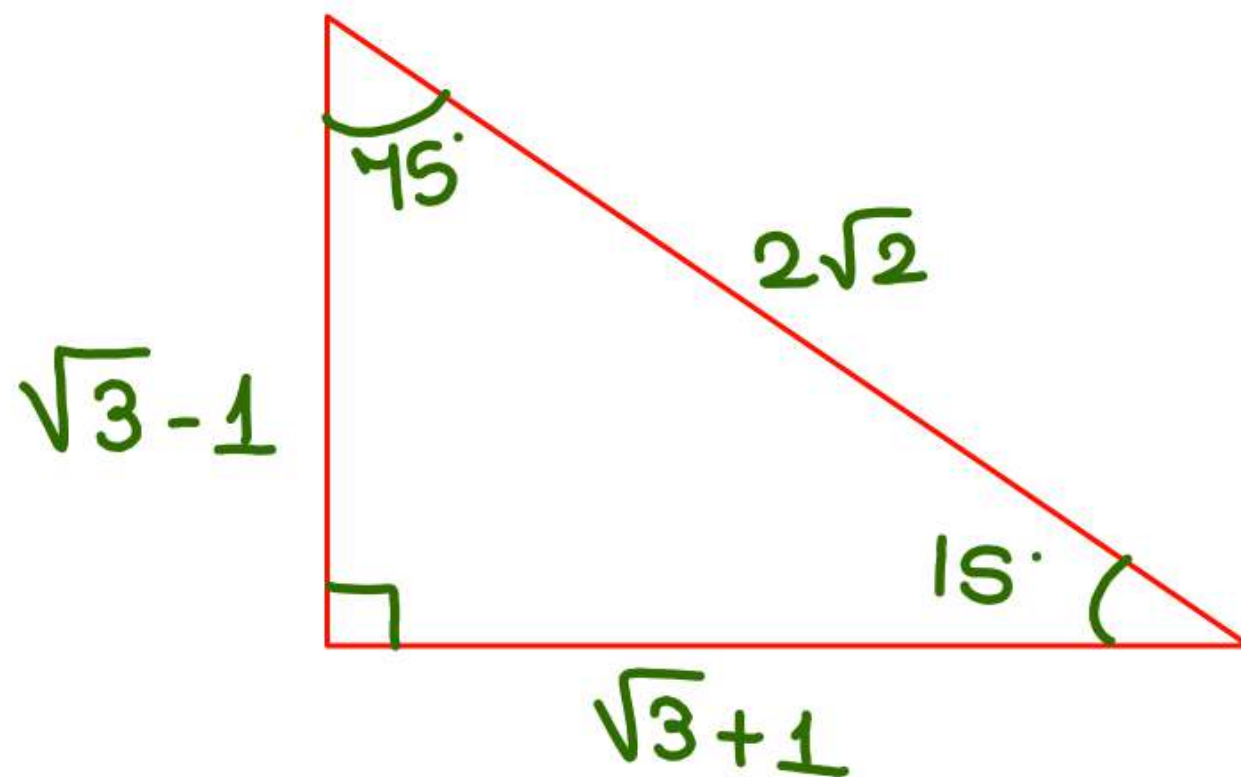
$$\Rightarrow \frac{2 + \sqrt{3}}{4} = \cos^2 15^\circ$$

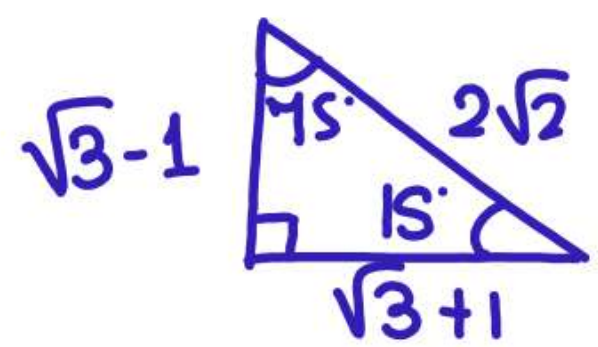
$$\Rightarrow \cos 15^\circ = \sqrt{\frac{2 + \sqrt{3}}{4}} = \sqrt{\frac{4 + 2\sqrt{3}}{8}} = \frac{\sqrt{3} + 1}{2\sqrt{2}}$$

