Class XI - MATHEMATICS

Chapter 3 – TRIGONOMETRIC FUNCTIONS

Module – 2/3

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Distance Learning Programme: An initiative by AEES, Mumbai

LEARNING OUTCOME

In this module we are going to learn about

- **Sign of trigonometric functions in different quadrants**
- **Domain and range of trigonometric functions**
- **Behaviour of trigonometric functions in different quadrants.**
- **Graph of trigonometric functions**

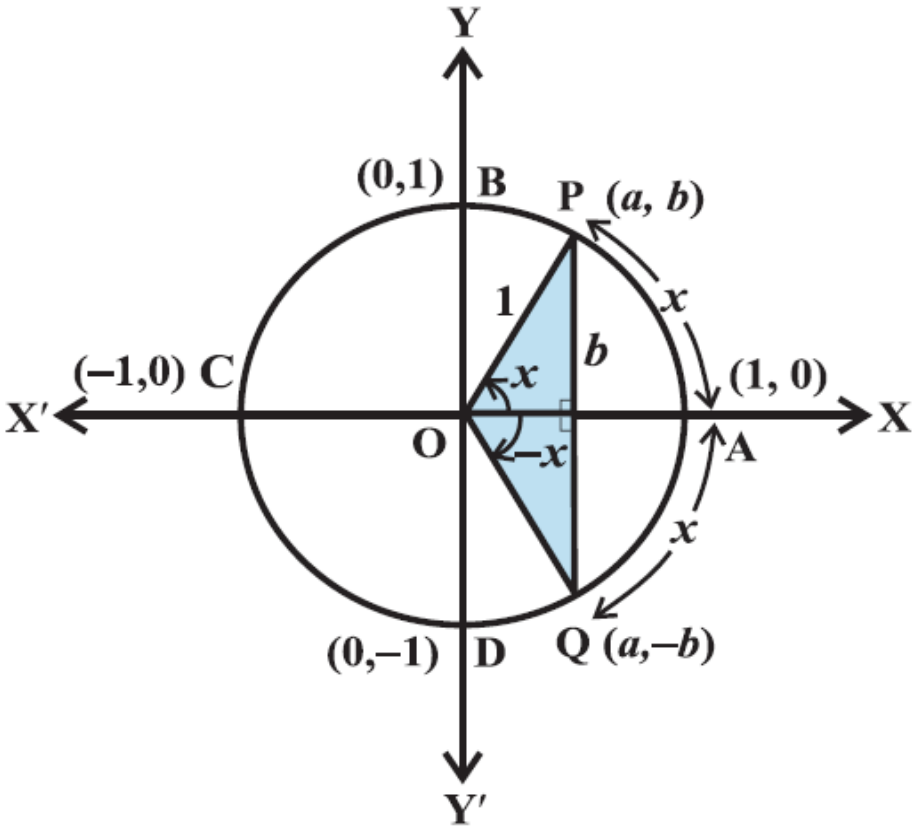
Sign of trigonometric functions in different quadrants

Let P(a, b) be a point on the unit circle with centre at the origin.

Let ∠AOP = x.

Then cos x = a and sin x = b.

If, ∠AOQ = – x, then coordinates of point Q will be (a, –b).



Therefore cos (– x) = cos x and sin (– x) = – sin x

Sign of trigonometric functions in different quadrants

	I	II	III	IV
sin x	+	+	–	–
cos x	+	–	–	+
tan x	+	–	+	–
cosec x	+	+	–	–
sec x	+	–	–	+
cot x	+	–	+	–

