Class XI – MATHEMATICS

Chapter 2 – RELATIONS AND FUNCTIONS

Module – 2/2

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Distance Learning Programme :   An initiative by AEES, Mumbai

Learning Outcome:

In this module we are going to learn about

➢ **Functions**

➢ **Domain, Co-domain and Range of a Function**
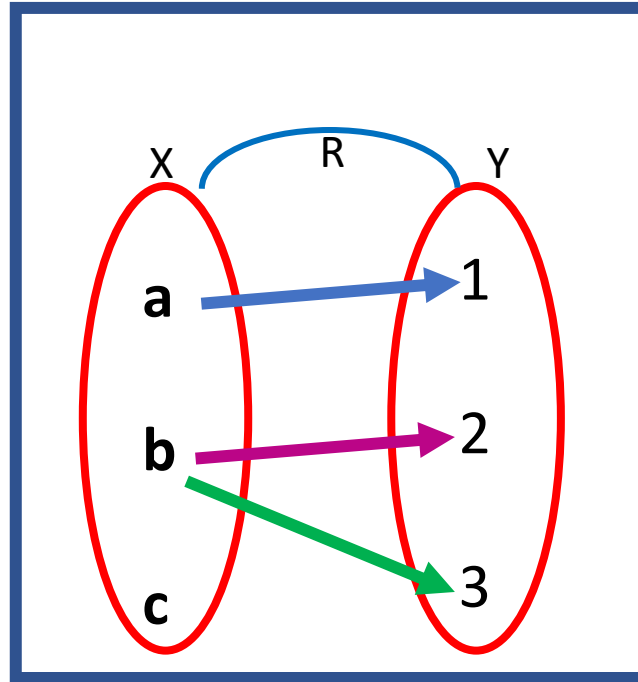
➢ **Different Types of functions**

FUNCTIONS

➢ **A function f from a set A to a set B is a special relation in which, every element of set A has unique image in set B.**