$$\cdot \cos 15^\circ = \frac{\sqrt{3}+1}{2\sqrt{2}}$$

$$\cdot \sin 15^\circ = \frac{\sqrt{3}-1}{2\sqrt{2}}$$

$$\cdot \tan 15^\circ = \frac{\sqrt{3}-1}{\sqrt{3}+1}$$





$$\cos 15^\circ = \frac{\sqrt{3}+1}{2\sqrt{2}}$$

$$\cos^2 15^\circ = \frac{(\sqrt{3}+1)^2}{4 \times 2} = \frac{3+1+2 \times \sqrt{3} \times 1}{8} = \frac{4+2\sqrt{3}}{8} = \frac{2+\sqrt{3}}{4}$$

7. What is the value of $\cos^2 15^\circ$?

SSC CGL 06/12/2022 (Shift- 04)

(a) $(2 + \sqrt{3})$

☒ (b) $\frac{(2 + \sqrt{3})}{4}$

(c) $\frac{(2 + \sqrt{3})}{2}$

(d) $\frac{(1 + \sqrt{3})}{2}$

8. What is the value of $\operatorname{cosec} 15^\circ \sec 15^\circ$

SSC CGL 13/12/2022 (Shift- 02)

m-1

(a) 0.5

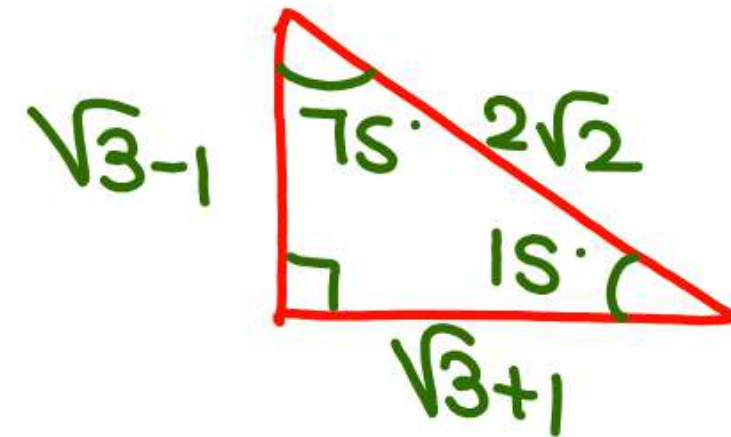
☒ (b) 4

(c) 2

(d) 1

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

$$= \frac{4 \times 2}{(3-1)} = \frac{4 \times 2}{2}$$



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

8. What is the value of $\operatorname{cosec} 15^\circ \sec 15^\circ$

SSC CGL 13/12/2022 (Shift- 02)

(a) 0.5

☒ (b) 4

(c) 2

(d) 1

$$= \frac{1}{\sin 15^\circ \cdot \cos 15^\circ} = \frac{2}{2 \sin 15^\circ \cos 15^\circ}$$

$$= \frac{2}{\sin 30^\circ} = \frac{2}{\frac{1}{2}} = 2 \times 2 = 4$$

9. What is the value of the expression $100(\sin 15^\circ \cos 15^\circ)$?

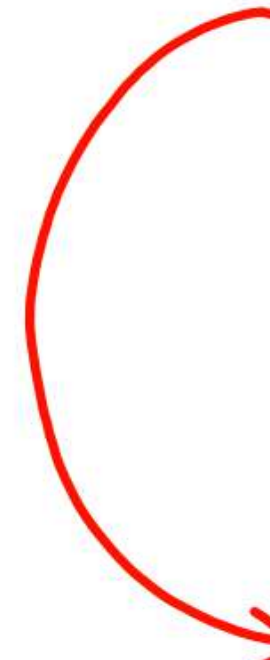
SSC CHSL 03/06/2022 (Shift- 03)

