Chapter 11

TRIGONOMETRIC FUNCTIONS & THEIR GRAPHS

DOMAIN AND RNAGE OF TRIGONOMETRIC FUNCTION

Function	Domain	Range
$y = \sin x$	$\Re$	$-1 \le y \le 1$
$y = \cos x$	$\Re$	$-1 \le y \le 1$
$y = \tan x$	$\forall\, x \in \Re$, but $x \neq (2n+1)\frac{\pi}{2}$, $n \in z$	$\Re$
$y = \cot x$	$\forall\, x \in \Re$, but $x \neq n\pi$, $n \in z$	$\Re$
$y = \sec x$	$\forall\, x \in \Re$, but $x \neq (2n+1)\pi/2$, $n \in z$	$y \ge 1$ or $y \le -1$
$y = \text{cosec } x$	$\forall\, x \in \Re$, but $x \neq n\pi$, $n \in Z$	$y \ge 1$ or $y \le -1$

Period

Period of a trigonometric function is the smallest +ve number which, when added to the original circular measure of the angle, given the same value of the function.

Formula to Find Period

$f(x) = f(x + P)$

Standard Periods

$\sin x = 2\pi$

$\cos x = 2\pi$

$\sec x = 2\pi$

$\text{cosec } x = 2\pi$

$\tan x = \pi$

$\cot x = \pi$

EXERCISE 11.1

Find the periods of the following functions:

Q.1 sin 3 x (Lahore Board 2005)

Solution:

Given function is $\sin 3x$

Since period of sin is 2π

Therefore $f(x) = f(x + P)$

$\sin 3x = \sin(3x + 2\pi)$

$\sin 3x = \sin 3\left(x + \frac{2\pi}{3}\right)$

Thus period of $\sin 3x$ is $\frac{2\pi}{3}$

Q.2 cos 2 x

Solution:

Given function is $\cos 2x$

Since period of cos is 2π

Therefore $f(x) = f(x + P)$

$\cos 2x = \cos(2x + 2\pi)$

$\cos 2x = \cos 2(x + \pi)$

Thus period of $\cos 2x$ is π.

Q.3 tan 4 x (Gujranwala Board 2007)

Solution:

Given function is $\tan 4x$

Since period of $\tan x$ is π

Therefore $f(x) = f(x + P)$

$\tan 4x = \tan(4x + \pi)$

$\tan 4x = \tan 4\left(x + \frac{\pi}{4}\right)$

Thus period of $\tan 4x$ is $\frac{\pi}{4}$.

Q.4 $\cot \frac{x}{2}$

Solution:

Given function is $\cot \frac{x}{2}$

Since period of cot is π

Therefore $f(x) = f(x + P)$

$$\cot \frac{x}{2} = \cot\left(\frac{x}{2} + \pi\right)$$

$$\cot \frac{x}{2} = \cot \frac{1}{2}(x + 2\pi)$$

Thus period of $\cot \frac{x}{2}$ is 2π

Q.5 $\sin \frac{x}{3}$ **(Lahore Board 2006)**

Solution:

Given function is $\sin \frac{x}{3}$

Since period of sin is 2π

Therefore $f(x) = f(x + P)$

$$\sin \frac{x}{3} = \sin\left(\frac{x}{3} + 2\pi\right)$$

$$\sin \frac{x}{3} = \sin \frac{1}{3}(x + 6\pi)$$

Thus period of $\sin \frac{x}{3}$ is 6π

Q.6 $\operatorname{cosec} \frac{x}{4}$

Solution:

Given function is $\operatorname{cosec} \frac{x}{4}$

Since period of cosec is 2π

Therefore $f(x) = f(x + P)$

$$\operatorname{cosec} \frac{x}{4} = \operatorname{cosec}\left(\frac{x}{4} + 2\pi\right)$$

$\operatorname{cosec} \frac{x}{4} = \operatorname{cosec} \frac{1}{4}(x + 8\pi)$

Thus period of $\operatorname{cosec} \frac{x}{4}$ is 8π

Q.7 $\sin \frac{x}{5}$ (Lahore Board 2010)

Solution:

Given function is $\sin \frac{x}{5}$

Since period of $\sin x$ is 2π

Therefore $f(x) = f(x + P)$

$\sin \frac{x}{5} = \sin\left(\frac{x}{5} + 2\pi\right)$

$\sin \frac{x}{5} = \sin \frac{1}{5}(x + 10\pi)$

Thus period of $\sin \frac{x}{5}$ is 10π

Q.8 $\cos \frac{x}{6}$

Solution:

Given function is $\cos \frac{x}{6}$

Since period of $\cos x$ is 2π

$f(x) = f(x + P)$

Therefore $\cos \frac{x}{6} = \cos\left(\frac{x}{6} + 2\pi\right) = \cos \frac{1}{6}(x + 12\pi)$

Thus period of $\cos \frac{x}{6}$ is 12π

Q.9 $\tan \frac{x}{7}$

Solution:

Given function is $\tan \frac{x}{7}$

Since period of $\tan x$ is π

$f(x) = f(x + P)$

Therefore $\tan \frac{x}{7} = \tan\left(\frac{x}{7} + \pi\right)$

$\tan \frac{x}{7} = \tan \frac{1}{7}(x + 7\pi)$

Thus period of $\tan \frac{x}{7}$ is 7π

Q.10 cot 8 x

Solution:

Given function is cot 8 x

Since period of cot x is π

$f(x) = f(x + P)$

Therefore $\cot 8x = \cot(8x + \pi)$

$\cot 8x = \cot 8\left(x + \frac{\pi}{8}\right)$

Thus period of cot 8 x is $\frac{\pi}{8}$

Q.11 sec 9 x

Solution:

Given function is sec 9 x

Since period of sec x is 2π

$f(x) = f(x + P)$

Therefore $\sec 9x = \sec(9x + 2\pi)$

$\sec 9x = \sec 9\left(x + \frac{2\pi}{9}\right)$

Thus period of sec 9 x is $\frac{2\pi}{9}$

Q.12 cosec 10 x

Solution:

Given function is cosec 10 x

Since period of cosec x is 2π

$f(x) = f(x + P)$

Therefore $\operatorname{cosec} 10x = \operatorname{cosec}(10x + 2\pi)$

$$\operatorname{cosec} 10x = \operatorname{cosec} 10\left(x + \frac{2\pi}{10}\right)$$

Thus period of $\operatorname{cosec} 10x$ is $\frac{\pi}{5}$

Q.13 3 sin x

Solution:

Given function is $3 \sin x$

Since period of $\sin x$ is 2π

$f(x) = f(x + P)$

Therefore $3 \sin x = 3 \sin(x + 2\pi)$

Thus period of $3 \sin x$ is 2π.

