

Foundation Batch



MATHS

Trigonometry

Part -10

LIVE

13-11-2024 07:00PM



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

Half angle

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

$$\boxed{\cos\theta = \sqrt{\frac{1 + \cos 2\theta}{2}}}$$

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

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

ex $\cos 22\frac{1}{2}^\circ$

$$\begin{aligned}\cos 22\frac{1}{2}^\circ &= \sqrt{\frac{1 + \cos 45^\circ}{2}} = \sqrt{\frac{1 + \frac{1}{\sqrt{2}}}{2}} = \sqrt{\frac{\sqrt{2} + 1}{2\sqrt{2}}}\end{aligned}$$

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

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

apply C & D Rule

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

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

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

$$\underline{\underline{(45^\circ + \theta)}}$$

$$\underline{\tan(45^\circ + \theta)} = \frac{\tan 45^\circ + \tan \theta}{1 - \tan 45^\circ \tan \theta} = \left\{ \frac{1 + \tan \theta}{1 - \tan \theta} \right\}$$

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

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

$$= \frac{1 + \sin 2\theta}{\cos 2\theta} = \underline{\underline{\sec 2\theta + \tan 2\theta}}$$

$$\frac{1 + \frac{\sin \theta}{\cos \theta}}{1 - \frac{\sin \theta}{\cos \theta}}$$

$$= \left\{ \frac{\cos \theta + \sin \theta}{\cos \theta - \sin \theta} \right\}$$

M Imp

$$\tan(45^\circ + \theta) = \frac{1 + \tan \theta}{1 - \tan \theta} = \frac{\cos \theta + \sin \theta}{\cos \theta - \sin \theta} = \sec 2\theta + \tan 2\theta$$

$$\cot(45^\circ + \theta) = \frac{\cos \theta - \sin \theta}{\cos \theta + \sin \theta} = \sec 2\theta - \tan 2\theta$$



112. $\frac{1}{4}[\sqrt{3}\cos 23^\circ - \sin 23^\circ] = ?$

(a) $\cos 43^\circ$ $\frac{1}{2} \left[\frac{\sqrt{3}}{2} \cos 23^\circ - \frac{1}{2} \sin 23^\circ \right]$

(b) $\cos 70^\circ$ $\frac{1}{2} [\cos 30^\circ \cos 23^\circ - \sin 30^\circ \sin 23^\circ]$

(c) $\cos 53^\circ$

(d) $\frac{1}{2} \cos 53^\circ$ $\therefore \cos A \cos B - \sin A \sin B = \cos(A+B)$

$$\frac{1}{2} \cos(30+23)$$

$$= \frac{1}{2} \underline{\underline{\cos 53^\circ}}$$

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M. Imp

113. Find the value of A for the given equation.

दिए गए समीकरण के लिए A का मान ज्ञात कीजिए।

$$\tan A + \tan 2A + \tan 3A = \tan A \tan 2A \tan 3A$$

(a) $\frac{\pi}{3}, \frac{2\pi}{3}$

(b) $\frac{5\pi}{6}$

(c) केवल $\frac{\pi}{3}$

(d) केवल $\frac{2\pi}{3}$

$$\tan A + \tan 2A = -\tan 3A + \tan A \tan 2A \tan 3A$$

$$\tan A + \tan 2A = -\tan 3A [1 - \tan A \tan 2A]$$

$$\frac{\tan A + \tan 2A}{1 - \tan A \cdot \tan 2A} = -\tan 3A$$

$$\tan(A + 2A) = -\tan 3A$$

$$\tan 3A = -\tan 3A$$

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$$\tan 3A = 0$$

$$\tan 3A = 0$$

$$\tan 3 \times \frac{\pi}{3}$$

$$\tan \pi = 0$$

$$\tan \left(3 \times \frac{2\pi}{3} \right)$$

$$\tan 2\pi = 0$$

114. Find the value of $\tan \frac{2\pi}{5} - \tan \frac{\pi}{15} - \sqrt{3} \tan \frac{2\pi}{5} \tan \frac{\pi}{15}$

$\tan \frac{2\pi}{5} - \tan \frac{\pi}{15} - \sqrt{3} \tan \frac{2\pi}{5} \tan \frac{\pi}{15}$ का मान ज्ञात कीजिए

