5.14 Graph of Trigonometric Functions:

In order to graph a function = f(x), we give number of values of x and obtain the corresponding values of y. The several ordered pairs (x, y) are obtained we plotted these points by a curve we get the required graph.

5.14.1 Graph of Sine Let, y = Sinx where, $0^\circ \le x \le 360^\circ$

Or where, $0 \le x \le 2\pi$

1. Variations

Quadrants

	1st	2nd	3rd	4th
x Sinx	0 to 90° + ve, Increase from 0 to 1	90° to 180° + ve, decrease from 1 to 0	180° to 270° – ve, decrease from 0 to -1	270° to 360° – ve, Increases from -1 to 0

2. Table:

x	0	30°	60°	90°	120°	150°	180°
Sinx	0	0.5	0.87	1	0.87	0.5	0

x	210°	240°	270°	300°	330°	360°
Sinx	-0.50	$-.87$	-1	$-.87$	$-.5$	0

3. Graph in Figure (5.19):

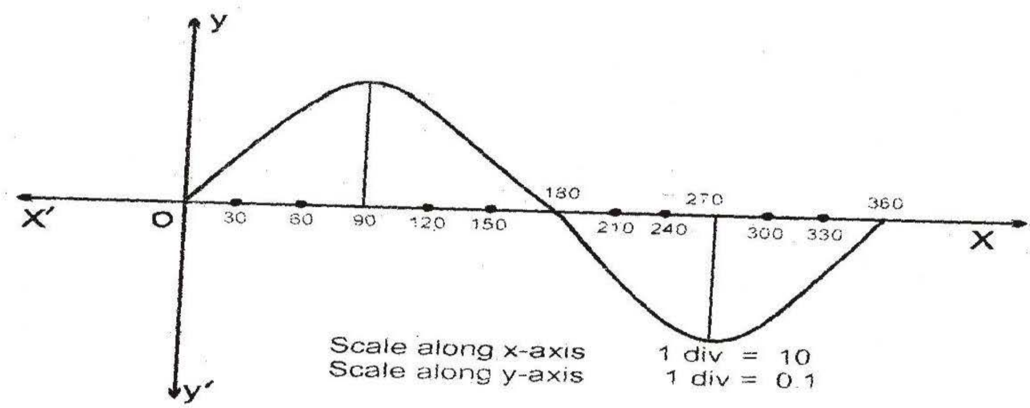

Fig. 4.19

5.14.2 Graph of Cosine

Let, y = Cosx where, $0^\circ \le x \le 360^\circ$

Or where, $0 \le x \le 2\pi$

1. Variations

Quadrants

	1st	2nd	3^{rd}	4^{th}
x y = Cosx	0 to 90^o + ve, decrease from 1 to 0	90^o to 180^o $-$ ve, decrease from 0 to -1	180^o to 270^o $-$ ve, increase from -1 to 0	270^o to 360^o + ve, increases from 0 to 1

2. Table:

x	0	30^o	60^o	90^o	120^o	150^o	180^o
y = Cosx	1	0.87	0.5	0	-0.5	-0.87	-1

x	210^o	240^o	270^o	300^o	330^o	360^o
y = Cosx	-0.87	-0.5	0	0.5	0.87	1

3. Graph in Figure (5.20):

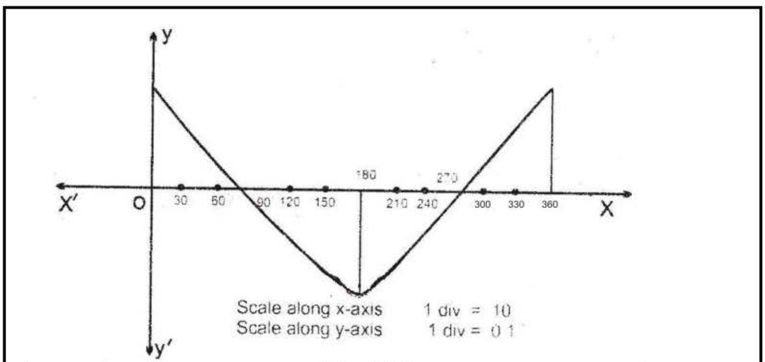

Fig. 4.20

5.14.3 Graph of tanx

Let, y = tanx where, $0^o \leq x \leq 360^o$

Or where, $0 \leq x \leq 2\pi$

1. Variations

Quadrants

	1^{st}	2nd	3rd	4^{th}
x y = tanx	0 to 90^o + ve, Increase from 0 to $\propto$	90^o to 180^o $-$ve, increase from $-\propto$ to 0	180^o to 270^o + ve, increase from 0 to $\propto$	270^o to 360^o $-$ve, increases from $-\propto$ to 0