Q.14 2 cos x

Solution:

Given function is $2 \cos x$

Since period of $\cos x$ is 2π

$f(x) = f(x + P)$

Therefore $2 \cos x = 2 \cos(x + 2\pi)$

Thus period of $2 \cos x$ is 2π

Q.15 $3 \cos \frac{x}{5}$ (Lahore Board 2008)

Solution:

Given function is $3 \cos \frac{x}{5}$

Since period of $\cos x$ is 2π

$f(x) = f(x + P)$

Therefore $3 \cos \frac{x}{5} = 3 \cos\left(\frac{x}{5} + 2\pi\right)$

$$3 \cos \frac{x}{5} = 3 \cos \frac{1}{5}(x + 10\pi)$$

Thus period of $3 \cos \frac{x}{5}$ is 10π.

EXERCISE 11.2

Q.1 Draw the graph of each of the following equations for the intervals mentioned against each:

(i) $y = -\sin x$; $x \in [-2\pi, 2\pi]$

Solution:

Given function is $y = -\sin x$

We want to draw the graph of $y = -\sin x$ from -360 to 360°.

Taking the sub–interval of 30°, we have the following table of values.

x	-360°	-330°	-300°	-270°	-240°	-210°	-180°	-150°	-120°	-90°	-60°	-30°
y	0	–0.5	–0.9	–1	–0.9	–0.5	0	0.5	0.9	1	0.9	0.5

x	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°	360°
y	0	–0.5	0.9	–1	–0.9	–0.5	0	0.5	0.9	1	0.9	0.5	0

Pairs

$(-360^\circ, 0)$, $(-330^\circ, -0.5)$, $(-300^\circ, -0.9)$, $(-270^\circ, -1)$, $(-240^\circ, -0.9)$

$(-210^\circ, -0.5)$, $(-180^\circ, 0)$, $(-150^\circ, 0.5)$, $(-120^\circ, 0.9)$, $(-90^\circ, 1)$

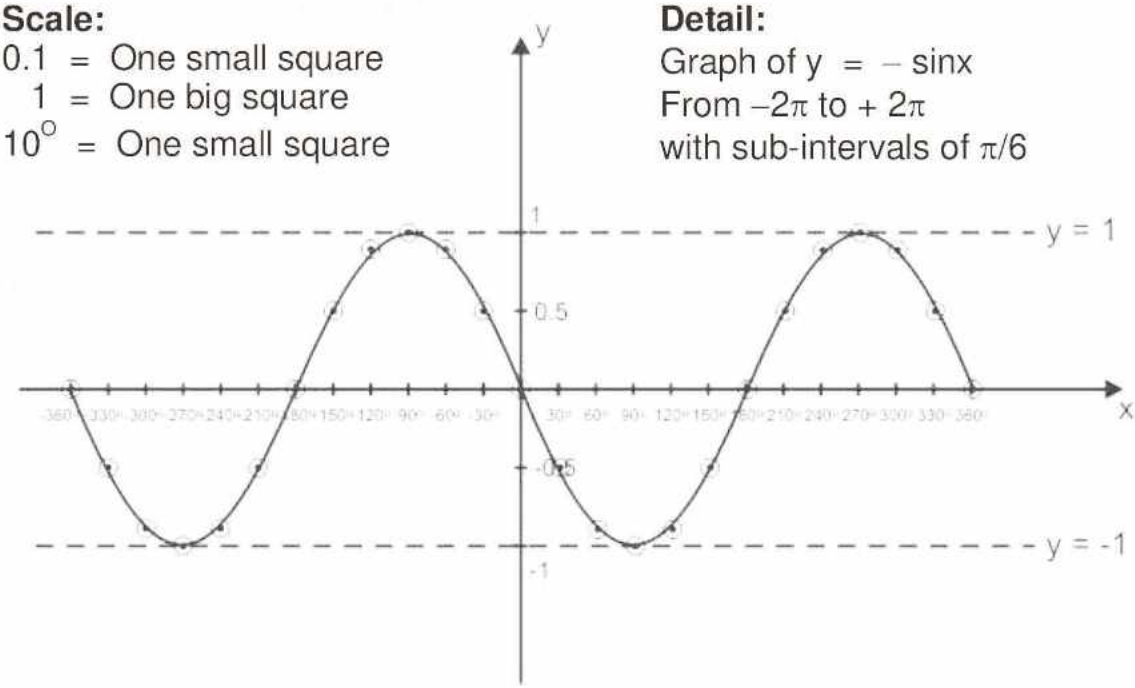
$(-60^\circ, 0.9)$, $(-30^\circ, 0.5)$, $(0^\circ, 0)$, $(30^\circ, -0.5)$, $(60^\circ, -0.9)$

$(90^\circ, -1)$, $(120^\circ, -0.9)$, $(150^\circ, -0.5)$, $(180^\circ, 0)$, $(210^\circ, 0.5)$

$(240^\circ, 0.9)$, $(270^\circ, 1)$, $(300^\circ, 0.9)$, $(330^\circ, 0.5)$, $(360^\circ, 0)$

Scale:
0.1 = One small square
1 = One big square
10° = One small square

Detail:
Graph of $y = -\sin x$
From -2π to $+2\pi$
with sub-intervals of $\pi/6$



(ii) $y = 2\cos x; \quad x \in [0, 2\pi]$

Solution:

Given function is $y = 2\cos x$

We want to draw the graph of $y = 2\cos x$ from 0 to 36.