All **S**ilver **T**ea **C**ups

Domain and range of trigonometric functions

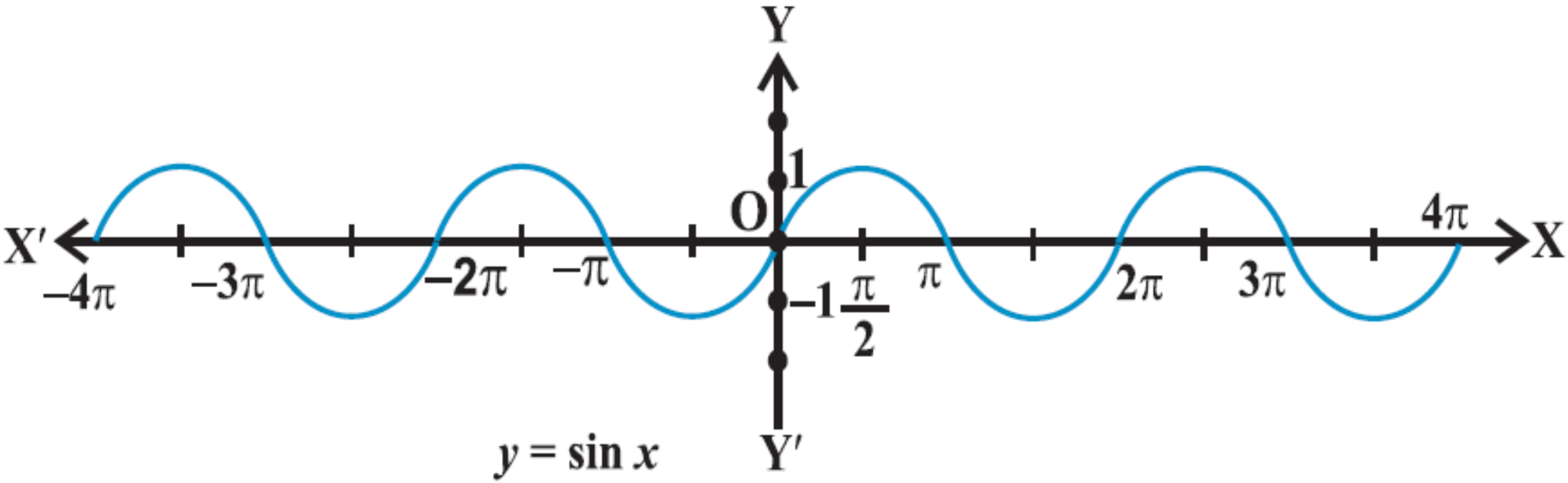
Function	Domain	Range
sin x	R	[–1, 1]
cos x	R	[–1, 1]
tan x	$R - \{ x : x = (2n+1)\frac{\pi}{2},\ n \in Z\}$	R
cosec x	$R - \{ x : x = n\pi ,\ n \in Z\}$	R – (– 1, 1)
sec x	$R - \{ x : x = (2n+1)\frac{\pi}{2},\ n \in Z\}$	R – (– 1, 1)
cot x	$R - \{ x : x = n\pi ,\ n \in Z\}$	R

Behaviour of trigonometric functions in different quadrants.

	I quadrant	II quadrant	III quadrant	IV quadrant
sin x	increases from 0 to 1	decreases from 1 to 0	decreases from 0 to –1	increases from –1 to 0
cos x	decreases from 1 to 0	decreases from 0 to -1	increases from –1 to 0	increases from 0 to 1
tan x	increases from 0 to ∞	increases from - ∞ to 0	increases from 0 to ∞	increases from - ∞ to 0
cosec x	decreases from ∞ to 1	increases from 1 to ∞	increases from - ∞ to -1	decreases from – 1 to -∞
sec x	increases from 1 to ∞	increases from - ∞ to -1	decreases from -1 to -∞	decreases from ∞ to 1
cot x	decreases from ∞ to 0	decreases from 0 to -∞	decreases from ∞ to 0	decreases from 0 to -∞