(a) 1

(b) 0

(c) $\sqrt{3}$

(d) $\sqrt{2}$

$$\tan \left(\frac{2\pi}{5} - \frac{\pi}{15} \right) = \frac{\tan \frac{2\pi}{5} - \tan \frac{\pi}{15}}{1 + \tan \frac{2\pi}{5} \tan \frac{\pi}{15}}$$

$$\tan \frac{\pi}{3} = \sqrt{3} \left(1 + \tan \frac{2\pi}{5} \tan \frac{\pi}{15} \right) = \tan \frac{2\pi}{5} - \tan \frac{\pi}{15}$$

$$\sqrt{3} + \sqrt{3} \tan \frac{2\pi}{5} \tan \frac{\pi}{15} = \tan \frac{2\pi}{5} - \tan \frac{\pi}{15}$$

$$\tan \frac{2\pi}{5} - \tan \frac{\pi}{15} - \sqrt{3} \tan \frac{2\pi}{5} \tan \frac{\pi}{15} = \sqrt{3}$$

$$\frac{\pi}{5} + \frac{\pi}{15}$$

$$\frac{6\pi + \pi}{15} = \frac{7\pi}{15}$$

$$\frac{\pi}{5} - \frac{\pi}{15}$$

$$\frac{6\pi - \pi}{15} = \frac{5\pi}{15}$$

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



$$\begin{aligned} & \tan(45^\circ + 9^\circ) \\ &= \frac{\cos 9^\circ + \sin 9^\circ}{\cos 9^\circ - \sin 9^\circ} \end{aligned}$$

115. $\tan 54^\circ = ?$

(a) $\frac{\sin 9^\circ + \cos 9^\circ}{\cos 9^\circ - \sin 9^\circ}$

(b) $\frac{\sin 9^\circ - \cos 9^\circ}{\sin 9^\circ + \cos 9^\circ}$

(c) $\frac{\cos 9^\circ + \tan 9^\circ}{\cos 9^\circ - \tan 9^\circ}$

(d) $\frac{\cos 9^\circ - \sin 9^\circ}{\cos 9^\circ + \sin 9^\circ}$

$$\tan(180 + 70) \\ = \tan 70^\circ$$

$$\tan(50 + 20) = \frac{\tan 50 + \tan 20}{1 - \tan 50 \tan 20}$$

$$\tan 70 (1 - \tan 50 \tan 20) = \tan 50 + \tan 20$$

$$\tan 70 - \tan 70 \tan 50 \tan 20 \\ = \tan 50 + \tan 20$$

$$\tan 70 - \tan 50 = \tan 50 + \tan 20$$

$$\tan 70 = 2 \tan 50 + \tan 20$$



Revise

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M

116. Find the value of 250° ?

$\tan 250^\circ$ का मान ज्ञात कीजिये।

(a) $2 \tan 50^\circ + \tan 20^\circ$

(b) $2 \tan 20^\circ + \tan 50^\circ$

(c) $2 \tan 50^\circ \tan 20^\circ$

(d) None of these



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

118. Simplify the expression:

व्यंजक को सरल करें:

$$\frac{1 - \tan^2 (22.5^\circ)}{1 + \tan^2 (22.5^\circ)} = \cos 45^\circ$$

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

☒ B. $\frac{1}{\sqrt{2}}$

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

D. $\sqrt{3}$

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



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119. If θ is a positive acute angle and $\tan 2\theta \cdot \tan 3\theta = 1$, then the value of $\left(2\cos^2 \frac{5\theta}{2} - 1\right)$ is

यदि θ एक धनात्मक न्यून कोण है और $\tan 2\theta \cdot \tan 3\theta = 1$ है, तो $\left(2\cos^2 \frac{5\theta}{2} - 1\right)$ का मान है