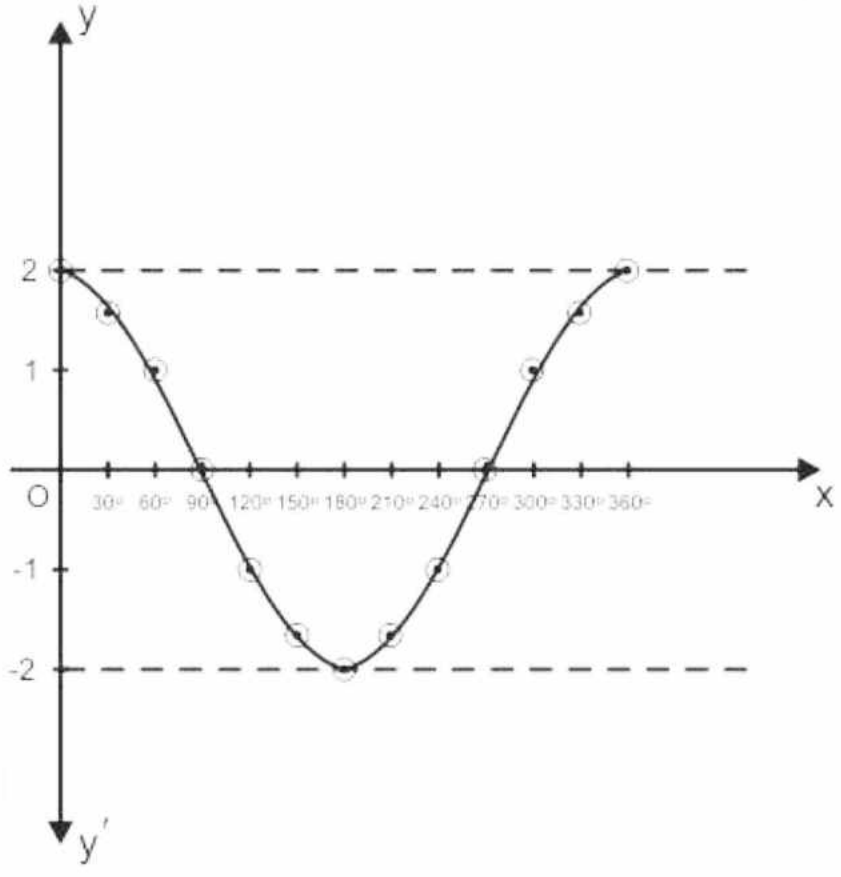
Taking the sub–interval of 30°, we have the following table of values.

x	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°	360°
$y = \cos x$	1	0.9	0.5	0	–0.5	–0.9	– 1	– 0.9	–0.5	0	0.5	0.9	1
$y = 2\cos x$	2	1.8	1	0	– 1	– 1.8	– 2	– 1.8	– 1	0	1	1.8	2

Pairs

$(0^\circ, 2)$, $(30^\circ, 1.8)$, $(60^\circ, 1)$, $(90^\circ, 0)$, $(120^\circ, -1)$, $(150^\circ, -1.8)$, $(180^\circ, -2)$

$(210^\circ, -1.8)$, $(240^\circ, -1)$, $(270^\circ, 0)$, $(300^\circ, 1)$, $(330^\circ, 1.8)$, $(360^\circ, 2)$



Scale:

0.1 = One small square

1 = One big square

10° = One small square

(iii) $y = \tan 2x$; $x \in [-\pi, \pi]$

Solution:

Given function is $y = \tan 2x$

We want to draw the graph of $y = \tan 2x$ from -180° to $+180^\circ$.

Taking the sub–interval of 30°, we have the following table of values.

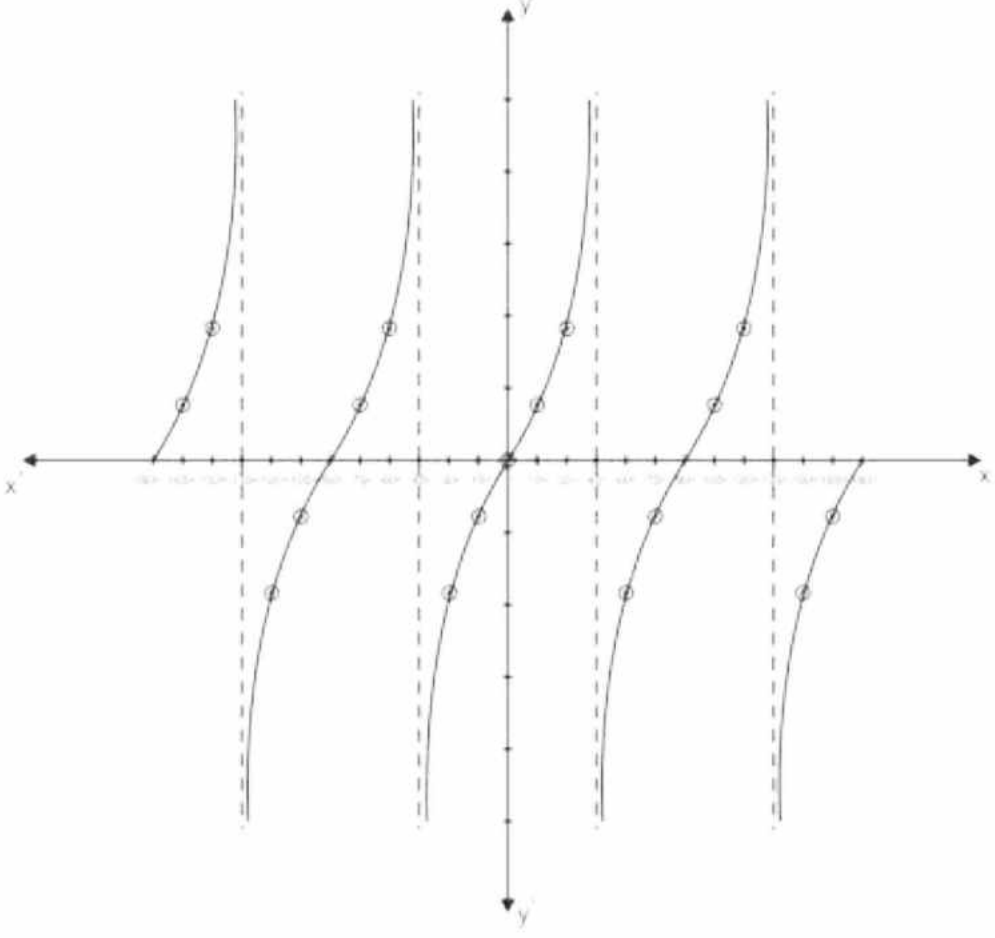
x	-180°	-165°	-150°	-135°	-120°	-105°	-90°	-75°	-60°	-45°	-30°	-15°	0°
2 x	-360°	-330°	-300°	-270°	-240°	-210°	-180°	-150°	-125°	-90°	-60°	-30°	0
y =tan 2x	0	0.6	1.73	∞	-1.73	-0.6	0	0.6	1.7	∞	-1.7	-0.6	0

x	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180°
2 x	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°	360°
y =tan 2x	0.6	1.7	∞	–1.7	–0.6	0	0.6	1.7	∞	–1.7	–0.6	0

Pairs

$(-180^\circ, 0)$, $(-165^\circ, 0.6)$, $(-150^\circ, -300^\circ)$, ... $(-15^\circ, -0.6)$

$(0, 0)$, $(15^\circ, 0.6)$, $(30^\circ, 1.7)$, ... $(180^\circ, 0)$



Scale:

0.1 = One small square , 1 = One big square , 10° = One small square

(iv) $y = \tan x$; $x \in [-2\pi, 2\pi]$

Solution:

Given function is $y = \tan x$

We want to draw the graph of $y = \tan x$ from -360° to $+360^\circ$.