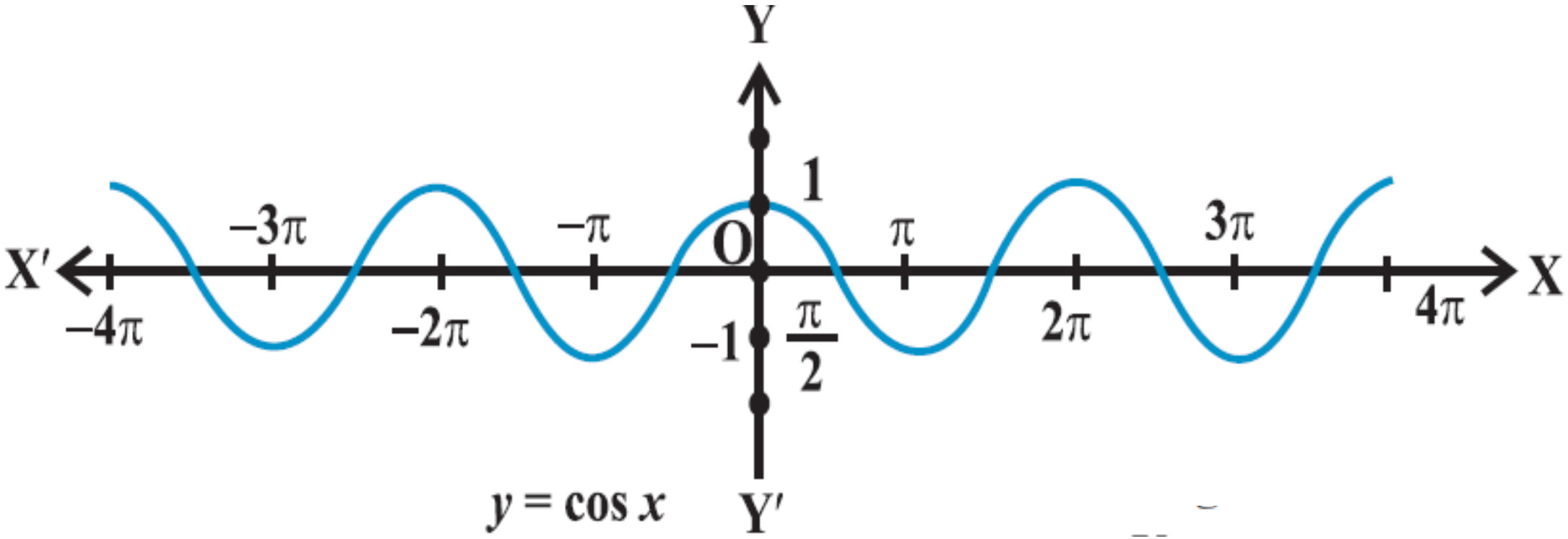
GRAPH OF TRIGONOMETRIC FUNCTIONS

1) y = sin x

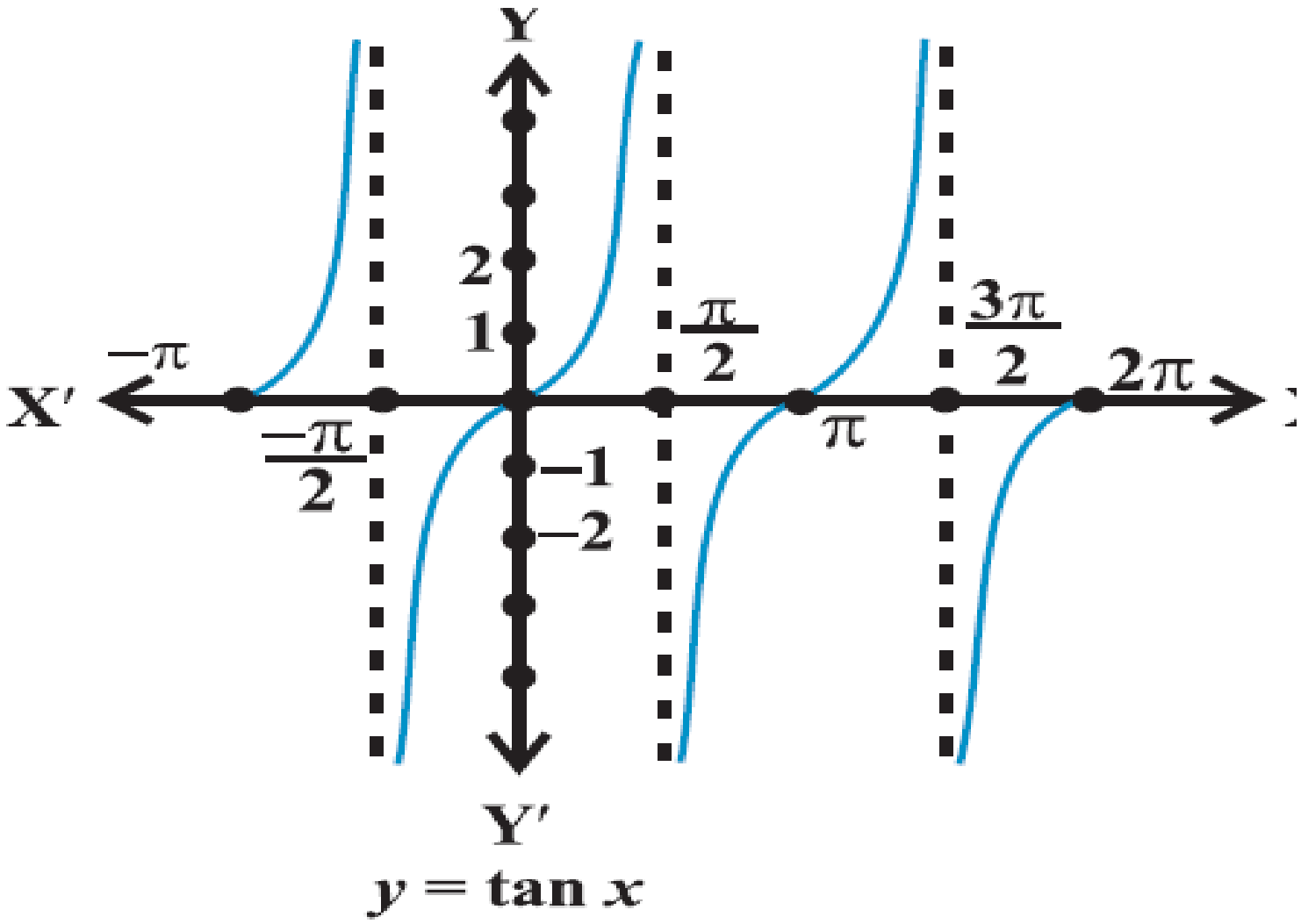


$y = \sin x$

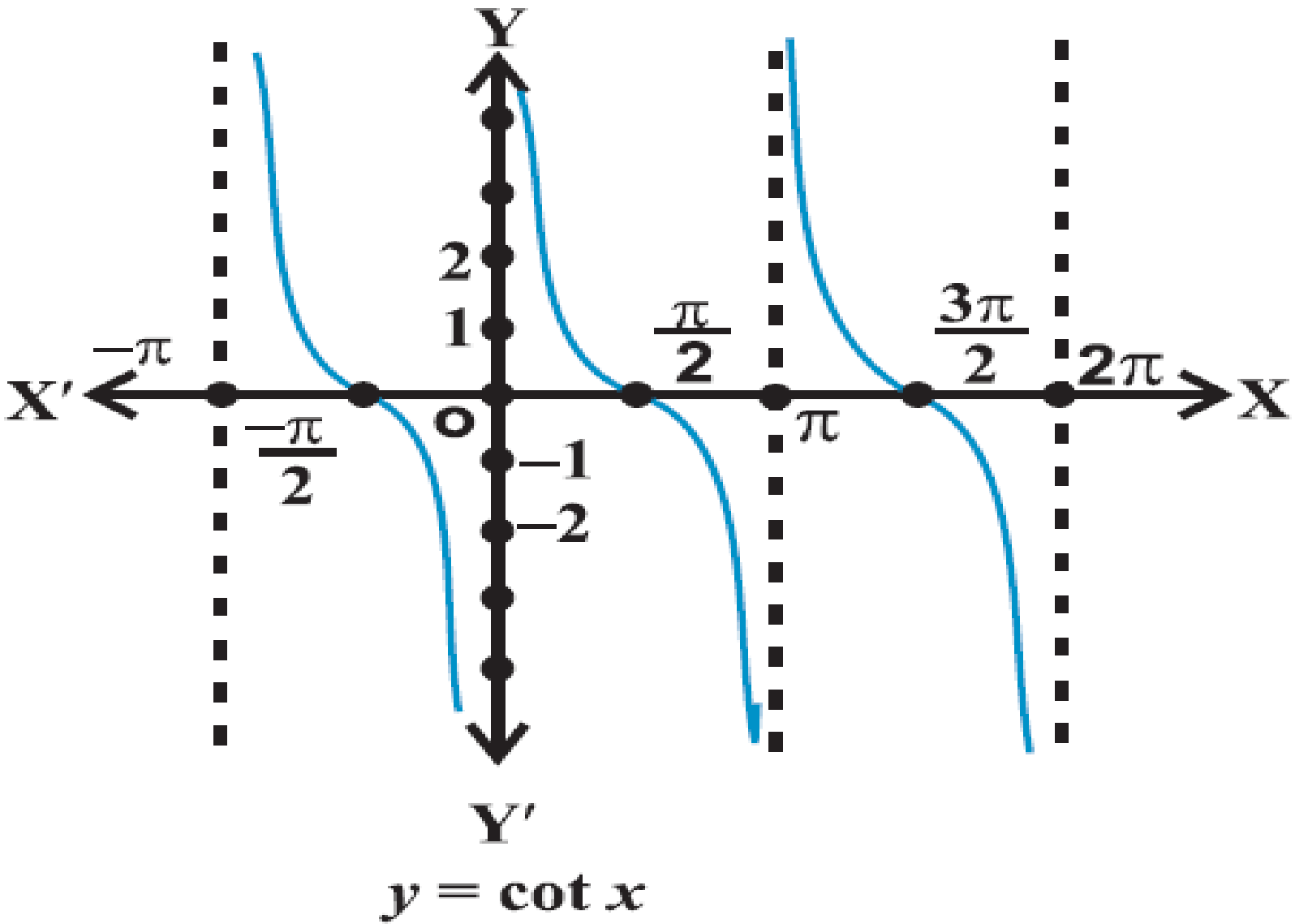
2) y= cos x



3) y= tan x

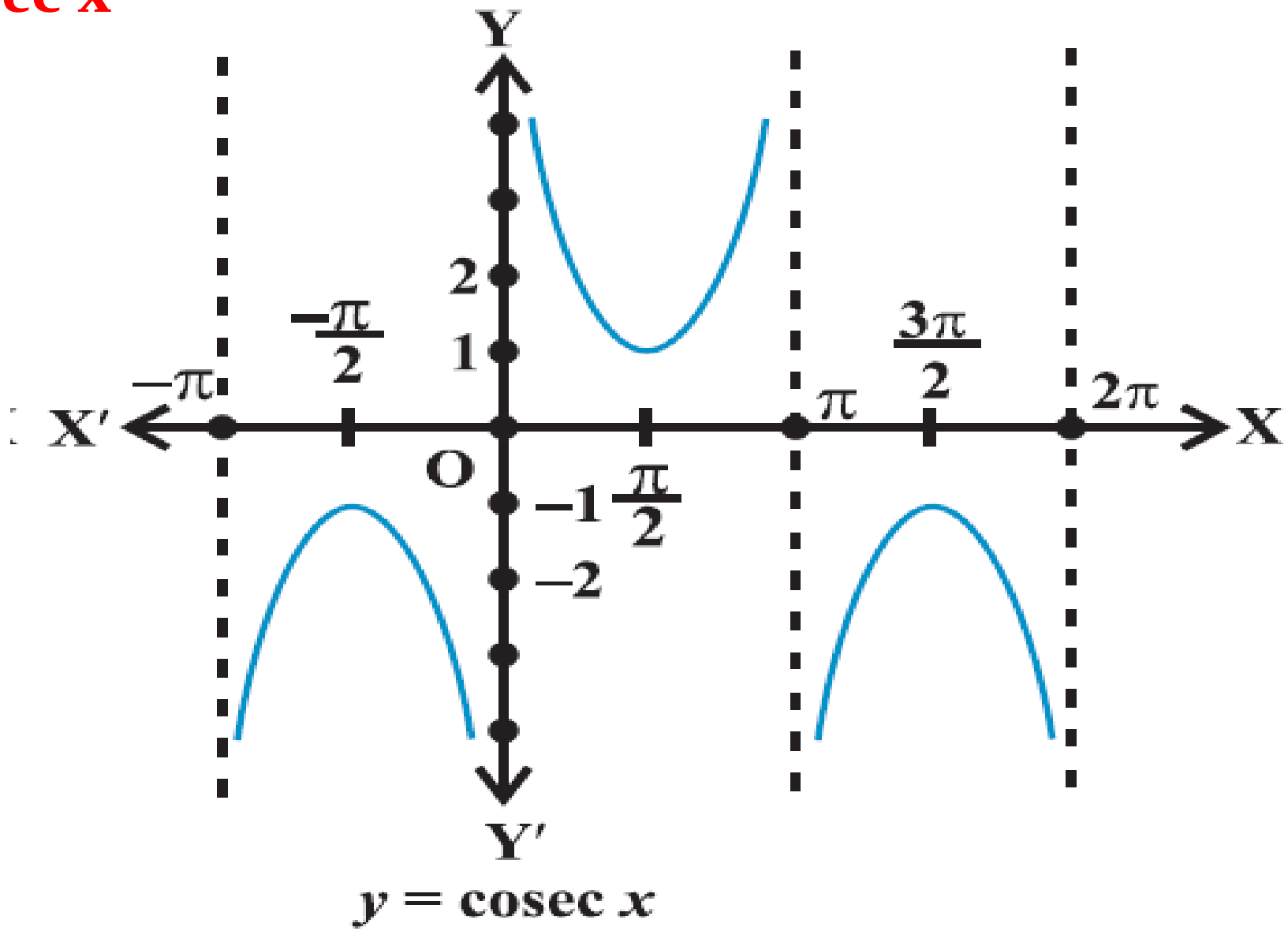


4) y= cot x



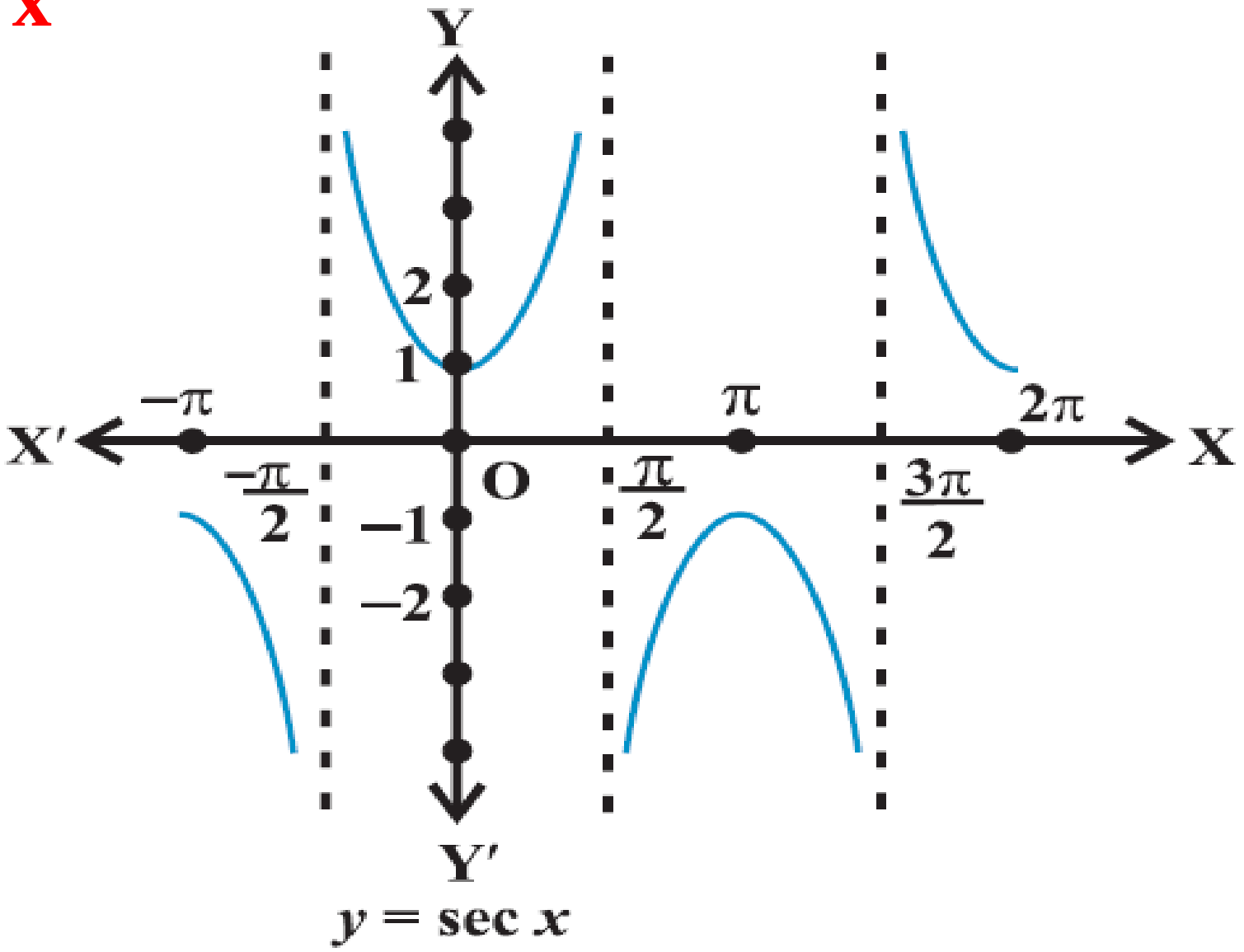
$y = \cot x$

5) y= cosec x



