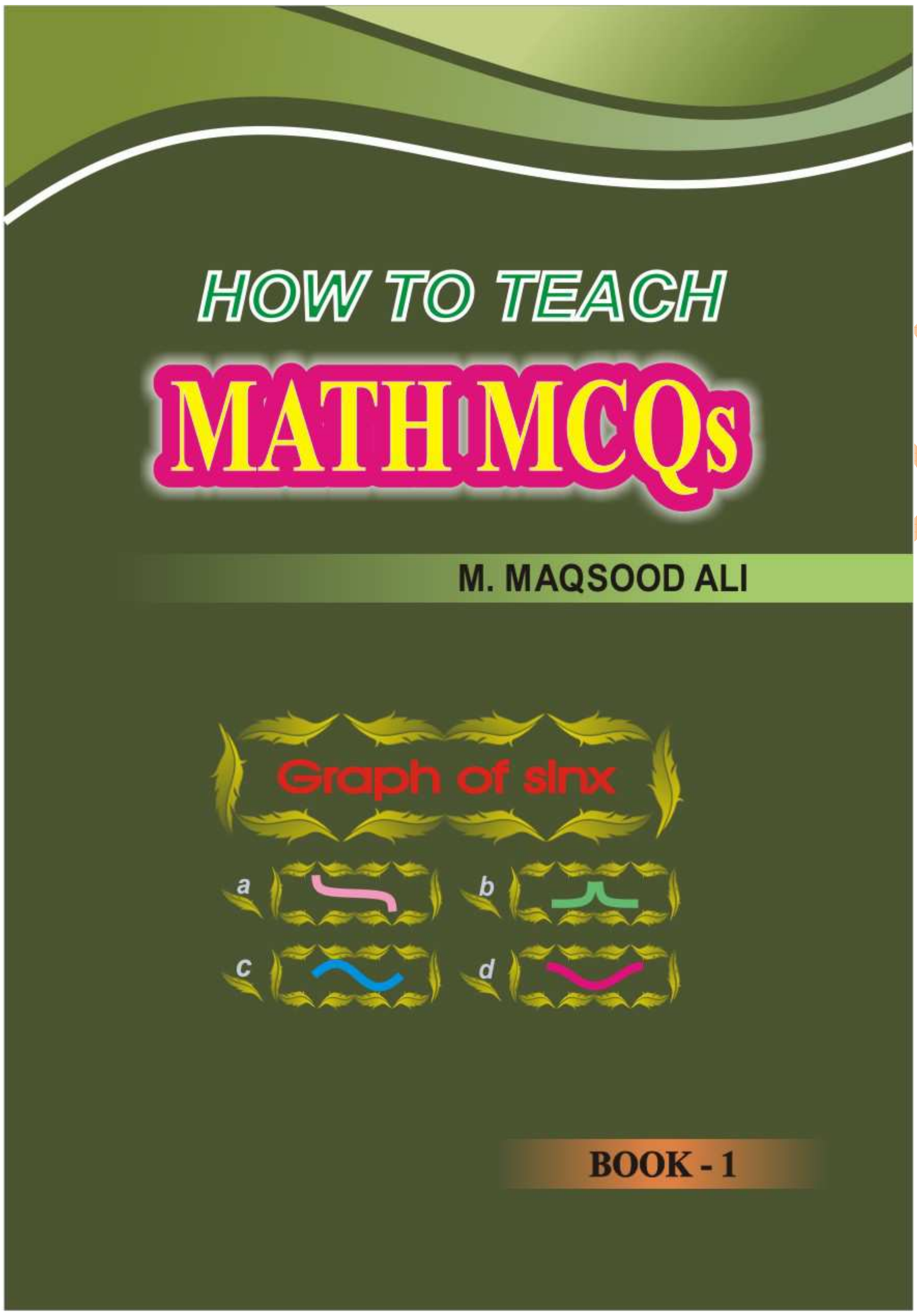
HOW TO TEACH
MATH MCQs
M. MAQSOOD ALI
Graph of sinx
a
b
c
d
BOOK - 1