Taking the sub–interval of 30°, we have the following table of values.

x	-360°	-330°	-300°	-270°	-240°	-210°	-180°	-150°	-120°
y= tanx	0	+0.6	+1.7	∞	–1.7	–0.6	0	0.6	1.7

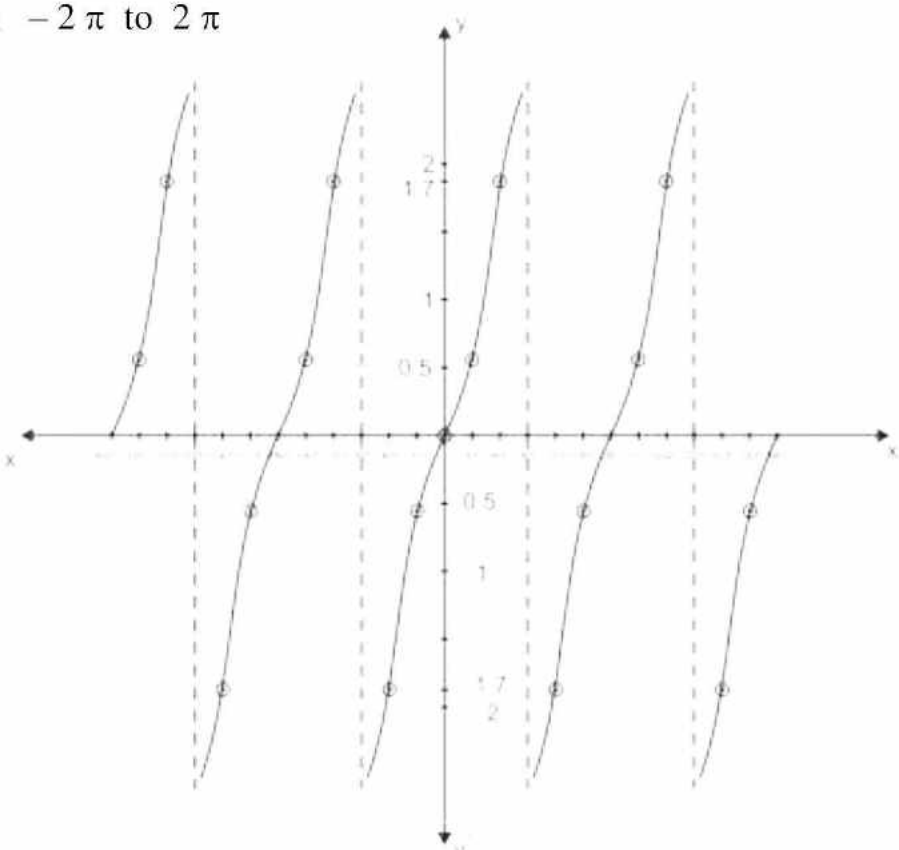
x	-90°	-60°	-30°	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°
y=tanx	$-\infty$	-1.7	-0.6	0	0.6	1.7	$+\infty$	-1.7	-0.6	0	0.6	1.7	$+\infty$	-1.7

x	330°	360°
y = tan x	-0.6	0

Pairs

$(-360^\circ, 0)$, $(-330^\circ, 0.6)$, $(-300^\circ, 1.7)$, ... $(360^\circ, 0)$

Graph of $y = \tan x$ from -2π to 2π



Scale:

0.1 = One small square , 1 = One big square , 10° = One small square

(v) $y = \sin \frac{x}{2}$; $x \in [0, 2\pi]$

Solution:

Given function is $y = \sin \frac{x}{2}$

We want to draw the graph of $y = \sin x$ from 0^o to 360^o.

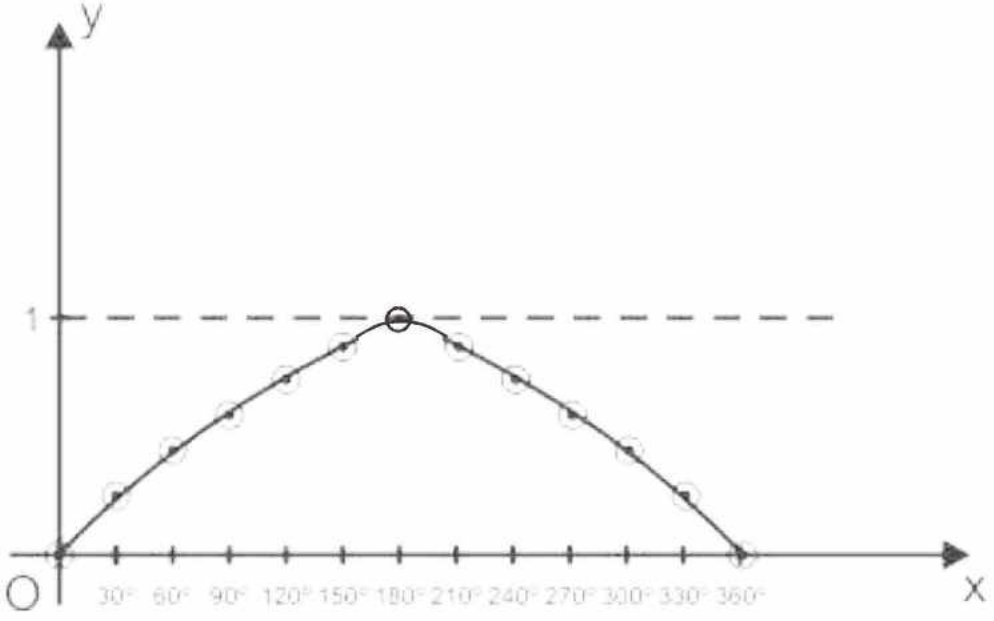
Taking the sub–interval of 30^o, we have the following table of values.

x	0^o	30^o	60^o	90^o	120^o	150^o	180^o	210^o	240^o	270^o	300^o	330^o	360^o
$\frac{x}{2}$	0^o	15^o	30^o	45^o	60^o	75^o	90^o	105^o	120^o	135^o	150^o	165^o	180^o
$y = \sin \frac{x}{2}$	0	0.3	0.5	0.7	0.8	0.95	1	0.95	0.8	0.7	0.5	0.3	0

Pairs

$(0^o, 0)$, $(30^o, 0.3)$, $(60^o, 0.5)$, $(90^o, 0.7)$, $(120^o, 0.8)$, $(150^o, 0.95)$

$(180^o, 1)$, $(210^o, 0.95)$, $(240^o, 0.8)$, $(270^o, 0.7)$, $(300^o, 0.5)$, $(330^o, 0.3)$, $(360^o, 0)$



Scale:

0.1 = One small square , 1 = One big square , 10° = One small square

(vi) $y = \cos \frac{x}{2}$; $x \in [-\pi, \pi]$

Solution:

Given function is $y = \cos \frac{x}{2}$

We want to draw the graph of $y = \cos\frac{x}{2}$ from -180° to 180°..

