Al-Mustaqbal University
College of Sciences
Intelligent Medical Systems Department

جامـــعـة المــســتـقـبـل
AL MUSTAQBAL UNIVERSITY

# كلية العـــــلوم
# قـــســـم الامن السيبراني

## LECTURE: (4)

**Subject:** Trigonometric Function
**Level: First**
**Lecturer: Dr. Mustafa Talal**

(ii) $f(\chi) = 3X^5 - 2X + 7$ polynomial of degree five.

(iii) F $(\chi)$ = 8 polynomial of degree Zero.

**Notes:**

The value of $\chi$ which make the polynomial f $(\chi)$ = 0 are called the roots of the equation $(f(\chi) = 0)$

Example: $(\chi)$ = 2 is the root of the polynomial

$F(\chi) = \chi^2 - \chi - 2$

Since f (2) = 0

Example: F $(\chi)$ Linear function if

$F(\chi) = a\chi + b$.

**Even Function**:

F $(\chi)$ is even if f (-x) = F (x)

Example: 1 - F $(\chi) = (\chi)^2$ is even since $f(-\chi) = (-\chi)^2 = (\chi)^2 = f(\chi)$

2 - F $(\chi)$ = cos $(\chi)$ is even because $f(-\chi) = \cos(-\chi) = \cos(\chi) = f(\chi)$

**Odd Function:**

If $f(-\chi) = -f(\chi)$ the function is called odd.

Example: 1 - $f(\chi) = \chi^3$ is odd since $f(-\chi) = -\chi 3 = -f(\chi)$

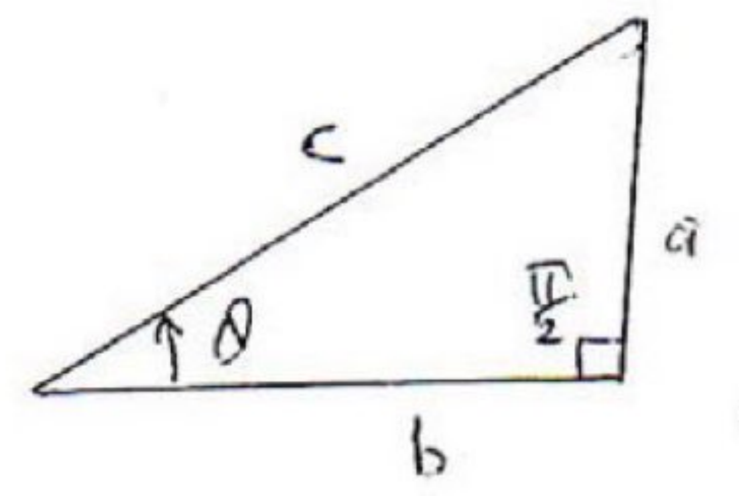
2 - $f(\chi) = Sin(-\chi) = -Sin X = -f(\chi)$.

