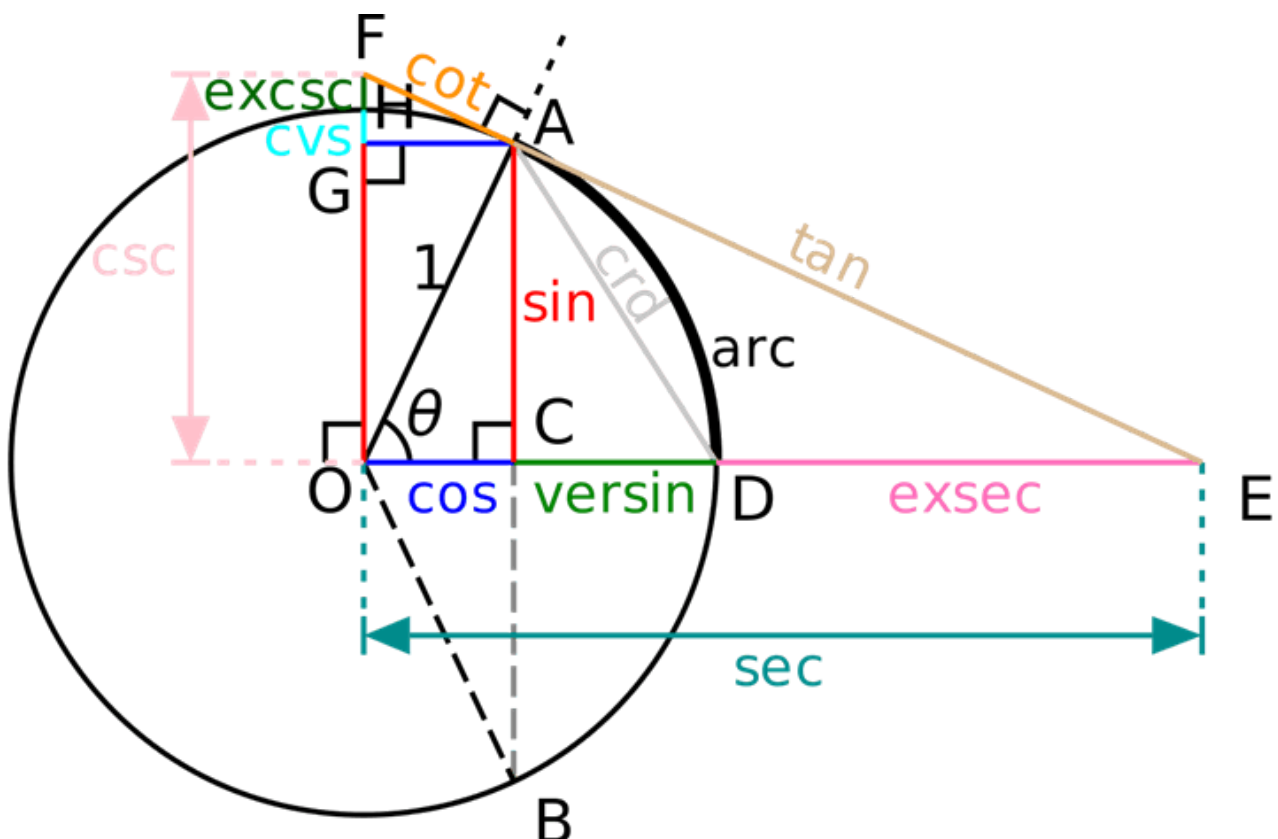


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NCERT Class 11 Mathematics Solutions: Chapter 3 – Trigonometric Functions Miscellaneous Exercise Part 1

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1. Prove that: $2 \cos \frac{\pi}{13} \cos \frac{9\pi}{13} + \cos \frac{3\pi}{13} + \cos \frac{5\pi}{13} = 0$

Answer:

L. H. S.

$$\begin{aligned}
 &= 2 \cos \frac{\pi}{13} \cos \frac{9\pi}{13} + \cos \frac{3\pi}{13} + \cos \frac{5\pi}{13} \\
 &= 2 \cos \frac{\pi}{13} \cos \frac{9\pi}{13} + 2 \cos \left(\frac{\frac{3\pi}{13} + \frac{5\pi}{13}}{2} \right) \cos \left(\frac{\frac{3\pi}{13} - \frac{5\pi}{13}}{2} \right) \left[\cos x + \cos y = 2 \cos \left(\frac{x+y}{2} \right) \cos \left(\frac{x-y}{2} \right) \right] \\
 &= 2 \cos \frac{\pi}{13} \cos \frac{9\pi}{13} + 2 \cos \frac{4\pi}{13} \cos \frac{-\pi}{13} \\
 &= 2 \cos \frac{\pi}{13} \cos \frac{9\pi}{13} + 2 \cos \frac{4\pi}{13} \cos \frac{\pi}{13} \\
 &= 2 \cos \frac{\pi}{13} \left[\cos \frac{9\pi}{13} + \cos \frac{4\pi}{13} \right] \\
 &= 2 \cos \frac{\pi}{13} \left[2 \cos \left(\frac{\frac{9\pi}{13} + \frac{4\pi}{13}}{2} \right) \cos \left(\frac{\frac{9\pi}{13} - \frac{4\pi}{13}}{2} \right) \right] \\
 &= 2 \cos \frac{\pi}{13} \left[2 \cos \frac{\pi}{2} \cos \frac{5\pi}{26} \right] \\
 &= 2 \cos \frac{\pi}{13} \times 2 \times 0 \times \cos \frac{5\pi}{26} \\
 &= 0 = R.H.S
 \end{aligned}$$

2. Prove that: $(\sin 3x + \sin x) \sin x + (\cos 3x - \cos x) \cos x = 0$

Answer:

L. H. S

$$\begin{aligned}
 &= (\sin 3x + \sin x) \sin x + (\cos 3x - \cos x) \cos x \\
 &= \sin 3x \sin x + \sin^2 x + \cos 3x \cos x - \cos^2 x \\
 &= \cos 3x \cos x + \sin 3x \sin x - (\cos^2 x - \sin^2 x) \\
 &= \cos (3x - x) - \cos 2x [\cos (A - B) = \cos A \cos B + \sin A \sin B] \\
 &= \cos 2x - \cos 2x \\
 &= 0 \\
 &= R.H.S
 \end{aligned}$$

3. Prove that: $(\cos x + \cos y)^2 + (\sin x - \sin y)^2 = 4 \cos^2 \frac{x+y}{2}$

Answer:

L. H. S.

$$\begin{aligned}
 &(\cos x + \cos y)^2 + (\sin x - \sin y)^2 \\
 &= \cos^2 x + \cos^2 y + 2 \cos x \cos y + \sin^2 x + \sin^2 y - 2 \sin x \sin y \\
 &= (\cos^2 x + \sin^2 x) + (\cos^2 y + \sin^2 y) + 2(\cos x \cos y - \sin x \sin y)
 \end{aligned}$$

$$\begin{aligned}
&= 1 + 1 + 2 \cos(x + y) [\cos(A + B) = (\cos A \cos B - \sin A \sin B)] \\
&= 2 + 2 \cos(x + y) \\
&= 2 [1 + \cos(x + y)] \\
&= 2 \left[1 + 2 \cos^2 \left(\frac{x + y}{2} \right) - 1 \right] [\cos 2A = 2 \cos^2 A - 1] \cos 2A \\
&= 4 \cos^2 \left(\frac{x + y}{2} \right) - 1 \\
&= R.H.S
\end{aligned}$$

3. Prove that: $(\cos x - \cos y)^2 + (\sin x - \sin y)^2 = 4 \sin^2 \frac{x - y}{2}$

Answer:

L. H. S.

$$\begin{aligned}
&= (\cos x - \cos y)^2 + (\sin x - \sin y)^2 \\
&= \cos^2 x + \cos^2 y - 2 \cos x \cos y + \sin^2 y - 2 \sin x \sin y \\
&= (\cos^2 x + \sin^2 x) + (\cos^2 y + \sin^2 y) - 2 [\cos x \cos y + \sin x \sin y] \\
&= 1 + 1 - 2 [\cos(x - y)] [\cos(A - B) = \cos A \cos B + \sin A \sin B] \\
&= 2 [1 - \cos(x - y)] \\
&= 2 \left[1 - \left\{ 1 - 2 \sin^2 \left(\frac{x - y}{2} \right) \right\} \right] [\cos 2A = 1 - 2 \sin^2 A] \\
&= 4 \sin^2 \left(\frac{x - y}{2} \right) = R.H.S
\end{aligned}$$