Taking the sub–interval of 30°, we have the following table of values.

$y = \cos\frac{x}{2}$

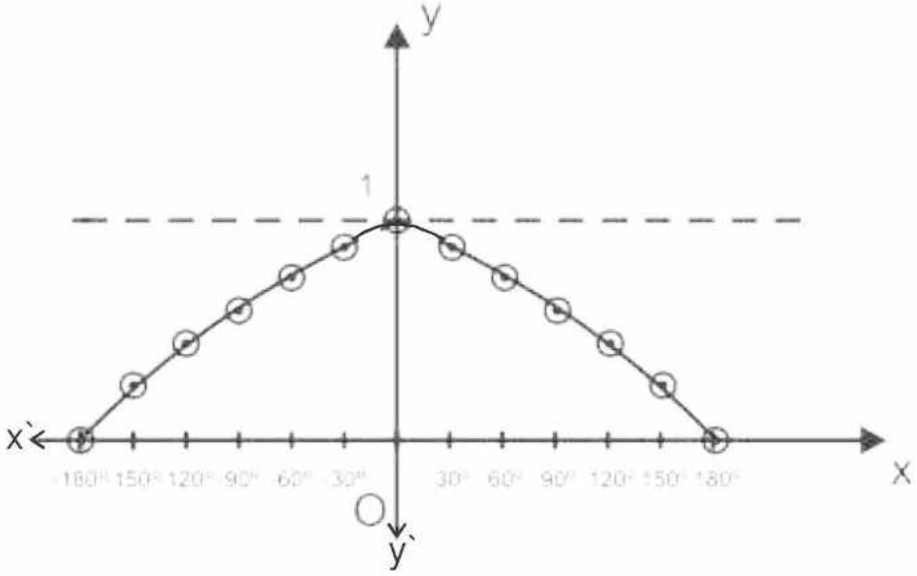
x	-180°	-150°	-120°	-90°	-60°	-30°	0°	30°	60°	90°	120°	150°	180°
$\frac{x}{2}$	-90°	-75°	-60°	-45°	-30°	-15°	0	15°	30°	45°	60°	75°	90°
$y = \cos\frac{x}{2}$	0	0.3	0.5	0.7	0.8	0.95	1	0.95	0.8	0.7	0.5	0.3	0

Pairs

$(-180^\circ, 0)$, $(-150^\circ, 0.3)$, $(-120^\circ, 0.5)$, $(-90^\circ, 0.7)$, $(-60^\circ, 0.8)$

$(-30^\circ, 0.95)$, $(0^\circ, 1)$, $(30^\circ, 0.95)$, $(60^\circ, 0.8)$, $(90^\circ, 0.7)$

$(120^\circ, 0.5)$, $(150^\circ, 0.3)$, $(180^\circ, 0)$



Scale:

0.1 = One small square , 1 = One big square , 10° = One small square

Q.2 On the same axes and to the same scale, draw the graphs of the following equations.

(i) $y = \sin x$ and $y = \sin 2x$

Solution:

Given functions are $y = \sin x$ and $y = \sin 2x$

As complete period of $\sin x$ is 2π

So we want to draw the graph of $y = \sin x$ from 0 to 360°.

As complete period of $\sin 2x$ is π

So we want to draw the graph of $y = \sin 2x$ from 0 to 180°.

Taking sub interval of 30°. We have the following tables of values.

$y = \sin x$

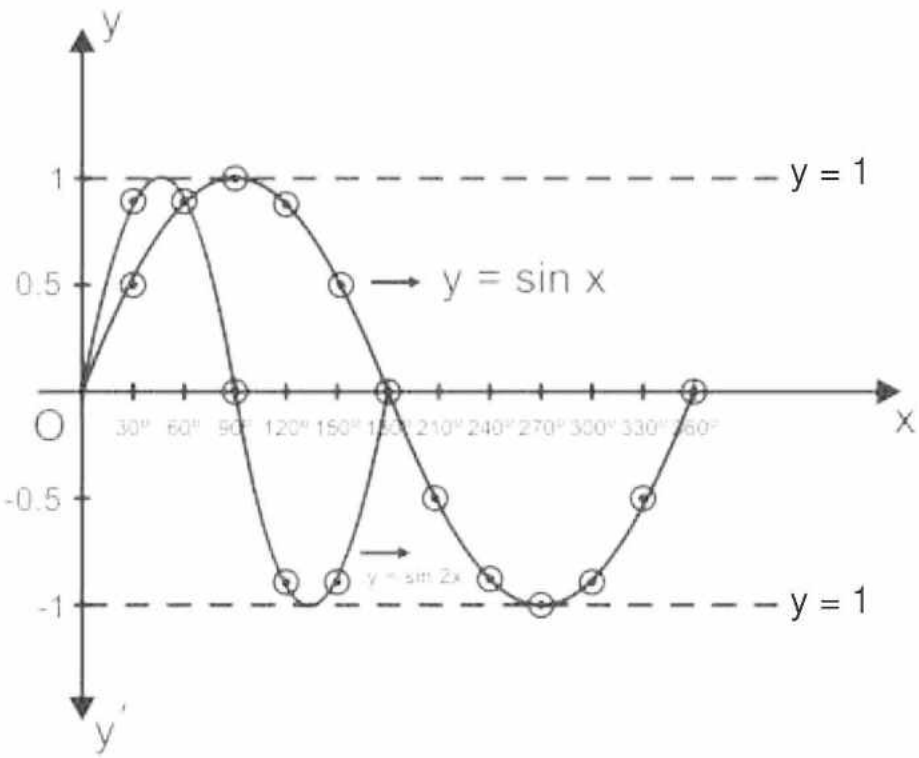
$y = \cos \frac{x}{2}$

x	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°	360°
y = sin x	0	0.5	0.9	1	0.9	0.5	0	-0.5	-0.9	-1	-0.9	-0.5	0

x	0°	30°	60°	90°	120°	150°	180°
2x	0	60°	120°	180°	240°	300°	360°
y = sin 2 x	0	0.8	0.9	0	-0.9	-0.8	0

Pairs

$(0^{\circ}, 0)$, $(30^{\circ}, 0.8)$, $(60^{\circ}, 0.9)$, $(90^{\circ}, 0)$, $(120^{\circ}, 0.9)$, $(150^{\circ}, 0.8)$, $(180^{\circ}, 0)$



Scale:

0.1 = One small square , 1 = One big square , 10° = One small square

(ii) On the same axes and to the same scale, draw the graphs of the following equations for their complete period.