**Trigonometric Function:**

1 – Sin $\varphi = \frac{a}{c}$

$2 - \text{Cos} \ \varphi = \dfrac{b}{c}$

$3 - \tan \ \varphi = \dfrac{a}{b}$



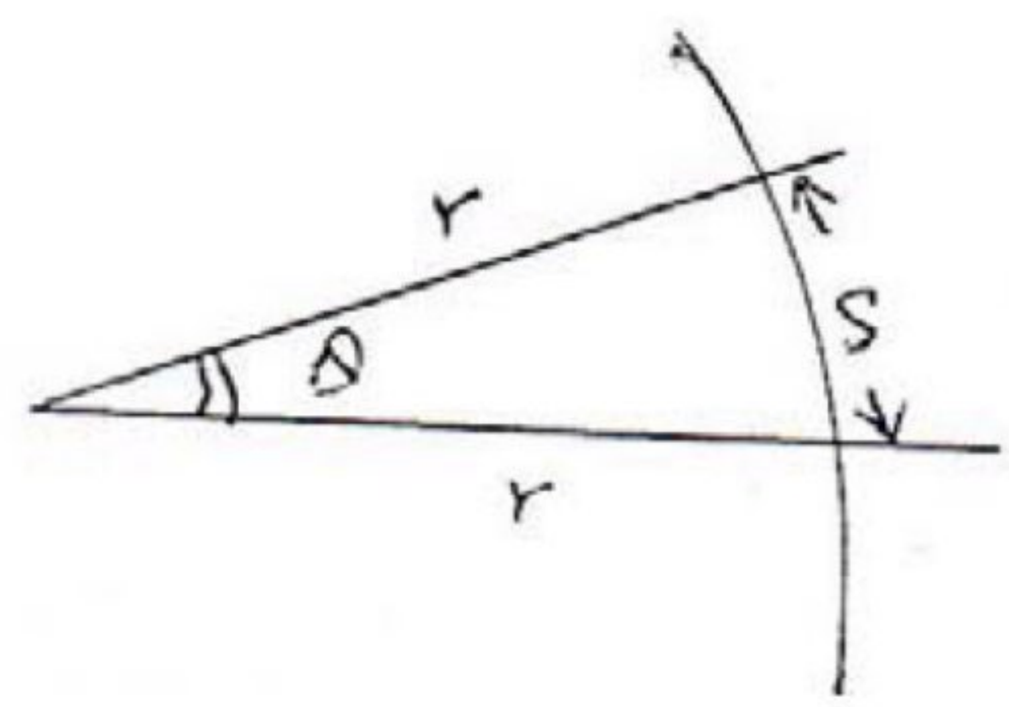

$4 - \text{Cotan} \ \varphi = \dfrac{1}{\tan\varphi} = \dfrac{b}{a}$

$5 - \text{Sec} \ \varphi = \dfrac{1}{\cos\varphi} = \dfrac{c}{b}$

$6\text{- CSC} \ \varphi = \dfrac{1}{Sin\,\varphi} = \dfrac{c}{a}$

**Relation ships between degrees and radians**

$\varphi$ In radius $= \dfrac{s}{r}$




$$360^{\circ} = \frac{2\pi r}{r}$$
$$= 2\pi \ radius$$

$1^{\circ} = \dfrac{\pi}{180}$ radius = 0.0174 radian

$1 \text{ radian} = \dfrac{180}{\pi} \deg ree = 57.29578^{\circ}$

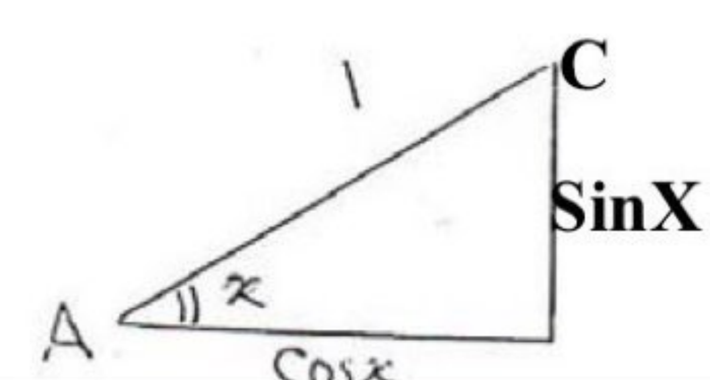
$\left(\dfrac{360}{2\pi}\right) = 1 radian = 57^{\circ}.18$