Chapter 13
FUNDAMENTALS OF TRIGONOMETRY

RADIANS AND DEGREE

Relation between radians and degree

$$\pi \text{ radians} = 180^0$$

so that

(i) $1 \text{ rad} = \dfrac{180^0}{\pi}$

(ii) $1^0 = \dfrac{\pi}{180} \text{ rad}$

MCQ- 1:

$210^o = ? \text{ rad}$

(a) 3π (b) 7π (c) $7\pi/3$ (d) $7\pi/6$

Solution:

$$\boxed{210^0}$$
$$= 210 \times \frac{\pi}{180} \text{ rad}$$
$$= \frac{7\pi}{3} \text{ rad}$$

The answer is (c).

MCQ-2 :

$\dfrac{8\pi}{3} = ? \text{ degree}$

(a) 480^0 (b) 240^0 (c) 120^0 (d) 540^0

Solution:

$$\boxed{\frac{8\pi}{3}}$$
$$= \frac{8\pi}{3} \times \frac{180^0}{\pi}$$
$$= 480^0$$

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MCQ- 3:

45 minutes = ? radians

(a) $3\pi/2$ (b) 45π (c) $5\pi/20$ (d) $\pi/240$

Solution:

$$45'$$

$$=\frac{45^0}{60}$$

$$=\frac{3}{4}\times\frac{\pi}{180}$$

$$=\frac{\pi}{240}$$

The answer is (d).

MCQ- 4:

300 seconds = ? rad

(a) $\frac{\pi}{1240}$ (b) $\frac{\pi}{2160}$ (c) $\frac{\pi}{540}$ (d) $\frac{\pi}{326}$

Solution:

Firstly , convert 300 seconds into degree and than into radians.

$$300''$$

$$=\frac{300^0}{3600}$$

$$=\frac{1^0}{12}$$

$$=\frac{1}{12}\times\frac{\pi}{180}\text{ rad}$$

$$=\frac{\pi}{2160}\text{ rad}$$

The answer is (b).

EXERCISE-1

(1) $80^0 =$ _________radians.

(a) $\frac{3\pi}{8}$ (b) $\frac{2\pi}{5}$ (c) $\frac{4\pi}{9}$ (d) $\frac{7\pi}{9}$

(2) $\frac{\pi}{10}$ radians = _______ degree.

(a) 24 (b) 6 (c) 18 (d) 9

(3) 20 minutes = ? degree

(a) 1/3 (b) 1/180 (c) 2/3 (d) 1/4

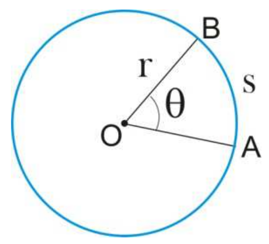
(4) 50 minutes = ? radians

(a) $\frac{\pi}{12}$ (b) $\frac{2\pi}{27}$ (c) $\frac{\pi}{216}$ (d) $\frac{5\pi}{18}$

(5) 120 seconds = ? radians

(a) $\frac{\pi}{5400}$ (b) $\frac{2\pi}{3}$ (c) $\frac{2\pi}{1243}$ (d) $\frac{3\pi}{1021}$

Relation between s, r and θ



$$s = r\theta$$

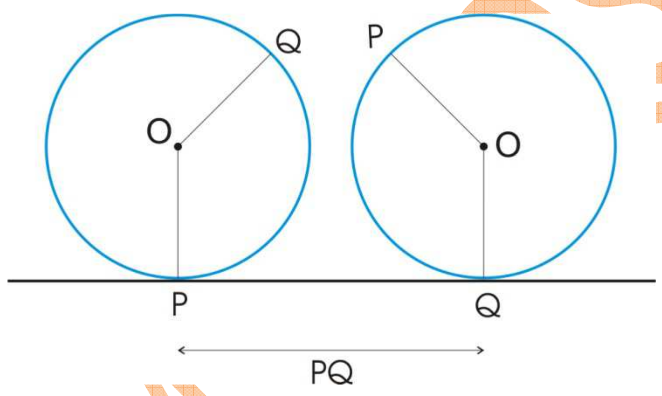
where

s = arc length

r = radius

θ = angle (in radians)

Rotating circle on a horizontal line:



Point P is touching horizontal line. Rotate the circle on horizontal line till the point Q touches the line.