$y = \text{cosec } x$

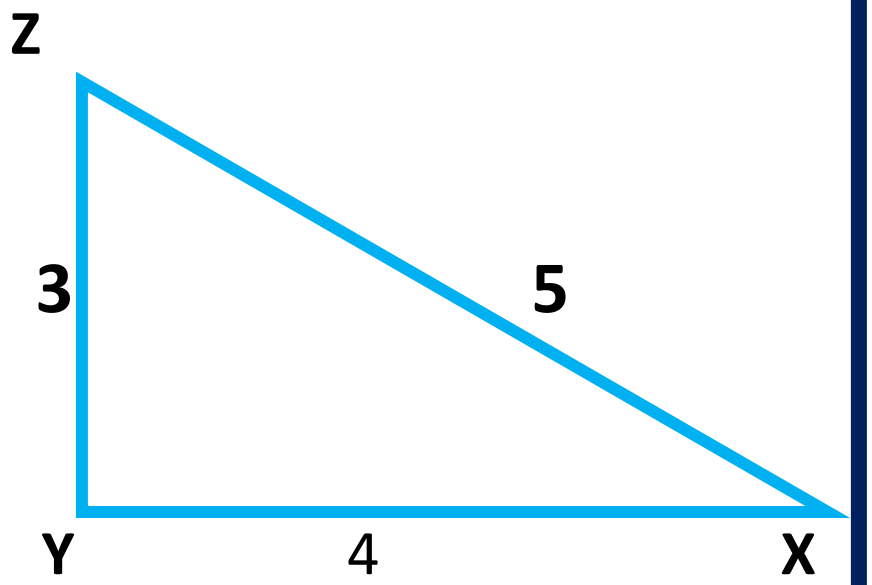
6) y= sec x



Example 1

Find the values of other five trigonometric functions if

$\sin x = \frac{3}{5}$, x lies in second quadrant



Solution: $\sin x = \frac{3}{5}$, therefore $\operatorname{cosec} x = \frac{5}{3}$

YZ = 3 units, XZ = 5 units, hence XY = 4 units