$180^{\circ} = \pi$ radians = 3.14159 – radians

$1^{\circ} = \dfrac{2\pi}{360} = \dfrac{\pi}{180} \approx 0.001754$ radians

$\tan\chi = \dfrac{\sin\chi}{\cos\chi}$

$Cot\chi = \dfrac{Cos\chi}{Sin\chi} = \dfrac{1}{\tan\chi}$



**B**

$$Sec\ \chi = \frac{1}{\cos \chi}$$

$$Csc\ \chi = \frac{1}{\sin \chi}$$

$$Cos^2\ \chi + Sin^2\ \chi = 1$$

$$\tan^2\ \chi + 1 = Sec^2\chi$$

$$Cot^2\ \chi + 1 = Csc^2\ X$$

$$Sin(\chi \pm y) = Sin \times Cosy\ \mu\ Cos \times Sin\ y$$

$$Cos(\chi \pm y) = Cos \times Cosy \pm Sin \times Siny$$

$$\tan(\chi \pm y) = \frac{\tan x \pm \tan y}{1\ \mu \tan x \tan y}$$

1 – $SinA + Sin\,B = 2\,Sin\,\frac{A+B}{2}\,Cos\,\frac{A-B}{2}$

2 - $Sin\,A - Sin\ B = 2\,Cos\ \frac{A+B}{2}\ Sin\ \frac{A-B}{2}$

3 – $Cos\,A + Cos\ b = 2\,Cos\ \frac{A+B}{2}\ Cos\ \frac{A-B}{2}$

4 - $Cos\,A - Cos\,B = 2\,Sin\,\frac{A+B}{2}\ Sin\,\frac{A-B}{2}$

$$Sin\,2\,X = 2\,Sin\ X\ CosX$$

$$Cos^2 = Cos^2 X - Sin^2 X$$

$$= 1 - 2\,Sin^2 X$$

$$= 2Cos^2 X - 1$$

$$Cos^2 x = \frac{1 + Cos^2 x}{2}$$

$$Sin^2\ x = \frac{1 - Cos^2 x}{2}$$

$$Sin(\varphi + 2\pi) = Sin\,\varphi$$

$$Cos(\varphi + 2\pi) = Cos\,\varphi$$

$$\tan(\varphi + \pi) = \tan\varphi$$

| Degree | O° | 30° | 45° | 60° | 90° | 180° | 270° | 360° |
|---|---|---|---|---|---|---|---|---|
| $\theta$ radius | O | $\frac{\pi}{6}$ | $\frac{\pi}{4}$ | $\frac{\pi}{3}$ | $\frac{\pi}{2}$ | $\pi$ | $\frac{3\pi}{2}$ | $2\pi$ |
| Sin $\theta$ | O | $\frac{1}{2}$ | $\frac{1}{\sqrt{2}}$ | $\sqrt{\frac{3}{2}}$ | 1 | O | -1 | O |
| Cos $\theta$ | 1 | $\sqrt{\frac{3}{2}}$ | $\frac{1}{\sqrt{2}}$ | $\frac{1}{2}$ | O | -1 | O | 1 |
| tan $\theta$ | O | $\frac{1}{\sqrt{3}}$ | 1 | $\sqrt{3}$ | | | | |

$$Cos(\varphi + 2n\pi) = Cos\,\varphi$$
$$Sin\,(\varphi + 2n\pi) = Sin\,\varphi$$
$$Cos(-\varphi) = Cos\,\varphi$$
$$Sin\,(-\varphi) = -Sin\,\varphi$$
$$Cos(\frac{\pi}{2} + \varphi) = Cos\,\varphi$$
$$\tan\,(\pi - \varphi) = -\tan\varphi$$
$$\tan\,(\frac{\pi}{2} + \varphi) = -Cot\varphi$$

**Graphs:**

The set of points in the plane whose coordinate pairs are also the ordered pairs of function is called the graph of function.

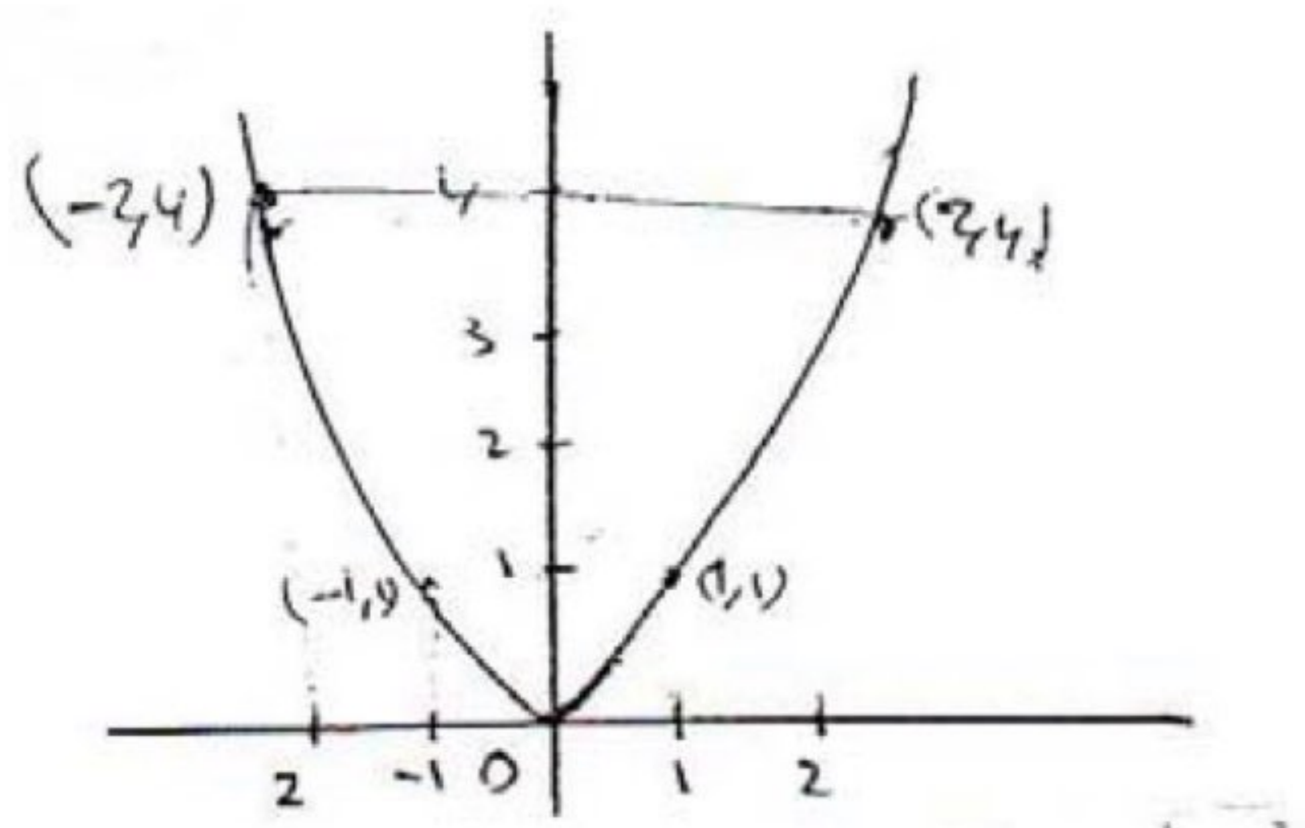
Example: Graph a function we carry out three steps $y = \chi^2, -2 \le x \le 2$

