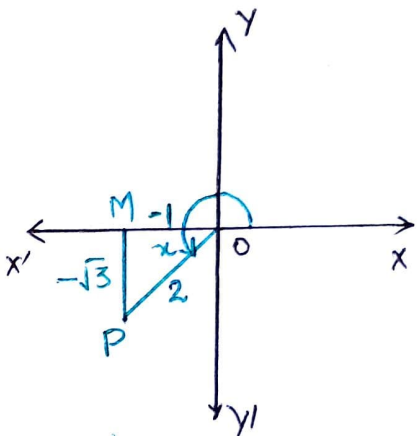
EXERCISE : 3.2

Find the values of other 5 trigonometric functions in each of the following :

Q No 1 : $\cos x = -\frac{1}{2}$; x lies in third quadrant.

Sol Let a revolving line starting from OX trace out an angle $\angle XOP = x$ where x lies in 3rd quadrant.



(x lies in 3rd quadrant)

from P draw $PM \perp X'OX$

Now $\cos x = -\frac{1}{2}$

$\therefore \frac{OM}{OP} = -\frac{1}{2}$ or $\frac{OM}{OP} = \frac{-1}{2}$

Let $OM = -1$ $\therefore OP = 2$ (in units)

Now using Pythagoras Theorem

$MP^2 = OP^2 - OM^2 \quad 4 + 3$

$\therefore MP = -\sqrt{3}$ ($\because$ MP is below X'OX)

$\therefore \sin x = \frac{MP}{OP} = \frac{-\sqrt{3}}{2} = -\frac{\sqrt{3}}{2}$

$\tan x = \frac{MP}{OM} = \frac{-\sqrt{3}}{-1} = \sqrt{3}$

$\cot x = \frac{OM}{MP} = \frac{-1}{-\sqrt{3}} = \frac{1}{\sqrt{3}}$

$\sec x = \frac{OP}{OM} = \frac{2}{-1} = -2$

$\operatorname{cosec} x = \frac{OP}{MP} = \frac{2}{-\sqrt{3}} = -\frac{2}{\sqrt{3}}$

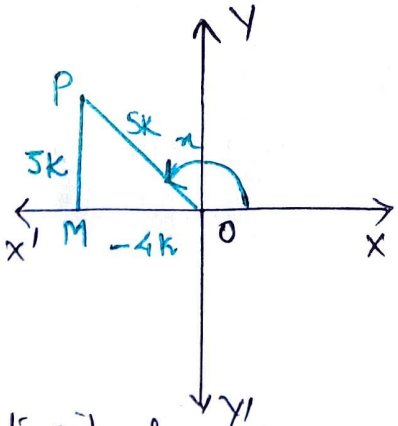
Q No 2 $\sin x = \frac{3}{5}$; x lies in Second quadrant.

Sol Let a revolving line starting from OX. trace out an angle $\angle XOP = x$ where x lies in Second quadrant.

Draw $PM \perp x'Ox$.

Now $\sin x = \frac{3}{5}$

$\therefore \frac{MP}{OP} = \frac{3}{5}$



Let $MP = 3k$, $OP = 5k$ where k is Constant of proportionality

$\Rightarrow OM^2 = OP^2 - MP^2 = 25k^2 - 9k^2 = 16k^2$

$\Rightarrow OM = -4k$ [$\because$ OM is towards left side of YOY']

$\therefore \cos x = \frac{OM}{OP} = \frac{-4k}{5k} = -\frac{4}{5}$ [Note that OP is always +ve (Positive)]

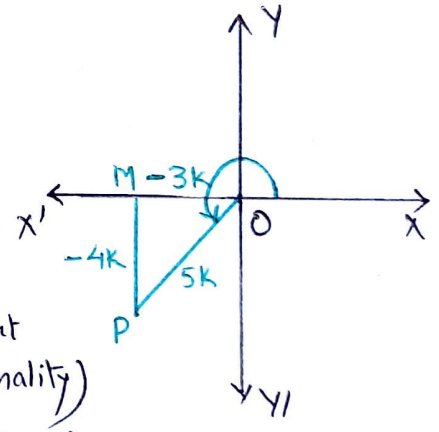
$\tan x = \frac{MP}{OM} = \frac{3k}{-4k} = -\frac{3}{4}$.

$\sec x = \frac{1}{\cos x} = -\frac{5}{4}$, $\operatorname{cosec} x = \frac{1}{\sin x} = \frac{5}{3}$, $\cot x = \frac{1}{\tan x} = -\frac{4}{3}$

QNo 3 $\cot x = \frac{3}{4}$; x lies in third quadrant.

Sol Let a revolving line, starting from OX, trace out an angle $\angle XOP = x$, x lies in 3rd quadrant.