Arc length PQ = Linear distance PQ on the line

MCQ-5 :

What is the distance covered by a car if its wheel, radius 27 cm, turns 100^o?

(a) $20\,\pi$ cm (b) $\frac{50\pi}{3}$ cm (c) $15\,\pi$ cm (d) $\frac{14\pi}{3}$ cm

Solution:

Angle θ must be in radians.

$$\boxed{s = r\,\theta}$$

$$= 27 \times 100 \times \frac{\pi}{180}$$

$$= 15\pi \; cm$$

The answer is (c).

MCQ-6 :

What is the radius of the circle if an arc of length 12 cm subtended an angle 30^o at the centre of the circle?

(a) 2π cm (b) $\frac{72}{\pi}$ cm (c) $\frac{12}{\pi}$ cm (d) $\frac{6}{\pi}$ cm

Solution:

$s = 12cm \quad , \quad r = ?$

Convert 30^0 into radians.

$$\theta = 30^0 = \frac{\pi}{6} \text{rad}$$

$$\boxed{s = r\theta}$$

$$12 = r \times \frac{\pi}{6}$$

$$r = \frac{72}{\pi} \; cm$$

The answer is (b).

MCQ-7 :

What is the angle subtended an arc of length 320 cm at the centre of the circle of radius 1.6 metres?

(a) 200^0 (b) 200 rad (c) 2^0 (d) 2 rad

Solution:

The units of length (cm) and radius (m) are not same, so

$$s = 320\,cm = 3.2\,m$$

$$s = r\theta$$

$$3.2 = 1.6\theta$$

$$\theta = 2 \text{ rad}$$

The answer is (d).

EXERCISE-2

(1) Arc length = 10 cm , angle = 50^o , radius = ? cm

(a) 2π cm (b) $\frac{72}{\pi}$ cm (c) $\frac{12}{\pi}$ cm (d) $\frac{36}{\pi}$ cm

(2) What is the distance covered by a bicycle if its wheel of radius 1.5 feet makes three complete revolutions?

(a) 15π feet (b) $6\,\pi$ feet (c) $12\,\pi$ feet (d) $9\,\pi$ feet

(3) What is the angle subtended an arc of length 150 cm at the centre of the circle of radius 2 metres?

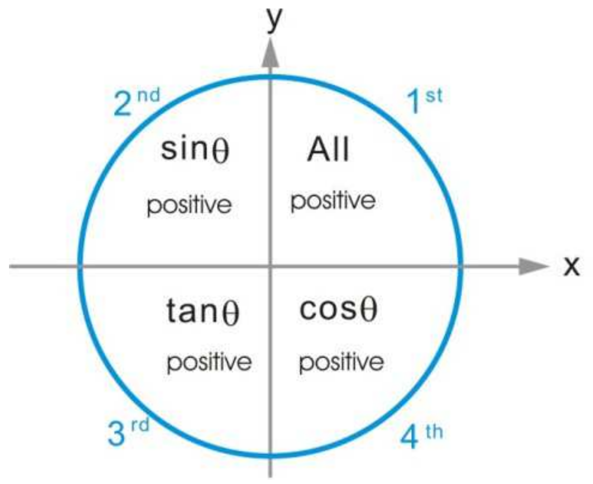
(a) 3/4 rad (b) 1.5 rad (c) 75 rad (d) 2 rad