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

(b) 1

(c) 0

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



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MA

$$\frac{1 + \tan^2(\pi - \frac{\theta}{2})}{2 \cot(\frac{\pi}{2} - \frac{\theta}{2})}$$

$$\frac{\sec^2(\pi - \frac{\theta}{2})}{2 \tan \frac{\theta}{2}}$$

$$= \frac{\sec^2 \frac{\theta}{2}}{2 \tan \frac{\theta}{2}}$$

$$\frac{1}{2 \cos^2 \frac{\theta}{2}} \times \frac{\cos \frac{\theta}{2}}{\sin \frac{\theta}{2}} \Rightarrow \frac{1}{2 \cos \frac{\theta}{2} \sin \frac{\theta}{2}} = \frac{1}{\sin \theta} = \text{cosec } \theta$$



120. Find the value of $\frac{[1 + \tan^2 \frac{2\pi - \theta}{2}]}{[2 \cot \frac{\pi - \theta}{2}]}$?

$\frac{[1 + \tan^2 \frac{2\pi - \theta}{2}]}{[2 \cot \frac{\pi - \theta}{2}]}$ का मान ज्ञात कीजिये।

(a) cosec θ

(b) sin θ

(c) $2 \tan \frac{\theta}{2}$

(d) cot 2θ

$$\frac{1}{2 \cos \frac{\theta}{2} \sin \frac{\theta}{2}} = \frac{1}{\sin \theta} = \text{cosec } \theta$$

121. The value of $\frac{\sin 2^\circ}{\sqrt{(2\cos^2 46^\circ - 1)^2}} + \frac{\sin 4^\circ}{\sqrt{(1 - 2\sin^2 43^\circ)^2}}$ का मान है

(a) -2

(b) 1

(c) 0

(d) 2

$$\frac{\sin 2^\circ}{\cos 92^\circ} + \frac{\sin 4^\circ}{\cos 86^\circ}$$

$$\frac{\sin 2^\circ}{\cos(90+2)} + 1$$

$$\frac{1 \sin 2}{-\sin 2} + 1 \Rightarrow -1 + 1 = 0$$



123. Consider the following:

निम्नलिखित पर विचार कीजिए :

~~(1)~~ $\cos^4 \theta - \sin^4 \theta = \frac{2 \tan \theta}{1 - \tan^2 \theta}, 0 < \theta < \frac{\pi}{2}$

~~(2)~~ $\operatorname{cosec} \theta + \cot \theta = \frac{1}{\operatorname{cosec} \theta - \cot \theta}, 0 < \theta < \frac{\pi}{2}$

~~(3)~~ $\cos^2 \theta - \sin^2 \theta = \frac{1 - \tan^2 \theta}{1 + \tan^2 \theta}, 0 < \theta < \frac{\pi}{2}$

Which of the above equations are identities?

उपर्युक्त समीकरणों में से कौन-सी सर्वसमिकाएँ हैं?

- (a) केवल 1 और 2 (b) केवल 2 और 3
(c) केवल 1 और 3 (d) 1, 2 और 3

$(\cos^2 \theta + \sin^2 \theta)(\cos^2 \theta - \sin^2 \theta)$
 $\cos 2\theta$

Triple Angle.

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

$$\underline{\underline{B=2A}}$$

$$\sin 3A = \sin A \cos 2A + \cos A \sin 2A$$

$$\sin A (1 - 2\sin^2 A) + \cos A \cdot 2 \sin A \cdot \cos A$$

$$\sin A - 2\sin^3 A + (1 - \sin^2 A) \cdot 2\sin A$$

$$\underline{\sin A} - 2\sin^3 A + 2\underline{\sin A} - 2\sin^3 A$$

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

$$A = 90^\circ + A$$

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

$$\sin(270^\circ + 3A)$$

$$- \cos 3A = 3 \sin(90^\circ + A) - 4 \sin^3(90^\circ + A)$$
$$3 \cos A - 4 \cos^3 A$$

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

$\tan 3\theta$

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

$$\tan(\theta + 2\theta) = \frac{\tan \theta + \tan 2\theta}{1 - \tan \theta \cdot \tan 2\theta}$$

$\tan(3\theta)$

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

$$\begin{aligned} & \frac{\tan \theta - \tan^3 \theta + 2 \tan \theta}{1 - \tan^2 \theta - 2 \tan^2 \theta} \\ &= \frac{3 \tan \theta - \tan^3 \theta}{1 - 3 \tan^2 \theta} \end{aligned}$$



