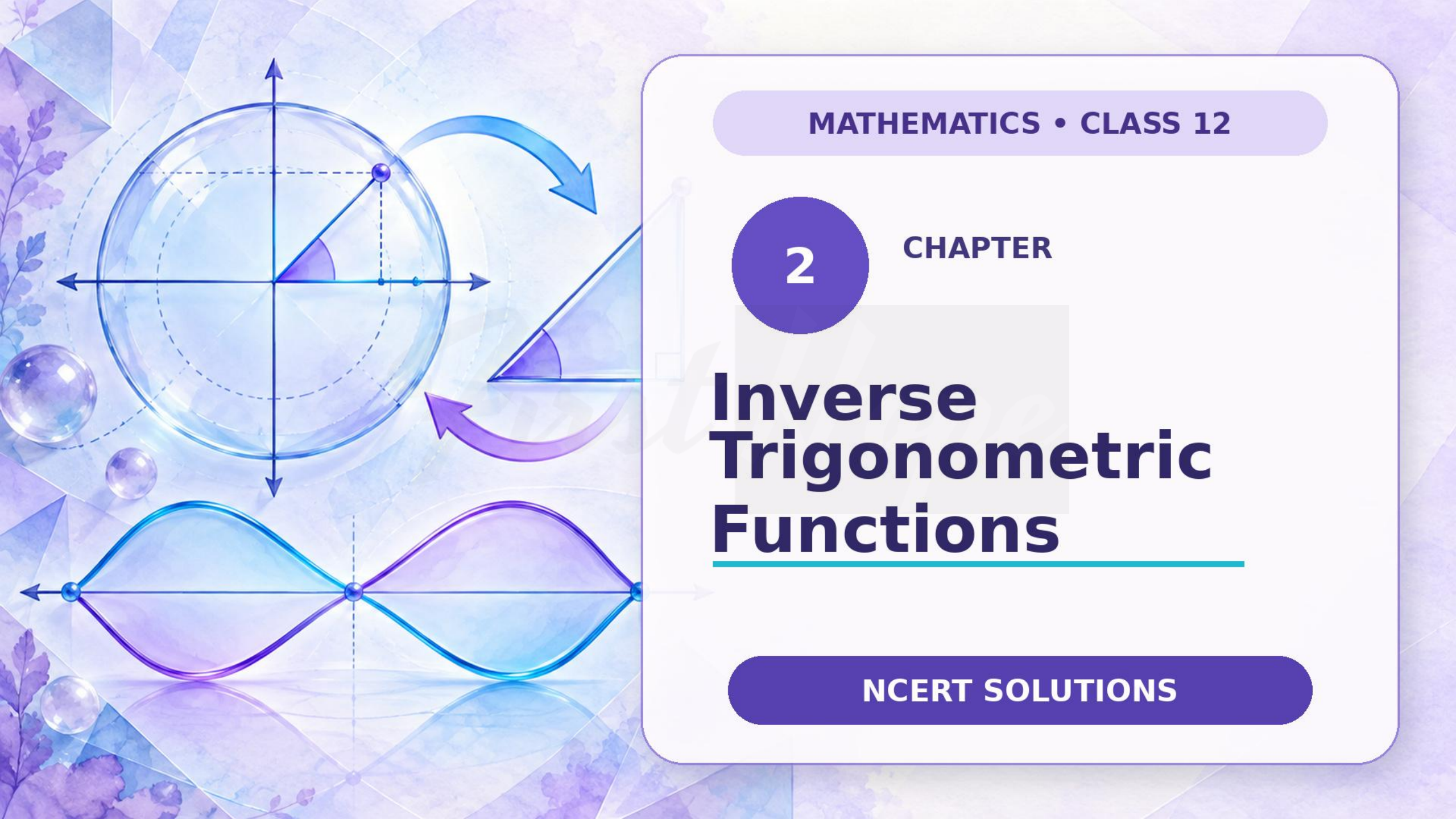




MATHEMATICS • CLASS 12

2

CHAPTER

# Inverse Trigonometric Functions

NCERT SOLUTIONS

## PRINCIPAL VALUE OF SINE - EXERCISE 2.1 Q1

Q. Find the principal value of  $\sin^{-1}\left(-\frac{1}{2}\right)$ .

Answer:

Use the principal range

Let  $\theta = \sin^{-1}\left(-\frac{1}{2}\right)$ . Then

$$\sin \theta = -\frac{1}{2}, \quad \theta \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right].$$

The inverse sine chooses the angle in this interval.

Find the reference angle

We know that

$$\sin\left(\frac{\pi}{6}\right) = \frac{1}{2}.$$

So the reference angle is  $\frac{\pi}{6}$ .

Choose the correct sign

The required sine value is negative.