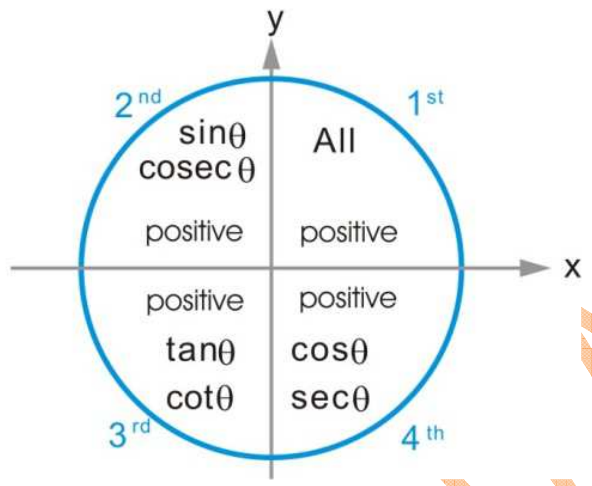
(4) What is the radius of the circle if an arc of length 20 cm subtended an angle 60^o at the centre of the circle?

(a) $\frac{30}{\pi}$ cm (b) $\frac{60}{\pi}$ cm (c) $\frac{40}{\pi}$ cm (d) $\frac{1}{3}$ cm

THE SIGNS OF THE VALUES OF TRIGONOMETRIC FUNCTIONS

A circle is divided into four equal parts. Each part is called quadrant.





Since $cosec\theta = \frac{1}{\sin\theta}$, $\sec\theta = \frac{1}{\cos\theta}$, $\cot\theta = \frac{1}{\tan\theta}$

Therefore:

i) in 1^{st} quadrant , all trigonometric functions are positive.

ii) in 2^{nd} quadrant, sin θ and cosec θ are positive.

iii) in 3^{rd} quadrant, tan θ and cot θ are positive.

iv) in 4^{th} quadrant, cos θ and sec θ are positive.

EXERCISE-3

(1) $cos\theta = -\frac{\sqrt{3}}{2}$ and sin θ is negative. In which quadrant does $\rho(\theta)$ lie?

(a) 1^{st} (b) 2^{nd} (c) 3^{rd} (d) 4^{th}

(2) $\cot\theta = 5$ and $\cos\theta$ is negative. In which quadrant does $\rho(\theta)$ lie?

(a) 1^{st} (b) 2^{nd} (c) 3^{rd} (d) 4^{th}

(3) $\mathrm{cosec}\,\theta = -2$ and $\tan\theta$ is positive. In which quadrant does $\rho(\theta)$ lie?

(a) 1^{st} (b) 2^{nd} (c) 3^{rd} (d) 4^{th}

(4) $\sin\theta = 5$ and sec θ is positive. In which quadrant does $\rho(\theta)$ lie?

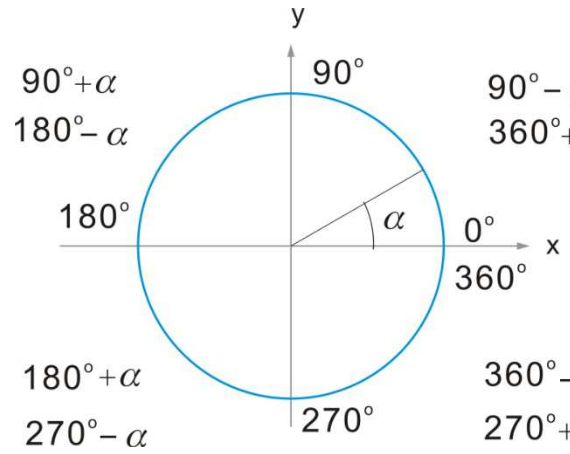
(a) 1^{st} (b) 2^{nd} (c) 3^{rd} (d) 4^{th}

(5) $\mathrm{cosec}\,\theta = -5$ and sec θ is positive. In which quadrant does $\rho(\theta)$ lie?

(a) 1^{st} (b) 2^{nd} (c) 3^{rd} (d) 4^{th}

∝ IS BASIC ANGLE

If ∝ is the basic angle, so it is in the first quadrant.



$f\ (180^0 \pm \propto)$ and $f\ (360^0 \pm \propto)$ into $f\ (\propto)$

180^0 and 360^0 are on x – axis .