Draw $PM \perp x'Ox$



Now $\cot x = \frac{3}{4}$ or $\cot x = \frac{-3}{-4}$

Let $OM = -3k$, $PM = -4k$ (k is Constant of proportionality)

$\therefore OP^2 = (OM)^2 + (PM)^2 = (-3k)^2 + (-4k)^2 = 25k^2$

$\therefore OP = 5k$ [$\because$ OP is always +ve]

$\therefore \sin x = \frac{MP}{OP} = \frac{-4k}{5k} = -\frac{4}{5}$

$\tan x = \frac{PM}{OM} = \frac{-4k}{-3k} = \frac{4}{3}$

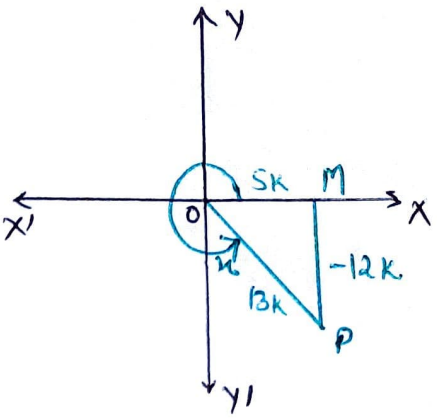
$\cos x = \frac{OM}{OP} = \frac{-3k}{5k} = -\frac{3}{5}$

$\sec x = \frac{1}{\cos x} = -\frac{5}{3}$, $\operatorname{cosec} x = \frac{1}{\sin x} = -\frac{5}{4}$

Q No 4: $\sec x = \frac{13}{5}$, x lies in 4th quadrant.

Sol Let a revolving line starting from OX, makes an angle $\angle XOP = x$, x lies in 4th quadrant.

From P, draw $PM \perp XOX'$



Now $\sec x = \frac{13}{5}$ ie $\frac{OP}{OM} = \frac{13}{5}$

Let $OP = 13K$, $OM = 5K$

Now $MP^2 = OP^2 - OM^2 \Rightarrow MP^2 = (12K)^2$

$\Rightarrow MP = -12K$ [$\because$ M is below X'OX]

$\therefore \sin x = \frac{MP}{OP} = \frac{-12K}{13K} = -\frac{12}{13}$.

$\therefore \operatorname{cosec} x = \frac{1}{\sin x} = -\frac{13}{12}$.

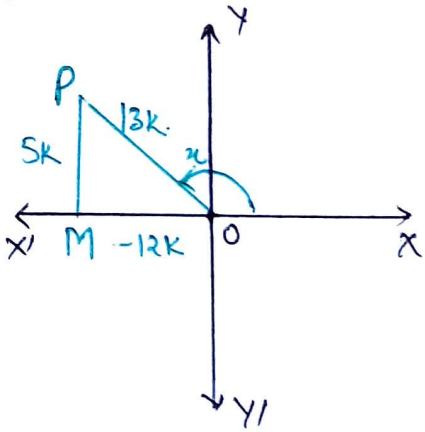
$\cos x = \frac{1}{\sec x} = \frac{5}{13}$

$\tan x = \frac{MP}{OM} = \frac{-12K}{5K} = -\frac{12}{5}$

$\therefore \cot x = \frac{1}{\tan x} = -\frac{5}{12}$

Q No 5 $\tan x = -\frac{5}{12}$; x lies in Second quadrant.

Sol. Let a revolving line starting from OX. trace out angle $\angle XOP = x$; x lies in Second quadrant. Draw $PM \perp XOX'$



Now $\tan x = \frac{MP}{OM} = \frac{-5}{12}$

Let $MP = 5K$ $OM = -12K$

$\Rightarrow OP = 13K$.

$\therefore \sin x = \frac{MP}{OP} = \frac{5K}{13K} = \frac{5}{13} \Rightarrow \operatorname{cosec} x = \frac{1}{\sin x} = \frac{13}{5}$

$\cos x = \frac{OM}{OP} = \frac{-12K}{13K} = -\frac{12}{13} \Rightarrow \sec x = \frac{1}{\cos x} = -\frac{13}{12}$

$\cot x = \frac{1}{\tan x} = -\frac{12}{5}$.

Find the values of trigonometric functions in Ex. from 6 to 10

QNo.6 $\sin 765^\circ$

Sol $\sin 765 = \sin(9\times 90^\circ + 45^\circ)$

$= +\cos 45^\circ$ [$\because$ Angle lies in first quadrant and $\sin\theta$ is +ve in first quadrant]

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

QNo.7 $\operatorname{Cosec}(-1410^\circ)$.

Sol. $\operatorname{Cosec}(-1410) = -\operatorname{Cosec}(1410) = -\operatorname{Cosec}(15\times 90^\circ + 60^\circ)$

$= -[-\sec 60^\circ]$ (Angle in 4th quadrant)

$= +\sec 60^\circ = 2$

QNo.8 $\tan\left(\frac{19\pi}{3}\right) = \tan\left(12\times\frac{\pi}{2} + \frac{\pi}{3}\right) = \tan\frac{\pi}{3} = \sqrt{3}$

QNo.9 $\sin\left(-\frac{11\pi}{3}\right) = -\sin\left(\frac{11\pi}{3}\right) = -\sin(660^\circ)$

$= -\sin(7\times 90 + 30^\circ) = -[-\cos 30^\circ]$

$= \cos 30^\circ = \frac{\sqrt{3}}{2}$.

QNo.10 $\cot\left(-\frac{15\pi}{4}\right) = \cot(-675^\circ)$

$= -\cot(675^\circ) = -\cot(7\times 90 + 45^\circ)$

$= -[-\tan 45^\circ] = +\tan 45^\circ = 1$

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