(a) 50

(b) 75

(c) 100

☒ (d) 25



So
 $= \cancel{100} \times \frac{2 \cdot \sin 15^\circ \cdot \cos 15^\circ}{2}$

$= 50 \cdot \sin 30^\circ$

$= 25 \times \frac{1}{2}$

$= 25$

$$= \frac{1 - \tan^2 22.5^\circ}{1 + \tan^2 22.5^\circ}$$

$$= \cos 45^\circ$$

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

10. Find the value of $\frac{1 - \tan^2 22\frac{1}{2}^\circ}{1 + \tan^2 22\frac{1}{2}^\circ}$ is :

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

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

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

(d) $\sqrt{3}$

11. $3 \sin A - 4 \sin^3 A = ?$

SSC CHSL 02/06/2022 (Shift- 01)

(a) $\cot 3A$

(c) $\cos 3A$

☒ (b) $\sin 3A$

(d) $\tan 3A$

* $\sin 3A = 3 \sin A - 4 \sin^3 A$

* $\cos 3A = 4 \cos^3 A - 3 \cos A$

13. What is the value of $(4\sin^3 x - 3\sin x + \sin 3x)$?

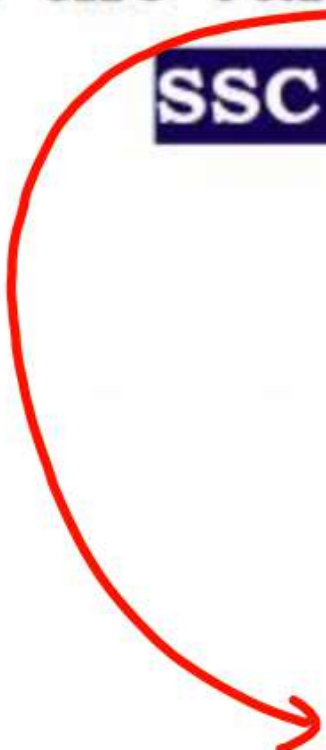
SSC CHSL 31/05/2022 (Shift- 02)

(a) 1

(b) 0

(c) 4

(d) 3


$$\begin{aligned} &= -(3\sin x - 4\sin^3 x) + \sin 3x \\ &= -\cancel{\sin 3x} + \cancel{\sin 3x} \\ &= 0 \end{aligned}$$

14. If $\sin \theta = \frac{\sqrt{3}}{2}$, and θ is an acute angle, find the value of $\cos 3\theta$.

SSC CHSL 10/06/2022 (Shift- 01)

$\theta = 60^\circ$

$\cos 180^\circ$

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

(b) 1

(c) -1

(d) 0

$\sin 180^\circ = 0$
 $\cos 180^\circ = -1$

15. If $\sin\theta = \frac{1}{2}$, then the value of $(3\cos\theta - 4\cos^3\theta)$ is:

SSC CGL 06/12/2022 (Shift- 03)

~~(a) 0~~

(c) 2

$\rightarrow \theta = 30^\circ$

(b) 1

(d) -1

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

$$= -\cos 3\theta$$

$$= -\cos 90^\circ$$

$$= 0$$

16. What will be the value of $\sin 10^\circ - \frac{4}{3} \sin^3 10^\circ$?

✓ SSC CGL 06/12/2022 (Shift-01)

(a) $\frac{1}{3\sqrt{3}}$

(c) $\frac{1}{2\sqrt{3}}$

✓ (b) $\frac{1}{6}$

(d) $\frac{\sqrt{3}}{6}$

$$= \frac{3}{3} \left(\sin 10^\circ - \frac{4}{3} \sin^3 10^\circ \right)$$

$$= \frac{1}{3} \left[3 \sin 10^\circ - 2 \times \frac{4}{2} \sin^3 10^\circ \right]$$

$$= \frac{1}{3} \times \sin 30^\circ$$

$$= \frac{1}{3} \times \frac{1}{2} = \frac{1}{6}$$

Identities based on Sum & Difference of angle of T-Ratio

(त्रिकोणमिति अनुपात के कोणों का योग तथा
अंतर पर आधारित सर्वसमिकाएँ)