The functions of sin , cos , and tan at ($180^0 \pm \propto$) and ($360^0 \pm \propto$) will not change, only the sign will change according to the quadrant , when the angles ($180^0 \pm \propto$) and ($360^0 \pm \propto$) are shifted in first quadrant.

$\theta = (180^0 - \propto)$ ρ (θ) is in the 2nd quadrant.	$\theta = 180^0 + \propto$ $\rho(\theta)$ is in the third quadrant
sinθ is positive and cosθ and tanθ are negative. i) $sin(180^0 - \propto) = sin \propto$ ii) $cos(180^0 - \propto) = -cos \propto$ iii) $tan(180^0 - \propto) = -tan \propto$	sinθ and cosθ are negative and tanθ is positive. i) $sin(180^0 + \propto) = -sin \propto$ ii) $cos\ (180^0 + \propto) = -cos \propto$ iii) $tan\ (180^0 + \propto) = tan \propto$

$\theta = 360^0 - \propto$ $\rho(\theta)$ is in the fourth quadrant	$\theta = 360^0 + \propto$ $\rho(\theta)$ is in the first quadrant
cosθ is positive and sinθ and tanθ are negative. i) $sin(360^0 - \propto) = -sin \propto$ ii) $cos(360^0 - \propto) = cos \propto$ iii) $tan(360^0 - \propto) = -tan \propto$	sinθ, cosθ and tanθ are positive. i) $sin(360^0 + \propto) = sin \propto$ ii) $cos(360^0 + \propto) = cos \propto$ iii) $tan(360^0 + \propto) = tan \propto$

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MCQ- 8:

$\sin(720^o - \theta) = ?$

(a) $-\tan\theta$ (b) $-\sin\theta$ (c) $-\cos\theta$ (d) $\cos\theta$

Solution:

$$\boxed{\sin(720^0 - \theta)}$$
$$= \sin(2 \times 360^0 -)$$
$$= -\sin\theta$$

The answer is (b).

EXERCISE-4

(1) $\sin(180^0 - \theta)\cos(180^0 + \theta)\tan(360^0 - \theta) = ?$

(a) $sin^2\theta$ (b) $cos^2\theta$ (c) $\sin\theta\cos\theta$ (d) $-\sin\theta\cos\theta$

(2) $\sec(180^0 + \theta)\cos(180^0 - \theta) = ?$

(a) $\tan\theta$ (b) $-\cot\theta$ (c) $-\tan\theta$ (d) 1

(3) $\sin(90^0 + \theta)\tan(270^0 + \theta) = ?$

(a) $\frac{\sin\theta}{\cos^2\theta}$ (b) $\frac{-\cos^2\theta}{\sin\theta}$ (c) $\sin\theta\cos^2\theta$ (d) $-\sin^2\theta\cos\theta$

(4) $\sin(180^0 + \theta)\cos(270^0 + \theta) = ?$

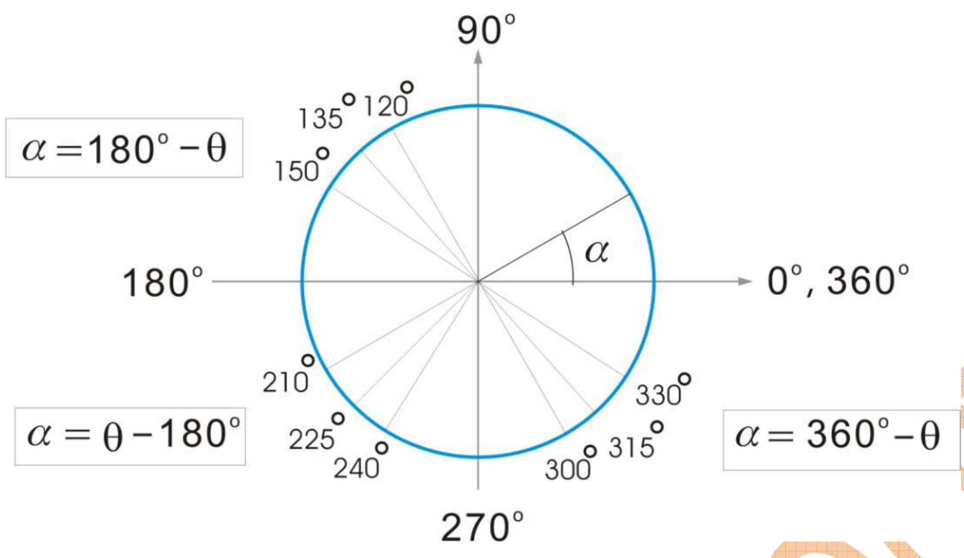
(a) $\sin^2\theta$ (b) $\cos^2\theta$ (c) $\sin\theta\cos\theta$ (d) $-\sin^2\theta$