$y = \cos x$ and $y = \cos 2x$

Solution:

Given functions are $y = \cos x$ and $y = \cos 2x$

Firstly, $y = \cos x$, as complete period of $\cos x$ is 2π

So, we want to draw the graph of $y = \cos x$ from $0°$ to $360°$.

Secondly, $y = \cos 2x$, as complete period of $\cos 2x$ is π

So we want to draw the graph of $y = \cos 2x$ from 0 to $180°$.

Taking sub–interval of $30°$, we have the following tables of values.

$y = \cos x$

x	$0°$	$30°$	$60°$	$90°$	$120°$	$150°$	$180°$	$210°$	$240°$	$270°$	$300°$	$330°$	$360°$
$y = \cos x$	1	0.9	0.5	0	– 0.5	– 0.9	– 1	– 0.9	– 0.5	0	0.5	0.9	1

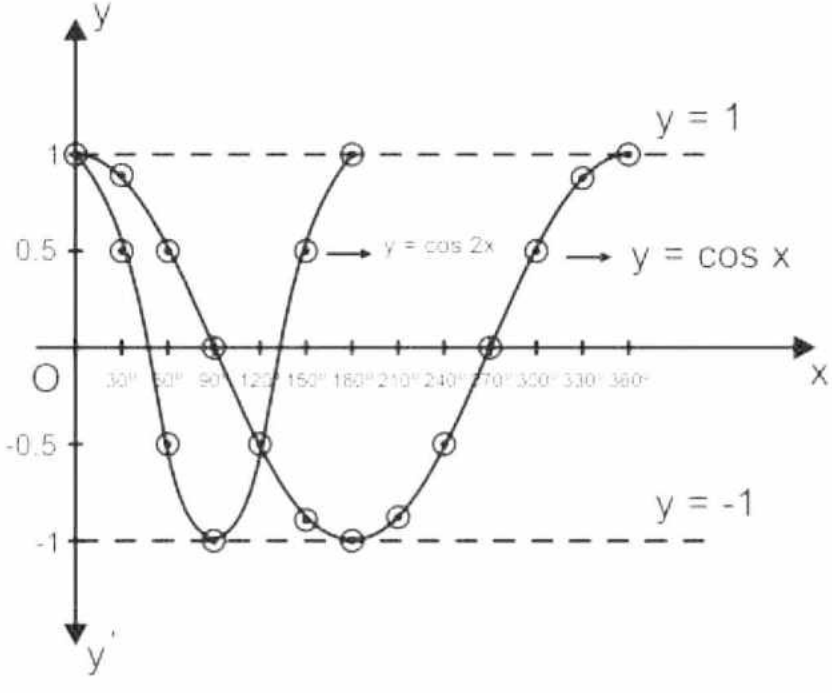
Pairs

$(0°, 1)$, $(30°, 0.9)$, $(60°, 0.5)$, ……., $(360°, 1)$

x	$0°$	$30°$	$60°$	$90°$	$120°$	$150°$	$180°$
2x	0	$60°$	$120°$	$180°$	$240°$	$300°$	$360°$
$y = \cos 2x$	1	0.8	– 0.5	1	– 0.5	0.5	1

Pairs

$(0°, 1)$, $(30°, 0.5)$, $(60°, – 0.5)$, $(120°, – 0.5)$, $(150°, 300°)$, $(180°, 1)$



Scale:

0.1 = One small square , 1 = One big square , $10°$ = One small square

Q.3 Solve graphically

(i) $\sin x = \cos x; \quad x \in [0, \pi]$

Solution:

Given equation is $\sin x = \cos x$

The solution of this equation will be the point of intersection of the graphs of

$y = \sin x$ and $y = \cos x$

We want to draw the graph of $y = \sin x$ and $y = \cos x$ from 0 to 180°.

Taking the sub-interval of 30°, we have the following table of values:

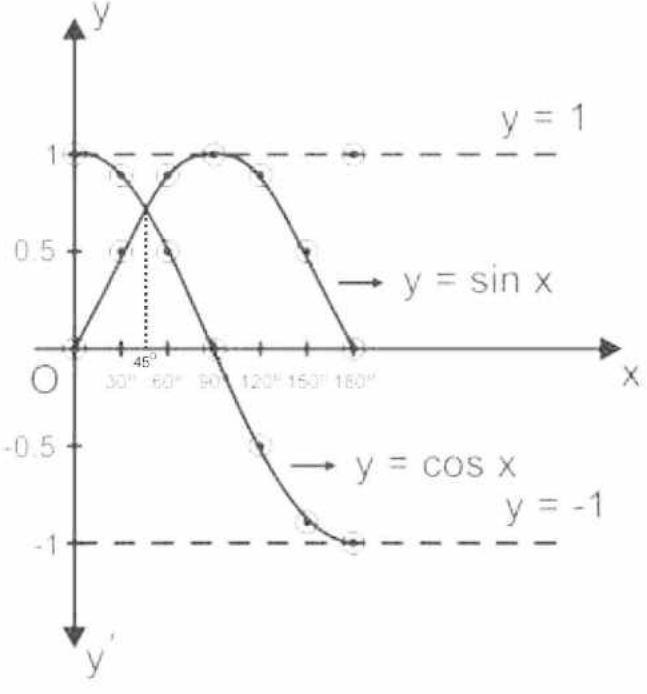
x	0°	30°	60°	90°	120°	150°	180°
$y = \sin x$	0	0.5	0.9	1	0.9	0.5	0
$y = \cos x$	1	0.9	0.5	0	– 0.5	– 0.9	– 1

The pairs for $y = \sin x$ are

$(0^{\circ}, 0), (30^{\circ}, 0.5), (60^{\circ}, 0.9), (90^{\circ}, 1), (120^{\circ}, 0.9), (150^{\circ}, 0.5), (180^{\circ}, 0)$

The pairs for $y = \cos x$ are

$(0^{\circ}, 1), (30^{\circ}, 0.9), (60^{\circ}, 0.5), (90^{\circ}, 0), (120^{\circ}, -0.5), (150^{\circ}, -0.9), (180^{\circ}, -1)$



From graph, the point of intersection of $y = \sin x$ and $y = \cos x$ is $x = 45^{\circ}$
Thus solution set of equation $\sin x = \cos x$ is $\{\pi/4\}$. Ans.