✓ ~~✗~~ $\sin(A + B) = \sin A \cos B + \cos A \sin B$

~~✗~~ $\sin(A - B) = \sin A \cos B - \cos A \sin B$

~~✗~~ $\cos(A + B) = \cos A \cos B - \sin A \sin B$

~~✗~~ $\cos(A - B) = \cos A \cos B + \sin A \sin B$

~~✗~~ $\tan(A + B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$

~~✗~~ $\tan(A - B) = \frac{\tan A - \tan B}{1 + \tan A \tan B}$

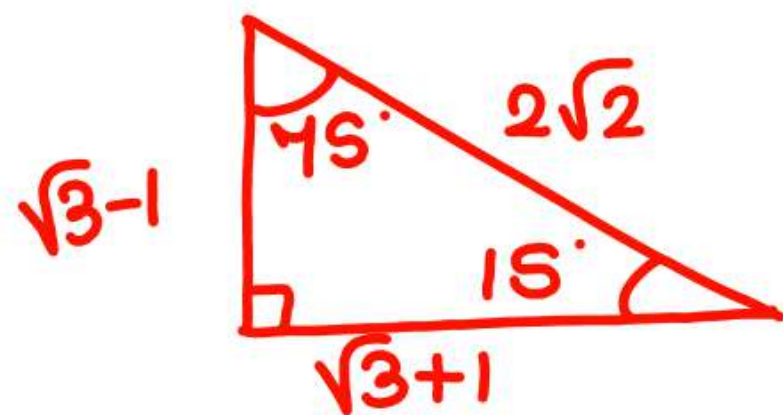
~~✗~~ $\cot(A + B) = \frac{\cot A \cot B - 1}{\cot B + \cot A}$

~~✗~~ $\cot(A - B) = \frac{\cot A \cot B + 1}{\cot B - \cot A}$

17. Which of the following options gives an expression equivalent to $\sin(A + B)$?

✓ **SSC CGL 24/07/2023 (Shift-2)**

- (a) $\cos A \cos B - \sin A \sin B$
- ✓ (b) $\sin A \cos B + \cos A \sin B$
- (c) $\cos A \cos B + \sin A \sin B$
- (d) $\sin A \cos B - \cos A \sin B$



$$\tan 15^\circ = \frac{\sqrt{3}-1}{\sqrt{3}+1} = 2-\sqrt{3}$$

$$\cot 15^\circ = \frac{\sqrt{3}+1}{\sqrt{3}-1} = 2+\sqrt{3}$$

24. What will be the value of $\frac{\tan 45^\circ - \tan 15^\circ}{1 + \tan 45^\circ \tan 15^\circ}$?

SSC CGL 07/12/2022 (Shift-03)

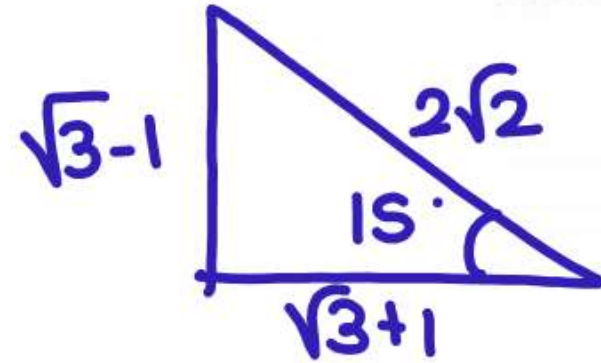
(a) $\sqrt{3}$

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

☒ (c) $\frac{1}{\sqrt{3}}$

(d) $\sqrt{2}$

$\rightarrow \tan(45^\circ - 15^\circ)$
 $= \tan 30^\circ$
 $= \frac{1}{\sqrt{3}}$



$$\cot 15^\circ = \frac{\sqrt{3}+1}{\sqrt{3}-1}$$

26. Using $\cot (A - B) = \frac{\cot A \cot B + 1}{\cot B - \cot A}$, find the value of $\cot 15^\circ$.

SSC CGL 19/07/2023 (Shift-02)

~~(a) $2 + \sqrt{3}$~~

~~(b) $2 - \sqrt{3}$~~

~~(c) $\sqrt{3} - 1$~~

~~(d) $\sqrt{3} + 1$~~

39. If A

Q. $\tan 7^\circ \tan 15^\circ \tan 22^\circ$

- (a) $\tan 7^\circ + \tan 15^\circ + \tan 22^\circ$
- (b) $\tan 15^\circ - \tan 7^\circ - \tan 22^\circ$
- (c) $\tan 7^\circ - \tan 15^\circ - \tan 22^\circ$
- (d) $\tan 22^\circ - \tan 7^\circ - \tan 15^\circ$