(5) $\mathrm{cosec}(270^0 + \theta)\tan(90^0 + \theta) = ?$

(a) $\sin^2\theta$ (b) $-\sec\theta$ (c) $\mathrm{cosec}\,\theta$ (d) $\cot\theta$

VALUES OF TRIGONOMETRIC FUNCTIONS

(SHIFTING THE ANGLE IN FIRST QUADRANT)



Learn following values by heart.

$sin30^0 = \frac{1}{2} = 0.5$ $cos30^0 = \frac{\sqrt{3}}{2} = 0.866$ $tan30^0 = \frac{1}{\sqrt{3}}$	$sin45^0 = \frac{1}{\sqrt{2}} = 0.707$ $cos45^0 = \frac{1}{\sqrt{2}} = 0.707$ $tan45^0 = 1$	$sin60^0 = \frac{\sqrt{3}}{2} = 0.866$ $cos60^0 = \frac{1}{2} = 0.5$ $tan60^0 = \sqrt{3}$

θ: in 2nd quadrant $\alpha = 180^0 - \theta$	θ: in 3rd quadrant $\alpha = \theta - 180^0$	θ: in 4th quadrant $\alpha = 360^0 - \theta$
$180^0 - 120^0 = 60^0$ $180^0 - 135^0 = 45^0$ $180^0 - 150^0 = 30^0$	$210^0 - 180^0 = 30^0$ $225^0 - 180^0 = 45^0$ $240^0 - 180^0 = 60^0$	$360^0 - 300^0 = 60^0$ $360^0 - 315^0 = 45^0$ $360^0 - 330^0 = 30^0$

Explanation:

Firstly write of the signs $(+ \, or \, -)$ of the value according to the quadrant, and than shift the angle in 1st quadrant from any other quadrant.

For example

i) $cos210^0 = -cos(210^0 - 180^0) = -cos30^0 = -\frac{\sqrt{3}}{2}$

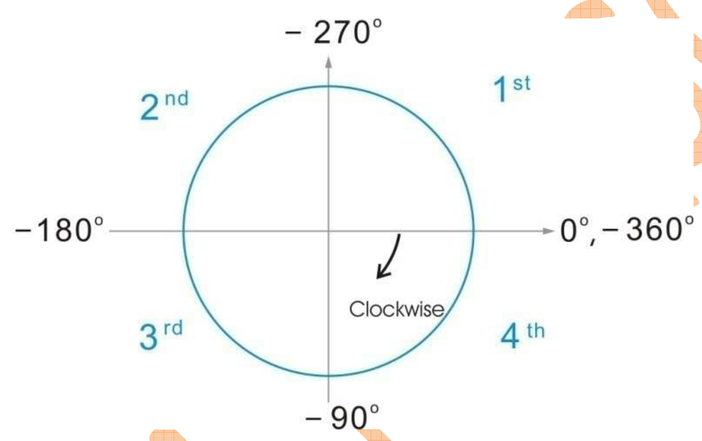
ii) $cos330^0 = cos(360^0 - 330^0) = cos30^0 = \frac{\sqrt{3}}{2}$