1 – Make a table of pairs from the function as

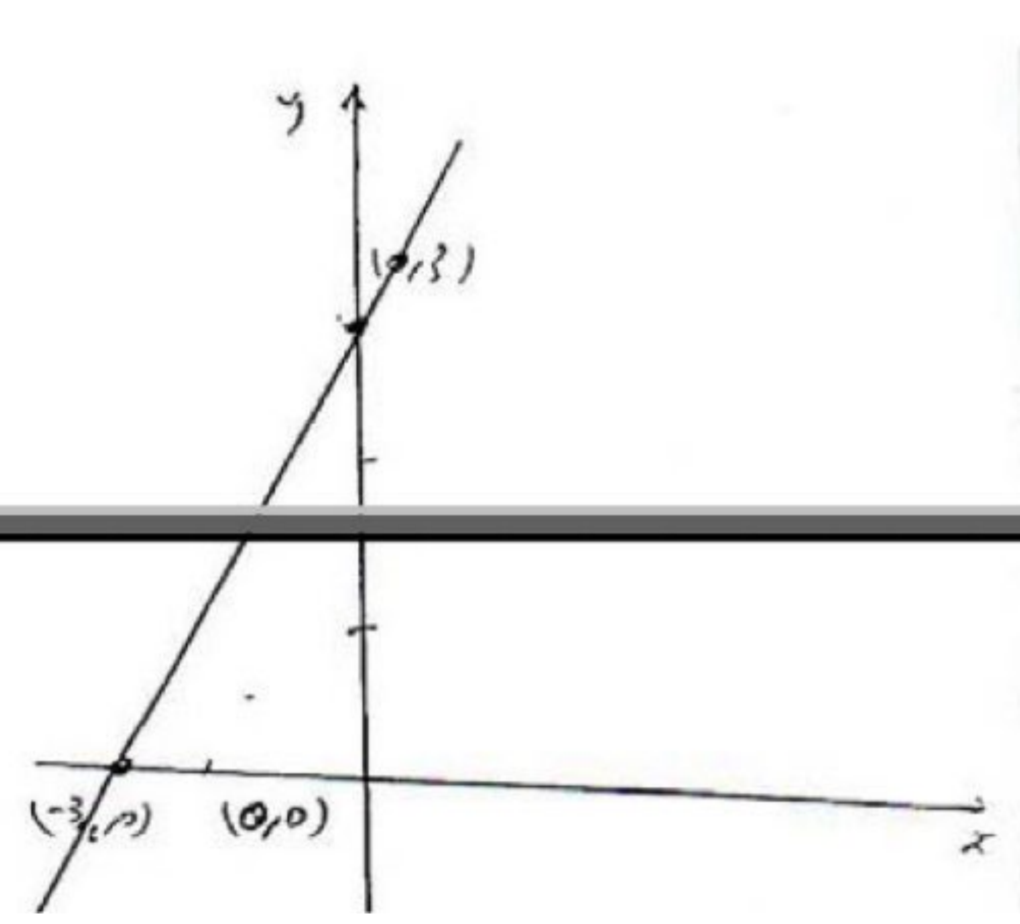
| $\chi$ | $y = \chi^2$ | $(\chi, y)$ |
|---|---|---|
| -2 | 4 | (2,4) |
| -1 | 1 | (-1,1) |
| 0 | 0 | (0,0) |
| +1 | 1 | (1,1) |
| 2 | 4 | (2,4) |

2 – Plot enough of the corresponding points to learn the shape of the graph. Add more pairs to the table if necessary.

3 – Complete the sketch by connecting the points.




Example: $y = 2\chi + 3$



| X | $y = 2X + 3$ | (X,y) |
|---|---|---|
| O | 3 | (0,3) |
| $-\frac{3}{2}$ | O | $(\frac{-3}{2},0)$ |

**Absolute Value:**

We define the absolute value function $y = |\chi|$, the function assign every negative number to non-negative, which corresponding points.