Scale:

0.1 = One small square , 1 = One big square , 10° = One small square

(ii) Solve graphically

$\sin x = x; \quad x \in [0, \pi]$

Solution:

Given equation is $\sin x = x$

The solution of this equation will be the point of intersection of the graphs of $y = \sin x$ and $y = x$

Here we want to draw the graph of $y = \sin x$ and $y = x$ from 0^o to 180^o.

Taking the sub-interval of 30^o, we have the following table of values:

x	0^o	30^o	60^o	90^o	120^o	150^o	180^o
$y = \sin x$	0	0.5	0.9	1	0.9	0.5	0
x in radians	0	0.5	1.1	1.6	2.1	2.6	3.1
$y = x$	0	0.5	1.1	1.6	2.1	2.6	3.1

Pairs for $y = \sin x$ are

$(0^o, 0), (30^o, 0.5), (60^o, 0.9), (90^o, 1), (120^o, 0.9), (150^o, 0.5), (180^o, 0)$

The pairs for $y = x$ are

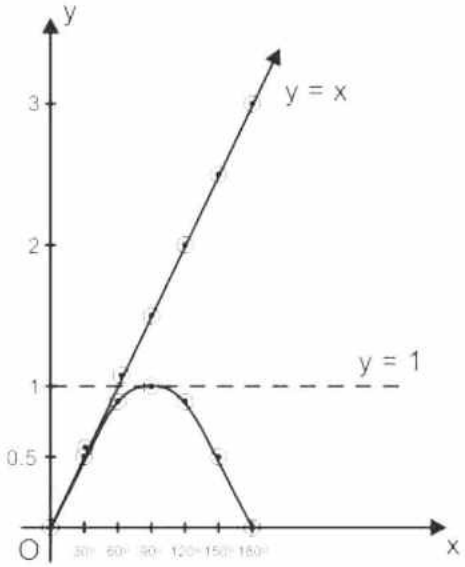
$(0^o, 0), (30^o, 0.5), (60^o, 1.1), (90^o, 1.6), (120^o, 2.1), (150^o, 2.6), (180^o, -1)$

From graph, the point of intersection of the equations.

$y = \sin x$ and $y = x$ is 0.

So solution set of the equation $\sin x = x$ is $\{0\}$.

Note: To convert degrees into radians, multiply then by $\frac{\pi}{180}$



Scale:

0.1 = One small square , 1 = One big square , 10° = One small square



TRIGONOMETRIC FUNCTIONS AND THEIR GRAPHS

MULTIPLE CHOICE QUESTIONS

(1) Period of $3 \sin \frac{x}{3}$ is:

(a) π (b) 2π

(c) 3π (d) 6π

[Lahore Board 2005]

(2) Range of $7 \sin x$ is:

(a) $[-7, 7]$ (b) $(-7, 7)$

(c) $[-1, 1]$ (d) None of these

[Lahore Board 2005]

(3) Cotangent is periodic function of period:

(a) π (b) 2π

(c) 3π (d) $\frac{\pi}{2}$

[Lahore Board 2005]

(4) Period of $\tan x$ is:

(a) 2π (b) $2n\pi$, $n \in Z$

(c) π (d) None of these

[Gujranwala Board 2005]

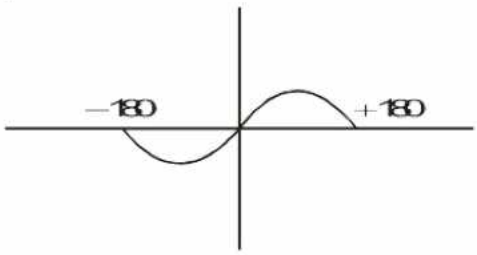
(5) Sine is periodic function whose period is:

(a) π (b) 2π

(c) 3π (d) $\frac{\pi}{2}$

[Gujranwala Board 2005]

(6) The graph



represents the function from −180 to +180

(a) sin x (b) cos x

(c) tan x (d) cot x

[Gujranwala Board 2005, Lahore Board 2015]

(7) Range of sin x is:

(a) π (b) $[-1, 1]$

(c) R (d) None of these

[Gujranwala Board 2005]

(8) The range of cos x is:

(a) $[0, 1]$ (b) R

(c) $[-1, 1]$ (d) $[-1, 0]$

[Gujranwala Board 2006]

(9) Domain of cot θ is:

(a) $\theta \in R$ but $\theta \neq n\pi$, $n \in Z$ (b) $\theta \in R$ but $\theta \neq (2n + 1)\frac{\pi}{2}$, $n \in Z$

(c) $\theta \notin R$ (d) Neon of these

[Gujranwala Board 2006]

(10) The period of $\cos \frac{x}{5}$ is:

(a) 10π (b) $\frac{2\pi}{5}$

(c) 2π (d) None of these

[Gujranwala Board 2006]

(11) The period of $\cot \pi x$ is:

(a) 1 (b) 2

(c) π (d) None

[Gujranwala Board 2006]

(12) Domain of cos x is:

(a) Z (b) Q

(c) R (d) None of these

[Lahore Board 2006]

(13) Period of y = sec x is:

(a) π (b) 2π

(c) 3π (d) $\frac{\pi}{2}$

[Lahore Board 2006]

(14) Period of $\tan\left(\frac{x}{7}\right)$ is:

(a) π (b) $\frac{\pi}{7}$

(c) 7π (d) $\pi + 7$

[Gujranwala Board 2007]

(15) The period of tan4x is:

(a) $\frac{\pi}{4}$ (b) $\frac{\pi}{2}$

(c) π (d) 2π

[Gujranwala Board 2007]

(16) Period of sin3x is:

(a) 3π (b) 2π

(c) $\frac{\pi}{3}$ (d) $\frac{2\pi}{3}$

[Lahore Board 2007]

(17) Domain of y = cos x is:

(a) $-\infty < x < +\infty$ (b) $-1 \leq y \leq 1$

(c) $0 < x < \infty$ (d) $-\infty < x < 0$

[Lahore Board 2008]

