

## Trigonometric Functions - Class XI

### Related Questions with Solutions

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#### Questions

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##### Question: 01

Let  $\alpha$  and  $\beta$  be non-zero real numbers such that  $2(\cos \beta - \cos \alpha) + \cos \alpha \cos \beta = 1$ . Then which of the following is/are true?

- A.  $\tan\left(\frac{\alpha}{2}\right) + \sqrt{3}\tan\left(\frac{\beta}{2}\right) = 0$   
B.  $\tan\left(\frac{\alpha}{2}\right) - \sqrt{3}\tan\left(\frac{\beta}{2}\right) = 0$   
C.  $\sqrt{3}\tan\left(\frac{\alpha}{2}\right) + \tan\left(\frac{\beta}{2}\right) = 0$   
D.  $\sqrt{3}\tan\left(\frac{\alpha}{2}\right) - \tan\left(\frac{\beta}{2}\right) = 0$

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#### Solutions

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##### Solution: 01

Let  $\tan^2 \frac{\alpha}{2} = m$  and  $\tan^2 \frac{\beta}{2} = n$ , then

$$\cos \alpha = \frac{1-m}{1+m} \quad \text{and} \quad \cos \beta = \frac{1-n}{1+n}$$

We have,  $2(\cos \beta - \cos \alpha) + \cos \alpha \cos \beta = 1$

$$\Rightarrow 2\left(\frac{1-n}{1+n} - \frac{1-m}{1+m}\right) + \frac{1-m}{1+m} \cdot \frac{1-n}{1+n} = 1$$

$$\Rightarrow 2\{(1+m)(1-n) - (1-m)(1+n)\} + (1-m)(1-n) = (1+m)(1+n)$$

$$\Rightarrow 2\{1+m-n-mn-1-n+m+mn\} + 1-m-n+mn = 1+m+n+mn$$

$$\Rightarrow 4(m-n) = 2(m+n) \Rightarrow 2m-2n = m+n \Rightarrow m = 3n$$

$$\Rightarrow \tan^2 \frac{\alpha}{2} = 3 \tan^2 \frac{\beta}{2}$$

$$\text{Thus, } \tan \frac{\alpha}{2} = \pm \sqrt{3} \tan \frac{\beta}{2}$$

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#### Correct Options

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Answer:01

Correct Options: A, B