The absolute values of X:

$$|X| = \sqrt{X^2} = \begin{cases} \chi & if X \geq 0 \\ -\chi & if X \langle 0 \end{cases}$$

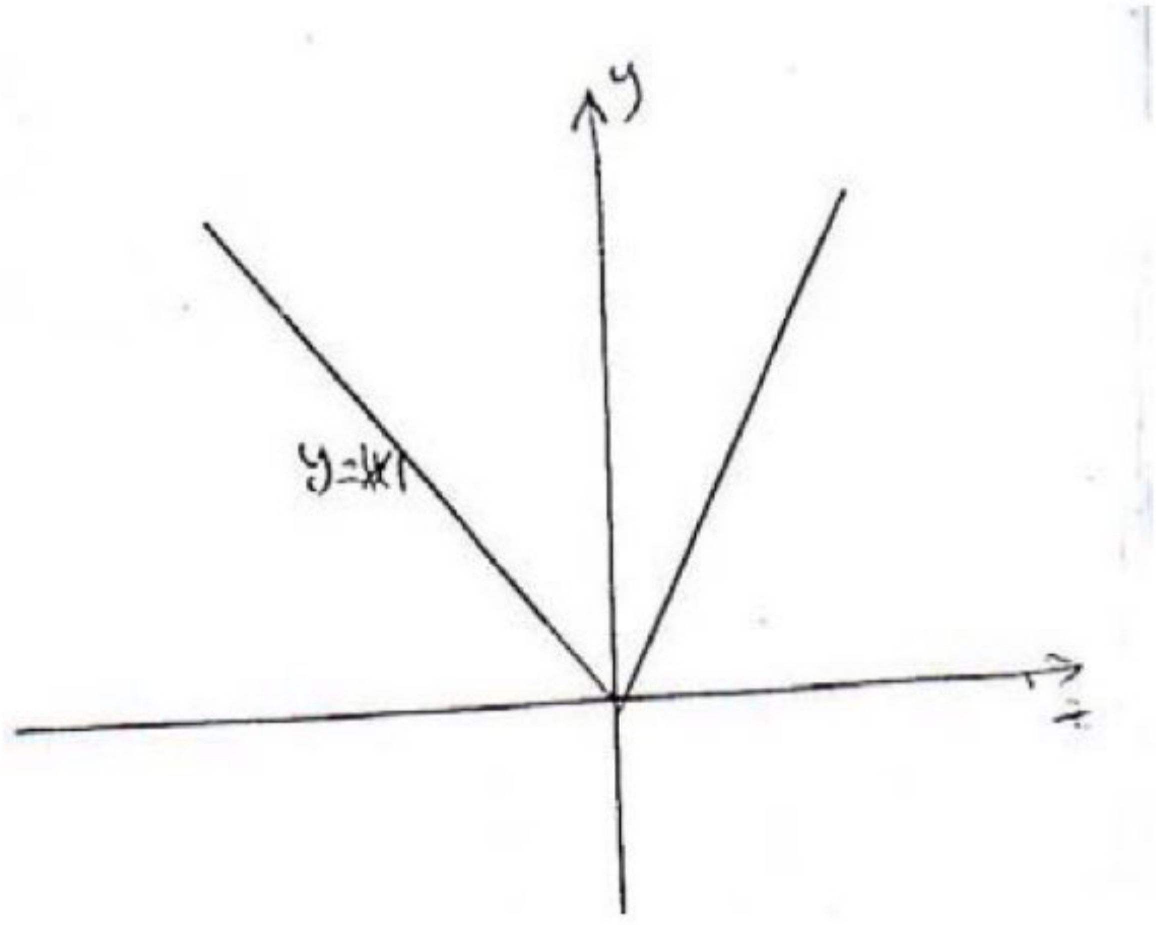
Then:

1 - $|a.b| = |a|,|b|$

2 - $|a + b| \leq |a| + |b|$

3 - $|a| \leq C \Leftrightarrow -C \leq a \leq C$

$y = f(\chi) = \chi$



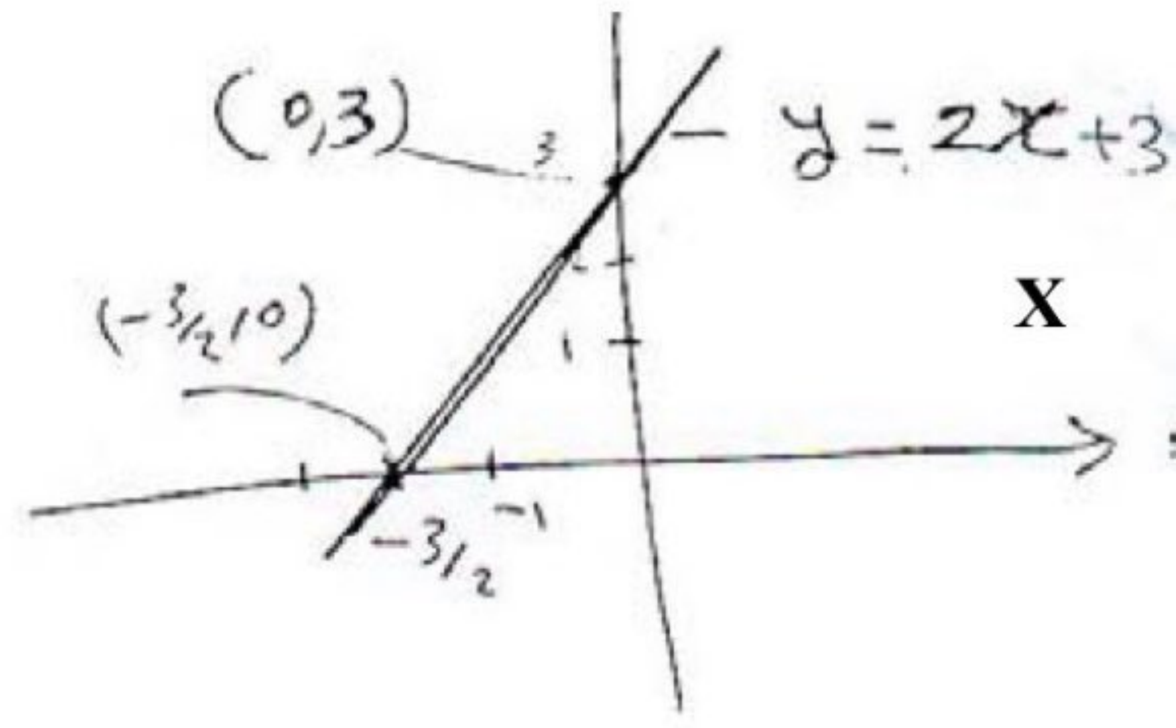

| X | y | (X,y) |
|---|---|---|
| -1 | 1 | ( -1,1) |
| 0 | 0 | (0,0) |
| 1 | 1 | (1,1) |

**Example 2:**

$y = f(\chi) = a\chi + b$

$y = f(\chi) = 2\chi + 3$

| **X** | **y** | **(X,y)** |
|---|---|---|
| O | 3 | (0,3) |
| $-\frac{3}{2}$ | 0 | $(-\frac{3}{2}, 0)$ |