➢ **The function f from A to B is denoted by f : A → B**

➢ **If, f(a) = b, then 'b' is called the image of 'a' under f and 'a' is called the pre image of 'b' under f.**
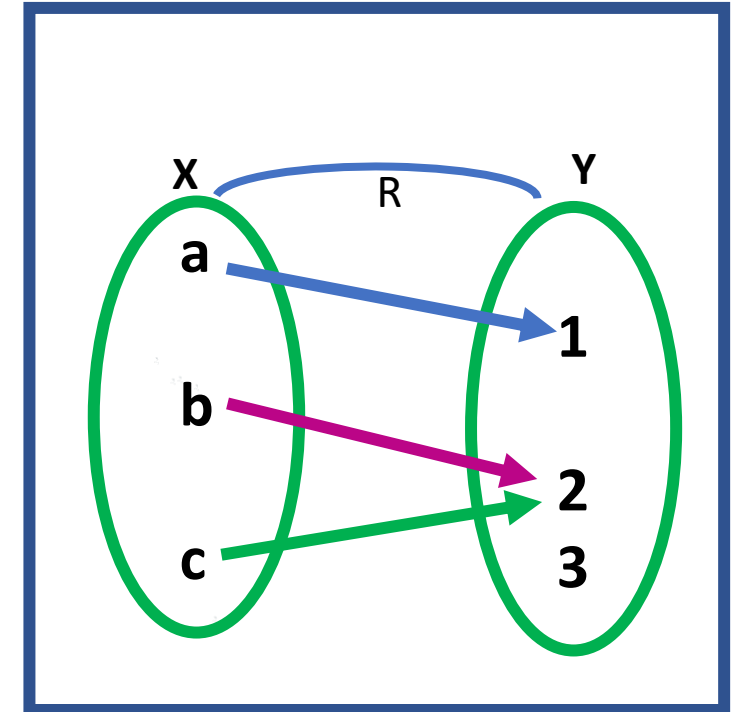
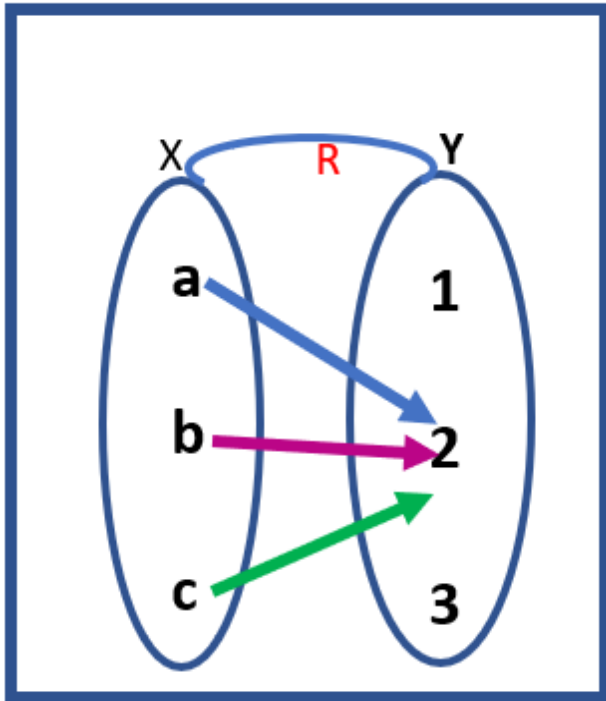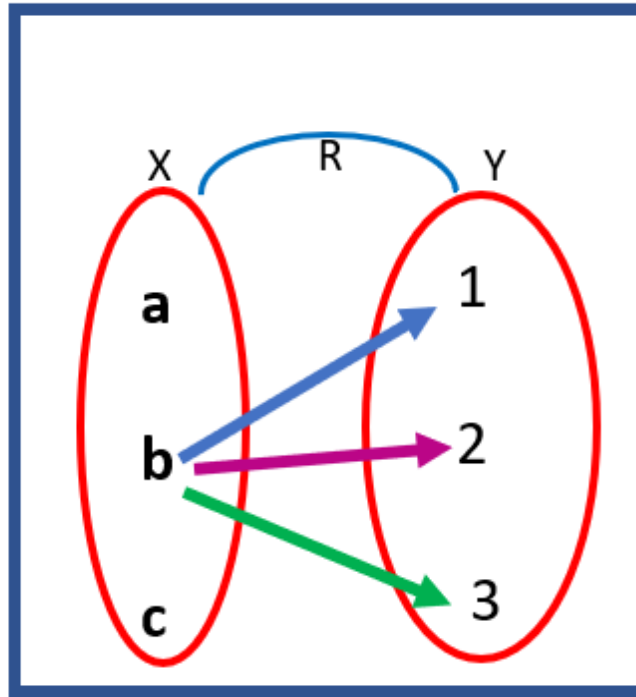# In the following diagrams, which of the relations are functions?

(i)

(ii)