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$$\frac{3\cancel{\sin\theta} - (3\cancel{\sin\theta} - 4\sin^3\theta)}{3\cancel{\cos\theta} + 4\cos^3\theta - 3\cancel{\cos\theta}}$$

$$+ \frac{4\cancel{\sin^3\theta}}{4\cos^3\theta} = \tan^3\theta$$

$$\tan^3\theta$$

124. $\frac{3\sin\theta - \sin 3\theta}{3\cos\theta + \cos 3\theta} = ?$

(a) $\tan^3\theta$

(b) $\cot^3\theta$

(c) $\sin^3\theta$

(d) $\cos^3\theta$



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MATH

125. Find: $\tan \left(\frac{5\pi}{4} + \theta \right) - \tan \left(\frac{\pi}{4} - \theta \right) ?$

ज्ञात कीजिये: $\left(\frac{5\pi}{4} + \theta \right) - \tan \left(\frac{\pi}{4} - \theta \right) ?$

(a) $2\cot 2\theta$

(b) $2\tan 2\theta$

(c) $2\sec 2\theta$

(d) $2\cos 2\theta$

$$\sin 40^\circ \sin 20^\circ \sin 80^\circ = \frac{1}{4} \sin 60^\circ$$

$$\rightarrow \sin (60^\circ - A) \sin A \sin (60^\circ + A) = \frac{1}{4} \sin 3A$$

$$\cos (60^\circ - A) \cos A \cos (60^\circ + A) = \frac{1}{4} \cos 3A$$

$$\tan (60^\circ - A) \tan A \tan (60^\circ + A) = \tan 3A$$



132. The value of $(\sin 10^\circ \sin 50^\circ \sin 70^\circ)$ is:

$(\sin 10^\circ \sin \underline{50^\circ} \sin \underline{70^\circ})$ का मान है:

(a) $\frac{1}{4}$

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

(c) $\frac{1}{8}$

(d) $\frac{3}{4}$

$$\theta = 10^\circ$$

$$\sin \theta \cdot \sin(60^\circ - \theta) \sin(60^\circ + \theta) = \frac{1}{4} \sin 3\theta$$

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

$$\frac{1}{4} \times \frac{1}{2} = \frac{1}{8}$$



133. The value of $\cos 20^\circ \cos 40^\circ \cos 80^\circ$ is:

$\cos 20^\circ \cos 40^\circ \cos 80^\circ$ का मान है:

(a) 1

(b) $\frac{1}{4}$

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

(d) $\frac{1}{8}$

$$= \frac{1}{4} \cos 3 \times 20$$

$$\frac{1}{4} \cos 60^\circ \Rightarrow \frac{1}{4} \times \frac{1}{2}$$

$$= \frac{1}{8}$$



134. The value of $(\tan 20^\circ \tan 40^\circ \tan 80^\circ)$ is:

$(\tan 20^\circ \tan 40^\circ \tan 80^\circ)$ का मान है:

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

(b) $\frac{\sqrt{3}}{4}$

(c) $\sqrt{3}$

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

$= \tan 30$

$\tan 3 \times 20$

$\tan 60 = \sqrt{3}$



135. What is the value of $\cos 1^\circ \cdot \cos 2^\circ \cdot \cos 3^\circ \dots \dots \dots$
 $\cos 177^\circ \cdot \cos 178^\circ \cdot \cos 179^\circ$
 $\cos 1^\circ \cos 2^\circ \cdot \cos 3^\circ \dots \dots \cos 177^\circ \cdot \cos 178^\circ \cdot \cos 179^\circ$
का मान क्या है?

a. 0

b. 1

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

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

$$\dots \times \overset{\cos 90^\circ}{\underset{\downarrow}{0}} \times \dots$$

$$\text{Ans} = 0$$

(SSC SELECTION POST XI 2023)



136. $\sin 1^\circ \cdot \sin 2^\circ \cdot \sin 3^\circ \dots \cdot \sin 180^\circ$ is equal to –
 $\sin 1^\circ \cdot \sin 2^\circ \cdot \sin 3^\circ \dots \cdot \sin 180^\circ$ किसके बराबर है?

(a) -1

(b) 1

(c) 0

(d) 2

----- $\downarrow$
0

Ans = 0