2. Table:

x	0	30^o	60^o	90^o	120^o	150^o	180^o
y = tanx	0	0.58	1.73	$\propto$	-1.73	-0.58	0

x	210^o	240^o	270^o	300^o	330^o	360^o
y = tanx	+ .58	1.73	$-\propto, +\propto$	-1.73	-2.58	0

3. Graph in Figure (5.21):

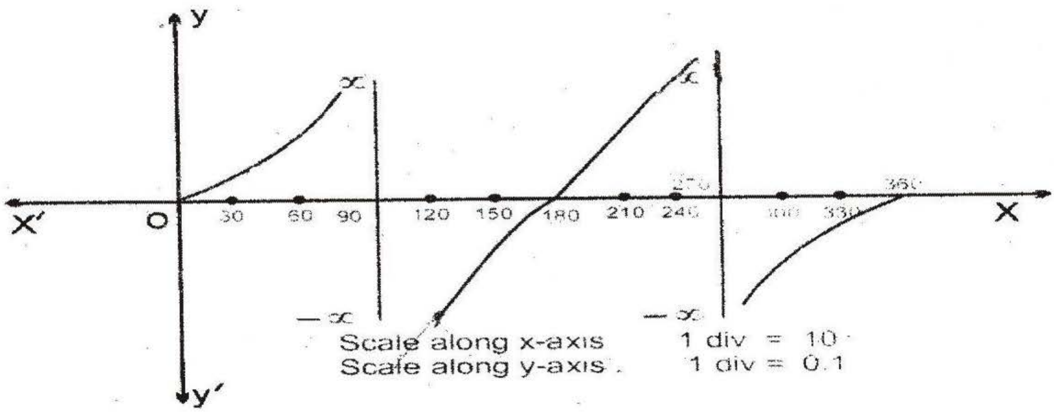

Fig. 4.21

Fig. 5.21

5.14.4 Graph of Cotx:

Let, y = cotx where, $0^o \leq x \leq 360^o$

1. Variations

Quadrants

	1^{st}	2nd	3rd	4^{th}
x y = Cotx	0 to 90^o + ve, Increase from $\propto$ to 0	90^o to 180^o $-$ve, increase from 0 to $-\propto$	180^o to 270^o + ve, increase from $\propto$ to 0	270^o to 360^o $-$ve, increases from 0 to $-\propto$

2. Table:

x	0	30^o	60^o	90^o	120^o	150^o	180^o
y = Cotx	$\propto$	1.73	0.58	0	-0.58	-1.73	$-\propto$

x	210^o	240^o	270^o	300^o	330^o	360^o
y = Cotx	1.73	0.58	0	-0.58	-1.73	$\propto$

3. Graph in Figure (5.22):

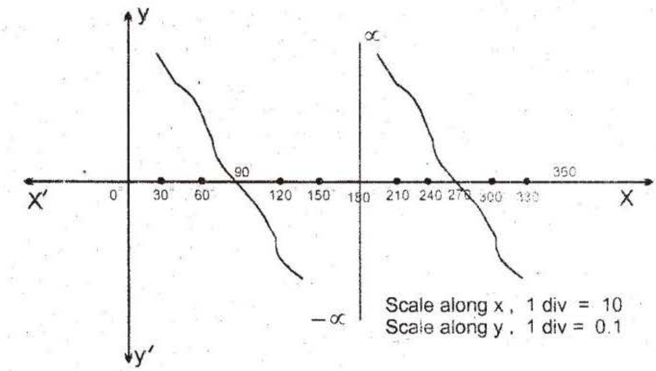

Fig. 4.22

5.14.5 Graph of Secx:

Let, y = secx where, $0^o \leq x \leq 360^o$

1. Variations

Quadrants

	1^{st}	2nd	3rd	4^{th}
x y = Secx	0 to 90^o + ve, Increase from 1 to ∝	90^o to 180^o − ve, increase from − ∝ to − 1	180^o to 270^o − ve, increase from − 1 to − ∝	270^o to 360^o + ve, increases from − ∝ to 1