(iii)
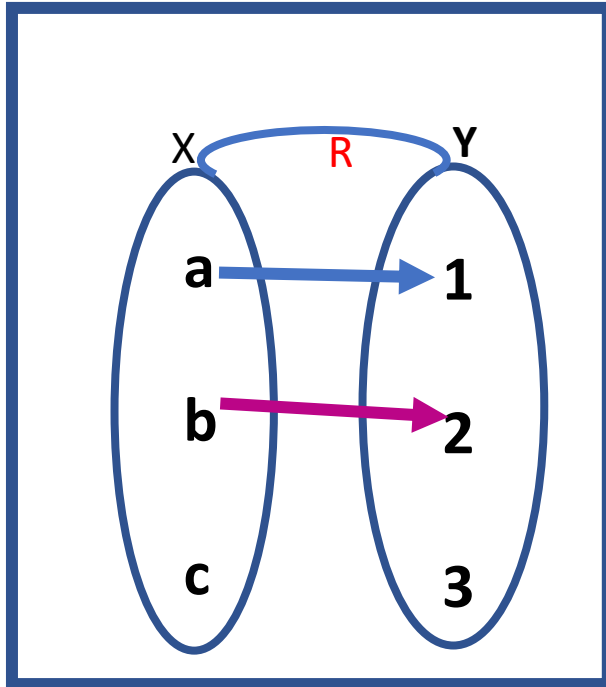
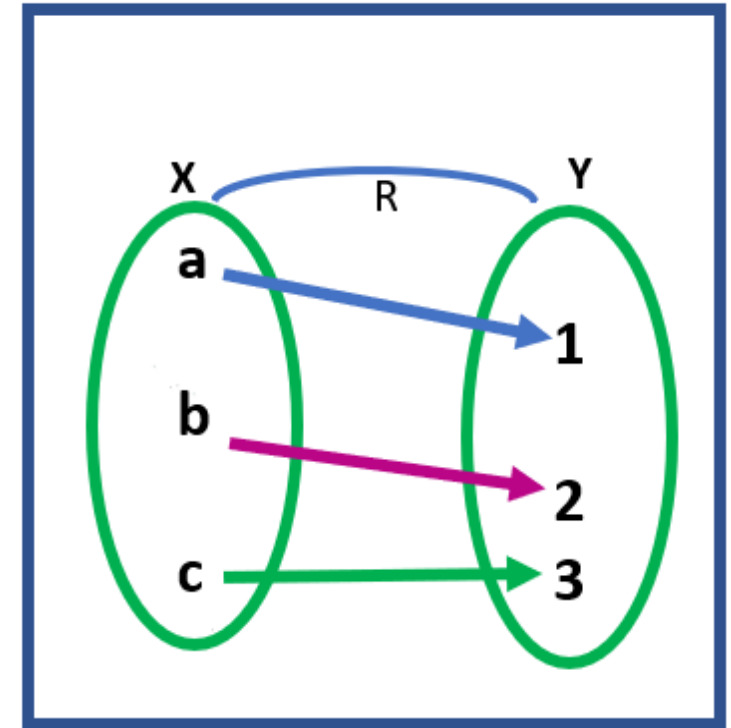Figures (iii) represents function.

In the following diagrams, which of the relations are functions?

(iv)

(v)

(vi)

Figures (iv) & (vi) represent functions

Example

Let A ={1,2,3,4,5,6}. Define a relation R on A by R = {(x , y) : y = x + 1 }

i) Write down the domain, codomain and range of R.
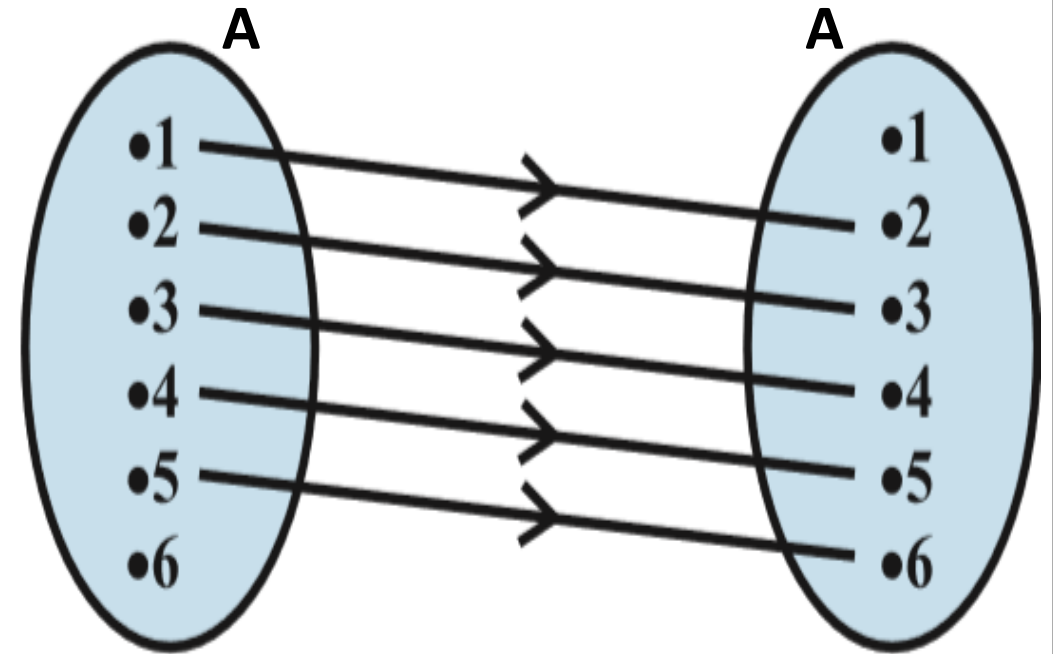
ii) Is the given relation a function? Give reason.