In the principal range, choose the negative angle.

$$\theta = -\frac{\pi}{6}.$$

Using  $\sin(-\alpha) = -\sin \alpha$ ,

$$\sin\left(-\frac{\pi}{6}\right) = -\sin\left(\frac{\pi}{6}\right) = -\frac{1}{2}.$$

Check the range

$$-\frac{\pi}{2} \leq -\frac{\pi}{6} \leq \frac{\pi}{2}.$$

Thus, the angle has the correct sine value and lies in the principal range.

$$\text{Hence, } \sin^{-1}\left(-\frac{1}{2}\right) = -\frac{\pi}{6}.$$

## PRINCIPAL VALUE OF COSINE - EXERCISE 2.1 Q2

Q. Find the principal value of  $\cos^{-1}\left(\frac{\sqrt{3}}{2}\right)$ .

Answer:

Use the principal range

Let  $\theta = \cos^{-1}\left(\frac{\sqrt{3}}{2}\right)$ . Then

$$\cos \theta = \frac{\sqrt{3}}{2}, \quad \theta \in [0, \pi].$$

The inverse cosine chooses the angle in this interval.

Recall the standard value

We know that

$$\cos\left(\frac{\pi}{6}\right) = \frac{\sqrt{3}}{2}.$$

So  $\frac{\pi}{6}$  is a possible angle.

Select the principal angle

The cosine value is positive. Within the principal range, a positive cosine occurs in the first quadrant.

Therefore, choose  $\theta = \frac{\pi}{6}$ .

Verify the answer

$$\cos\left(\frac{\pi}{6}\right) = \frac{\sqrt{3}}{2},$$

$$0 \leq \frac{\pi}{6} \leq \pi.$$

Both the required value and the principal-range condition are satisfied.

$$\text{Hence, } \cos^{-1}\left(\frac{\sqrt{3}}{2}\right) = \frac{\pi}{6}.$$

## PRINCIPAL VALUE OF COSECANT - EXERCISE 2.1 Q3

Q. Find the principal value of  $\operatorname{cosec}^{-1}(2)$ .

Answer:

Use the principal range

Let  $\theta = \operatorname{cosec}^{-1}(2)$ , Then

$$\operatorname{cosec} \theta = 2,$$

$$\theta \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right] \setminus \{0\}.$$

The angle must lie in this interval and cannot be zero.

Convert to sine

$$\text{Since } \operatorname{cosec} \theta = \frac{1}{\sin \theta},$$

$$\frac{1}{\sin \theta} = 2 \Rightarrow \sin \theta = \frac{1}{2}.$$

Find the angle

We know that

$$\sin\left(\frac{\pi}{6}\right) = \frac{1}{2}.$$

Hence, choose  $\theta = \frac{\pi}{6}$ .

This is a positive angle in the principal range.

Verify the answer

$$\operatorname{cosec}\left(\frac{\pi}{6}\right) = \frac{1}{\frac{1}{2}} = 2.$$

$$\text{Also, } 0 < \frac{\pi}{6} \leq \frac{\pi}{2},$$

so the angle is allowed.

$$\text{Hence, } \operatorname{cosec}^{-1}(2) = \frac{\pi}{6}.$$

## PRINCIPAL VALUE OF TANGENT - EXERCISE 2.1 Q4

Q. Find the principal value of  $\tan^{-1}(-\sqrt{3})$ .

Answer:

Use the principal range

Let  $\theta = \tan^{-1}(-\sqrt{3})$ . Then

$$\tan \theta = -\sqrt{3},$$

$$\theta \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right).$$

The endpoints are excluded because tangent is undefined there.

Find the reference angle

We know that

$$\tan\left(\frac{\pi}{3}\right) = \sqrt{3}.$$

So the reference angle is  $\frac{\pi}{3}$ .

Choose the negative angle

The required tangent value is negative.

In the principal range, choose  $\theta = -\frac{\pi}{3}$ .

Using  $\tan(-\alpha) = -\tan \alpha$ ,

$$\tan\left(-\frac{\pi}{3}\right) = -\tan\left(\frac{\pi}{3}\right) = -\sqrt{3}.$$

Check the range

$$-\frac{\pi}{2} < -\frac{\pi}{3} < \frac{\pi}{2}.$$

Thus, the angle lies inside the open principal interval.

$$\tan^{-1}(-\sqrt{3}) = -\frac{\pi}{3}.$$

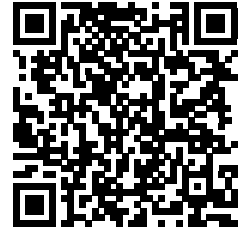


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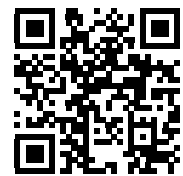


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