2. Table:

x	0	30^o	60^o	90^o	120^o	150^o	180^o
y = Secx	1	1.15	2	+∝	−2	1.15	1

x	210^o	240^o	270^o	300^o	330^o	360^o
y = Secx	−1.15	−2	∝	2	1.15	1

3. Graph in Figure (5.23):

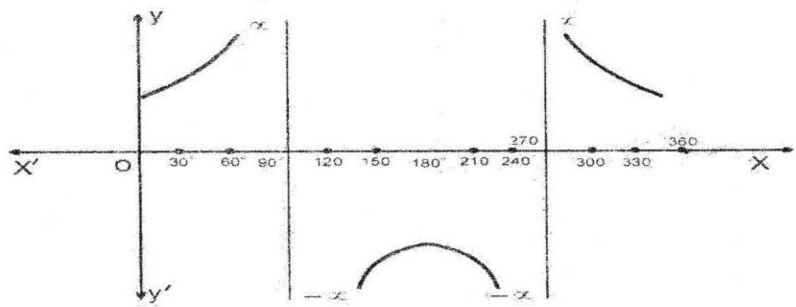

Fig. 4.23

5.14.6 Graph of Cosecx: Let, y = Cosecx

where, $0^o \leq x \leq 360^o$

1. Variations

Quadrants

	1st	2nd	3rd	4th
x y = Cosecx	0 to 90^o + ve, Increase from $\propto$ to 1	90^o to 180^o + ve, increase from 1 to $\propto$	180^o to 270^o $-$ ve, increase from $-\propto$ to -1	270^o to 360^o $-$ ve, increases from -1 to $-\propto$

2. Table:

x	0	30^o	60^o	90^o	120^o	150^o	180^o
y = Cosecx	$\propto$	2	1.15	1	1.15	2	$\propto$

x	210^o	240^o	270^o	300^o	330^o	360^o
y = Cosecx	-2	-1.15	-1	-1.15	-2	$-\propto$

3. Graph in Figure (5.24):

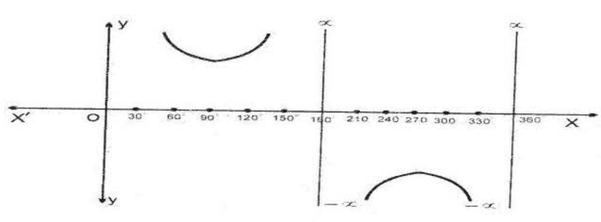

Fig. 4.24

Fig.5.24

Exercise 5.4

Q.1 Draw the graph of tan 2A as A varies from 0 to π.

Q.2 Plot the graph of 1 – Sin x as x varies from 0 to 2π.

Q.3 Draw the graphs for its complete period.

(i) $y = \frac{1}{2}\text{Sin } 2x$ (ii) $y = \text{Sin } 2x$

(iii) $y = \frac{1}{2}\text{Cos } 2x$

Summary

Trigonometry means measurement of triangles.

1. Radian is an angle subtended at the center of a circle by an arc of the circle equal in length to its radius.

   i.e. π Radian = 180 degree

   1 rad = $57^{o}\ 17'\ 45''$

   1 degree = 0.01745 radian

2. Length of arc of the circle, $l = s = r\theta$

3. Trigonometric functions are defined as:

$$\text{Sin}\theta = \frac{AP}{OP}, \text{Cosec}\theta = \frac{OP}{AP}$$

$$\text{Cos}\theta = \frac{OA}{OP}, \text{Sec}\theta = \frac{OP}{OA}$$

$$\tan\theta = \frac{AP}{OA}, \text{Cot}\theta = \frac{OA}{AP}$$

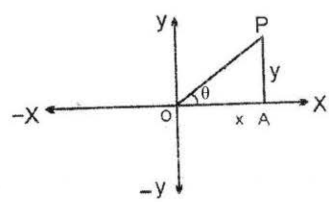

Fig. 4.25

4. Relation between trigonometric ratios:

(i) $\text{Sec}\theta = \frac{1}{\text{Cos}\theta}$ (ii) $\text{Cosec}\theta = \frac{1}{\text{Sin}\theta}$

(iii) $\text{Cot}\theta = \frac{1}{\tan\theta}$ (iv) $\text{Cos}\theta = \frac{1}{\text{Sec}\theta}$

(v) $\text{Sin}\theta = \frac{1}{\text{Cosec}\theta}$ (vi) $\tan\theta = \frac{1}{\text{Cot}\theta}$

(vii) $\text{Sin}^2\theta + \text{Cos}^2\theta = 1$ (viii) $\text{Sec}^2\theta = 1 + \tan^2\theta$

(ix) $\text{Cosec}^2\theta = 1 + \text{Cot}^2\theta$

5. Signs of the trigonometric functions in the Four Quadrants.

Quadrant	I	II	III	IV
Positive	All +ve	Sinθ, Cosecθ	tanθ, cotθ	Cosθ, Secθ
Negative	Nil	Cosθ Secθ tanθ Cotθ	Cosθ Secθ Sinθ Cosecθ	Sinθ Cosecθ tanθ Cotθ