(18) Period of sine function is:

(a) π (b) $-\pi$

(c) 2π (d) 0

[Lahore Board 2008]

(19) The period of cos x is:

(a) π (b) 2π

(c) 3π (d) $\frac{\pi}{2}$

[Gujranwala Board 2008]

(20) Range of y = sin x equals:

(a) $-1 < y < 1$ (b) $y \geq 1$ or $y \leq -1$

(c) $-\infty < y < \infty$ (d) $-1 \leq y \leq 1$

[Gujranwala Board 2008]

(21) Domain of $\cot\theta$ =

(a) $-\infty < \theta < \infty$, $\theta \neq n\pi$, $n \in Z$ (b) $-\infty < \theta < \infty$, $\theta \neq \left(\frac{2n+1}{2}\right)\pi$

(c) $-1 < \theta < 1$ (d) $\theta \geq 1$ or $\theta \leq -1$

[Lahore Board 2010]

(22) The range of y = cosx is:

(a) $-1 \leq x \leq 1$ (b) $-\infty < x < +\infty$

(c) $-1 \leq y \leq 1$ (d) $-\infty < y < +\infty$

[Lahore Board 2010]

(23) The smallest positive integer P for which f(P + x) = f(x) is called:

(a) Domain (b) Range

(c) Co-domain (d) Period

[Gujranwala Board 2010]

(24) The domain of sin x is:

(a) [−1, 1] (b) $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$

(c) R (d) Q

[Lahore Board 2011]

(25) The graphs of trigonometric functions, within their domains are:

(a) Continuous (b) Discontinuous

(c) Co-terminal (d) None of these

(26) Domain of y = cos x is:

(a) $-\infty < x < \infty$ (b) $-1 \leq x \leq 1$

(c) $R - \{x|x = n\pi\}\ n \in z$ (d) $R - \{x|x = 2n\pi\}\ n \in z$

[Lahore Board 2012]

(27) The period of $\tan \frac{x}{7}$ is:

(a) π (b) 7π

(c) $\frac{\pi}{7}$ (d) $\pi + 7$ **[Lahore Board 2012]**

(28) The period of $\tan \frac{x}{3}$ is:

(a) π (b) 2π

(c) 3π (d) None of these

[Lahore Board 2013]

(29) Period of 3 sin 3x is:

(a) 2π (b) $\frac{2\pi}{3}$

(c) $\frac{3\pi}{2}$ (d) 3π **[Lahore Board 2013]**

(30) In the graphs of tanx ; the dashes lines are:

(a) Horizontal asymptotes (b) Lines

(c) Vertical asymptotes (d) Periodic

(31) Point (30° , 0.87) lies on:

(a) y = cosx (b) y = sinx

(c) y = tanx (d) None of these

(32) Trigonometric function y = cosec x meet x-axis at x =

(a) 30° (b) 60°

(c) 90° (d) None

(33) All the trigonometric functions repeat their value. This behaviour is called:

(a) Period (b) Periodicity

(c) Continuity (d) None of these

(34) $\sin(2\pi + x)$ =

(a) $\sin(x + 4\pi)$ (b) $\sin(x + 3\pi)$

(c) $\cos(2\pi + x)$ (d) $\cos(3\pi + x)$

(35) Period of $\cos \frac{x}{2}$ = _____

(a) π (b) 2π

(c) 4π (d) 6π **[Lahore Board 2014]**

(36) Period of $\sin \frac{x}{3}$ is:

(a) π (b) 3π

(c) $\frac{2\pi}{3}$ (d) 6π **[Lahore Board 2014]**

Answers

(1)	d	*(2)*	a	*(3)*	a	*(4)*	c	*(5)*	b
(6)	a	*(7)*	c	*(8)*	b	*(9)*	a	*(10)*	a
(11)	a	*(12)*	c	*(13)*	b	*(14)*	c	*(15)*	a
(16)	d	*(17)*	a	*(18)*	c	*(19)*	b	*(20)*	d
(21)	a	*(22)*	c	*(23)*	d	*(24)*	c	*(25)*	a
(26)	a	*(27)*	b	*(28)*	c	*(29)*	b	*(30)*	c
(31)	a	*(32)*	d	*(33)*	b	*(34)*	a	*(35)*	c
(36)	d								

SOLUTION

Q.1 As period of sin x is 2π.

$$\Rightarrow \quad 3\sin\frac{x}{3} = 3\sin\left(\frac{x}{3} + 2\pi\right)$$

$$= 3\sin\frac{1}{3}(x + 6\pi)$$

$\Rightarrow$ Period of $3\sin\frac{x}{3}$ is 6π.

Q.2 As range of sinx is $[-1, 1]$

$\Rightarrow$ range of 7sinx is $[-7, 7]$

Q.10 As period of cosx is 2π.

$$\Rightarrow \quad \cos\frac{x}{5} = \cos\left(\frac{x}{5} + 2\pi\right)$$

$$= \cos\frac{1}{5}(x + 10\pi)$$

$\Rightarrow$ Period of $\cos\frac{x}{5}$ is 10π.

Q.11 The period of $\cot\pi$ x is π.

$$\Rightarrow \quad \text{Cot}\pi\ x = \cot(\pi x + \pi)$$

$$= \cot\pi\ (x + 1)$$

Period of $\cot\pi$ x is 1.

Q.29 Put, $(30°, 0.87)$ in $y = \cos x$

$\Rightarrow \quad 0.87 = \cos 30°$

$\Rightarrow \quad 0.87 = 0.87$ (Satisfy)

$\Rightarrow$ $(30°, 0.87)$ lies on $y = \cos x$

Q.30 The trigonometric function $y = \text{cosec}x$ does not meet x-axis at any point.

Q.32 As period of sinx is 2π.

$$\Rightarrow \quad \sin(2\pi + x)$$

$$= \sin(x + 2\pi)$$

$$= \sin(x + 2\pi + 2\pi)$$

$$= \sin(x + 4\pi)$$

Q.35 As period of $\cos x$ is 2π.

$$\cos x = \cos(2\pi + x)$$

$$\cos \frac{x}{2} = \cos\left(\frac{x}{2} + 2\pi\right)$$

$$= \cos \frac{1}{2}(x + 4\pi)$$

Period is 4π.

Q.36 As period of $\sin x$ is 2π.

$$\sin \frac{x}{3} = \sin\left(\frac{x}{3} + 2\pi\right)$$

$$= \sin \frac{1}{3}(x + 6\pi)$$

Period is 6π.