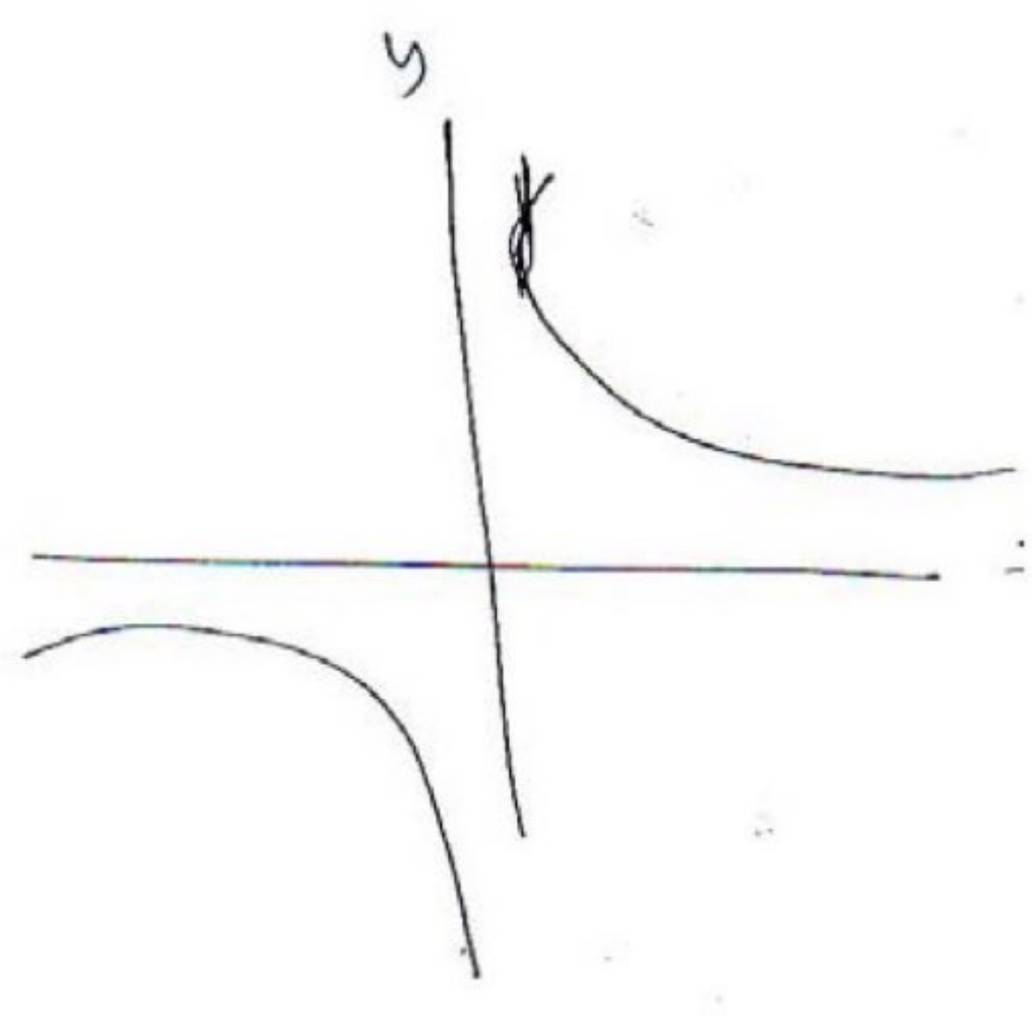

**Example 3:**

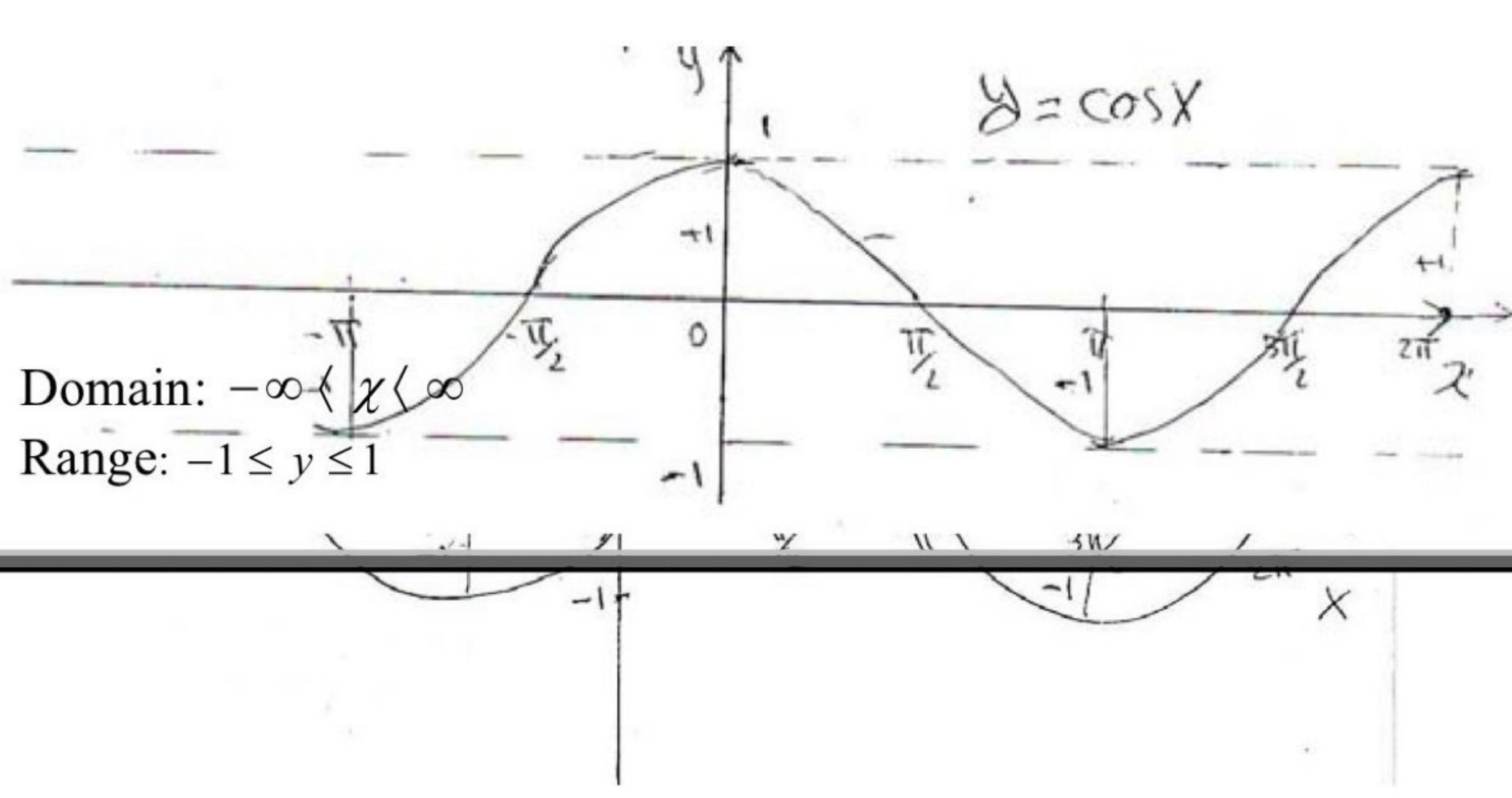
$y = f(\chi) = \frac{1}{\chi}$

| X | y | (X,y) |
|---|---|---|
| 1 | 1 | (1,1) |
| -1 | -1 | (-1,1) |
| $\frac{1}{2}$ | 2 | $(\frac{1}{2},2)$ |
| $\frac{1}{3}$ | 3 | $(\frac{1}{3},3)$ |
| 2 | $\frac{1}{2}$ | $(2, \frac{1}{2})$ |
| 3 | $\frac{1}{3}$ | $(3, \frac{1}{3})$ |