Since x lies in second quadrant,

cos x, sec x, tan x and cot x will be negative.

Therefore, $\cos x = \frac{-4}{5}$, $\sec x = \frac{-5}{4}$, $\tan x = \frac{-3}{4}$ and $\cot x = \frac{-4}{3}$

Example 2 :

Find the value of cos (–1710°).

Solution:

We know that values of cos x repeats after an interval of 2π or 360°.

$$\text{Therefore, } \cos(-1710^\circ) = \cos(-1710^\circ + 5 \times 360^\circ)$$

$$= \cos(-1710^\circ + 1800^\circ)$$

$$= \cos 90^\circ = 0$$

Example 3:

Find the value of $\sin \frac{-31\pi}{3}$

Solution: We know that sin(-x) = - sinx

Also, values of sin x repeat after an interval of 2π.

Therefore, $\sin \frac{-31\pi}{3} = -\sin \frac{31\pi}{3}$

$$= -\sin\left(10\pi + \frac{\pi}{3}\right) = -\sin\frac{\pi}{3} = -\frac{\sqrt{3}}{2}.$$

What have we learned today?

- Sign of trigonometric functions in different quadrants
- Domain and range of trigonometric functions
- Behaviour of trigonometric functions in different quadrants.
- Graph of trigonometric functions

THANK YOU