Solution:

i). Domain = {1, 2, 3, 4, 5}.

Co-domain = {1, 2, 3, 4, 5, 6},

Range = {2, 3, 4, 5, 6}

iii) Since the element 6 is not having
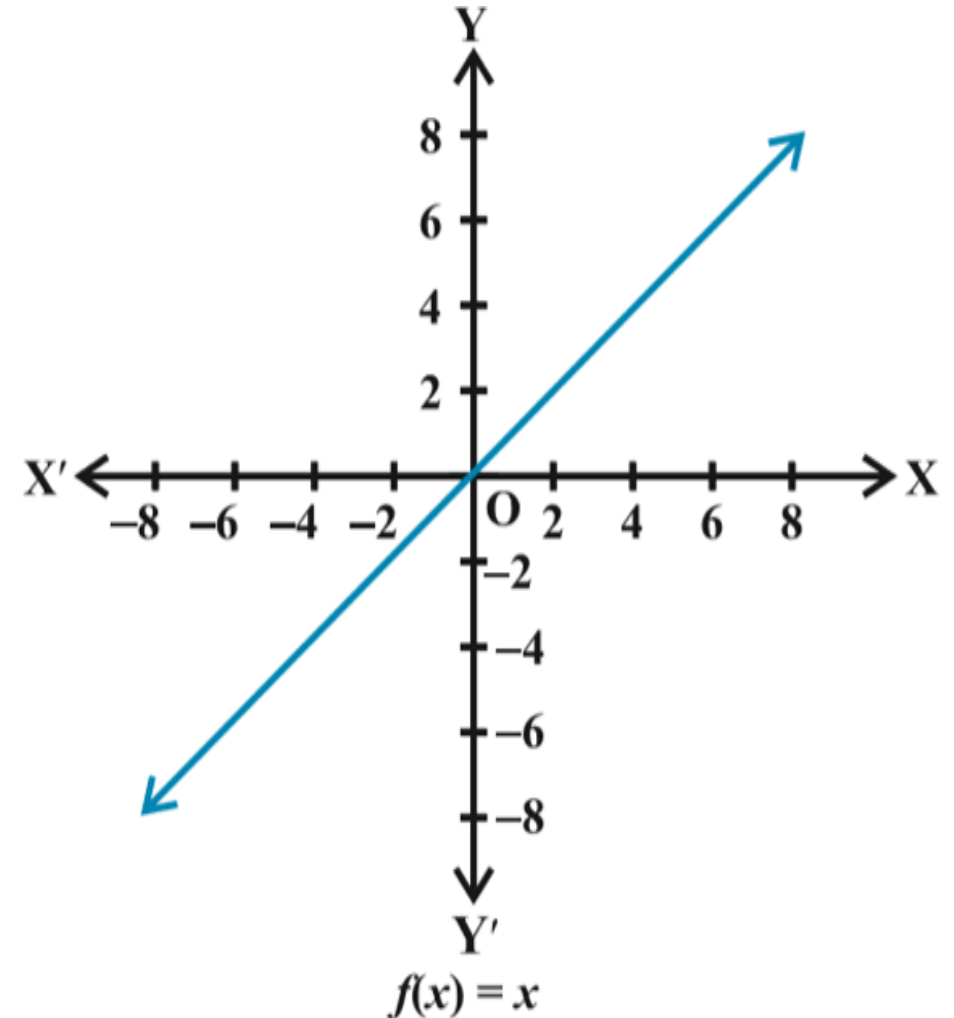
an image, this relation is not a function.