Domain: $-\infty \langle \chi \langle \infty$

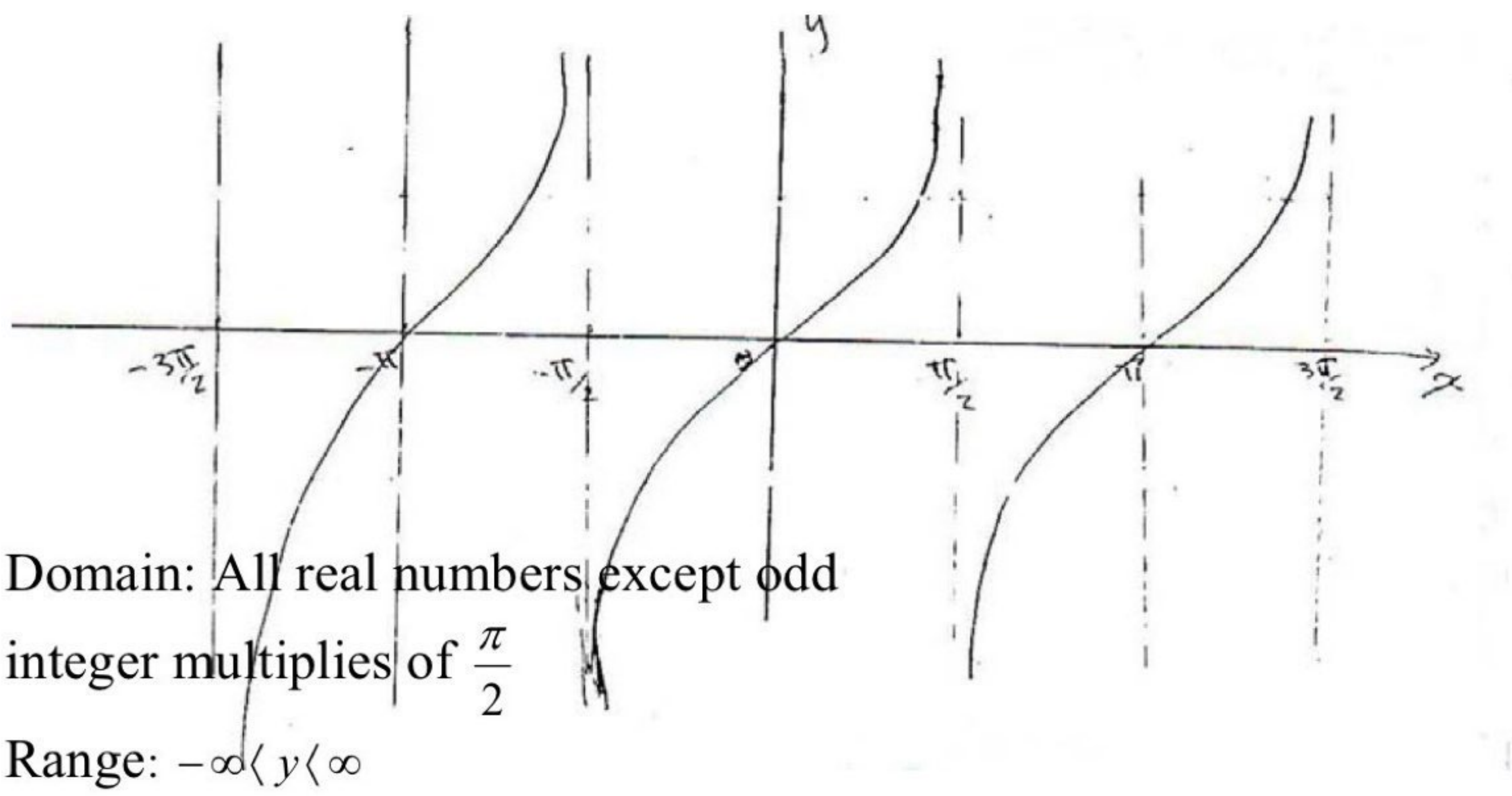
Range: $-1 \leq y \leq 1$




Domain: $-\infty \langle \chi \langle \infty$

Range: $-1 \leq y \leq 1$




Domain: All real numbers except odd integer multiplies of $\frac{\pi}{2}$

Range: $-\infty \langle\, y \,\langle \infty$