iii) $cos120^0 = -cos(180^0 - 120^0) = -cos60^0 = -\frac{1}{2}$

iv) $sin240^0 = -\sin(240^0 - 180^0) = -sin60^0 = -\frac{\sqrt{3}}{2}$

v) $tan150^0 = -tan(180^0 - 150^0) = -tan30^0 = -\frac{1}{\sqrt{3}}$

FOR NEGATIVE ANGLES



i) $sin(-\theta) = -sin\theta$

ii) $cos(-\theta) = cos\theta$

iii) $tan(-\theta) = -tan\theta$

so that

i) $sin(-150^0) = -sin150^0 = -sin(180^0 - 150^0) = -sin30^0 = -{}^1/_2$

ii) $cos(-150^0) = cos150^0 = -cos(180^0 - 150^0) = -cos30^0 = -{}^{\sqrt{3}}/_2$

iii) $tan(-300^0) = -tan300^0 = -\{-tan(360^0 - 300^0)\} = tan60^0 = \sqrt{3}$

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MCQ-12 :

$sin\frac{\theta}{2} = ?$ if $\sin\theta = \frac{3}{5}$, ρ (θ) is in the second quadrant.

(a) $-{}^{3}/_{\sqrt{5}}$ (b) ${}^{4}/_{\sqrt{10}}$ (c) ${}^{4}/_{5}$ (d) ${}^{3}/_{\sqrt{10}}$

Solution:

$$\because \sin\frac{\theta}{2} = \sqrt{\frac{1-cos\theta}{2}}$$

First find the value of cos θ

$$\cos^2\theta = 1 - \sin^2\theta$$

$$\cos^2\theta = 1 - \frac{9}{25}$$

$$= \frac{16}{25}$$

$$\cos\theta = \pm 4/5$$

$\because \rho(\theta)$is in the 2nd quadrant.

$$\cos\theta = -\frac{4}{5}$$

{$\because$ ρ ($\frac{\theta}{2}$) is in the 1st quadrant.

$$sin\frac{\theta}{2} = \sqrt{\frac{1-cos\theta}{2}}$$

$$= \sqrt{\frac{1+\frac{4}{5}}{2}}$$

$$= \frac{3}{\sqrt{10}}$$

The answer is (d).

EXERCISE-6

(1) $\sin\theta = -\frac{1}{5}$ and $\rho(\theta)$ is in the 4th quadrant. What is the value of $\tan\theta$?

(a) $\frac{1}{2\sqrt{6}}$ (b) $-\frac{1}{2\sqrt{6}}$ (c) $-\frac{1}{\sqrt{26}}$ (d) $\frac{1}{\sqrt{26}}$

(2) $\tan\theta = \frac{3}{2}$ and $\rho(\theta)$ is in the 3rd quadrant. What is the value of $\cos\theta$?

(a) $\frac{-3}{\sqrt{5}}$ (b) $\frac{-2}{\sqrt{5}}$ (c) $\frac{2}{\sqrt{13}}$ (d) $\frac{-2}{\sqrt{13}}$

(3) $\cos\theta = \frac{-2}{3}$ and $\rho(\theta)$ is in the 2nd quadrant. What is the value of $\sin\theta$?

(a) $\frac{\sqrt{5}}{3}$ (b) $\frac{-\sqrt{5}}{3}$ (c) $\frac{\sqrt{13}}{3}$ (d) $\frac{2}{\sqrt{13}}$

(4) Given that $\cos\theta = \frac{-2}{7}$ and $\tan\theta = \frac{-3\sqrt{5}}{2}$, $\rho(\theta)$ is in the 2nd quadrant, what is the value of $\sin\theta$?

(a) $\frac{7}{3\sqrt{5}}$ (b) $\frac{3\sqrt{5}}{7}$ (c) $\frac{-3\sqrt{5}}{7}$ (d) $\frac{5}{\sqrt{7}}$

(5) Given that $\sin\theta = \frac{-3}{5}$ and $\rho(\theta)$ is in the 4th quadrant, what is the value of $\cot\theta$?

(a) $\frac{-2}{\sqrt{6}}$ (b) $\frac{-\sqrt{34}}{3}$ (c) $\frac{-4}{5}$ (d) $\frac{-4}{3}$

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