Types of functions

1) Identity function

The function f : R→ R defined

by, y = f(x) = x , x ∈ R is called

the identity function.

Domain = R, Range = R.

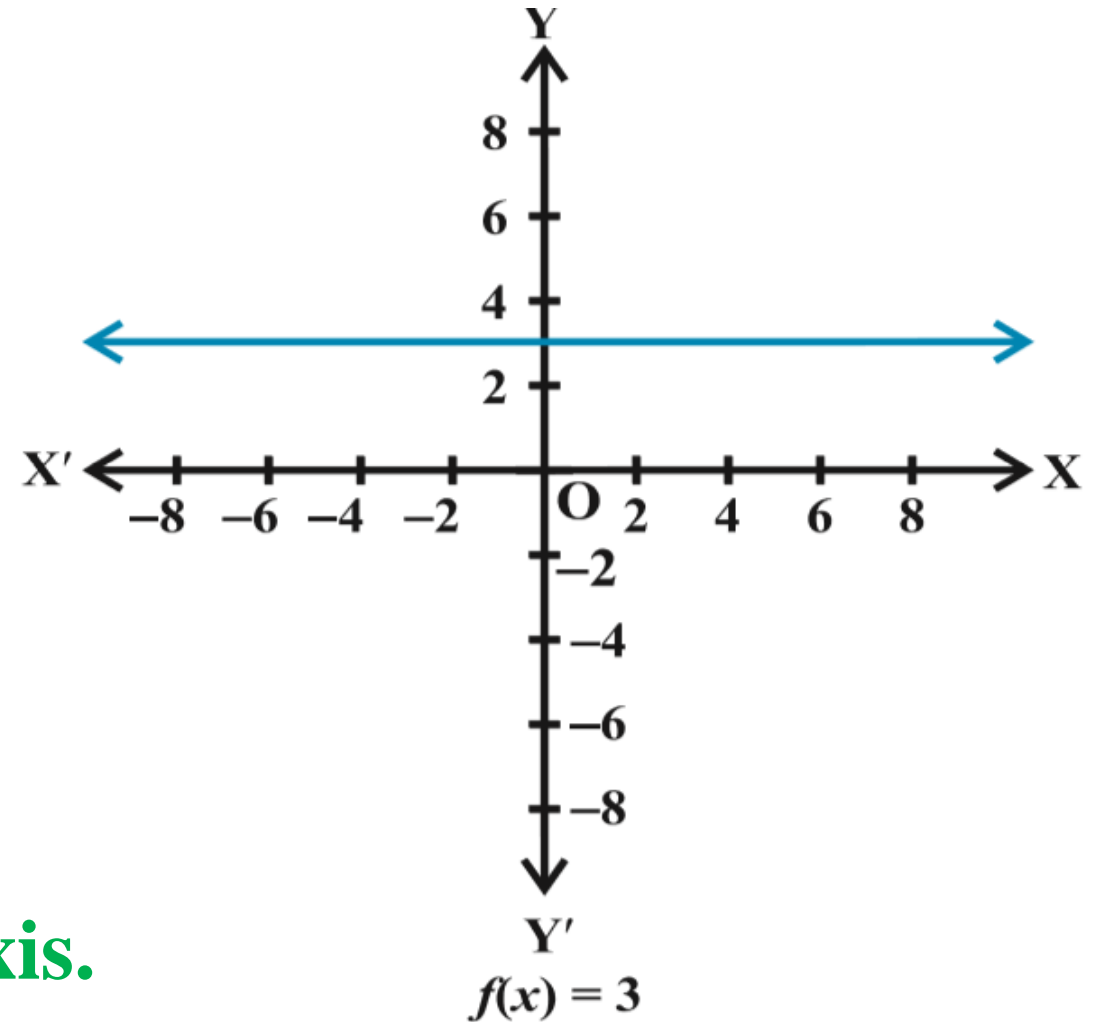The graph is a straight line. It

passes through the origin.

$f(x) = x$

2) Constant function:

The function f : R → R defined

by, $y = f(x) = c, x \in$ R where c is a

constant is called constant

function.

Domain = R, Range = {c}.

The graph is a line parallel to x-axis.

$f(x) = 3$

3) Polynomial function:

A function f: R $\rightarrow$ R defined by f (x) = a_0 + $a_1 x$ + a_2x^2 + ...+ a_n x^n, where n is a non-negative integer and $a_0, a_1, \ldots \ldots a_n$ $\in$ R is called a polynomial function.

Note:

1). The function f(x) = ax + b, x $\in$ **R**, is called a linear function.

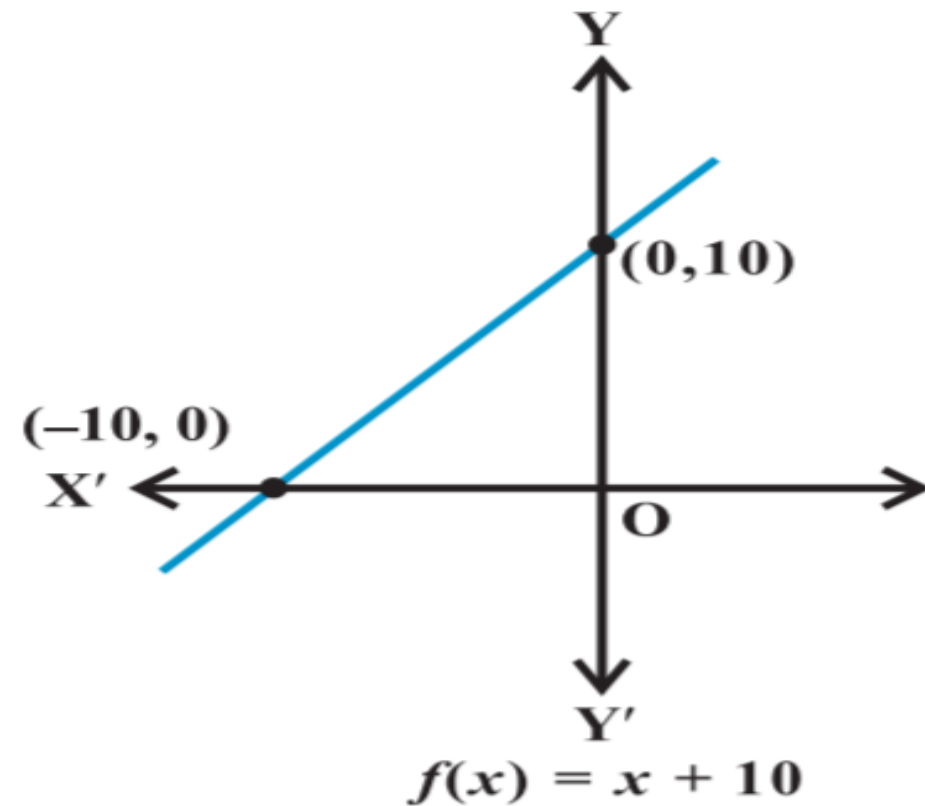2) The function f(x) = ax^2 + bx + c, x $\in$ **R**, is called a quadratic function, where a , b and c $\in$ **R**

Graph of some polynomial functions

i) Linear function

Example :

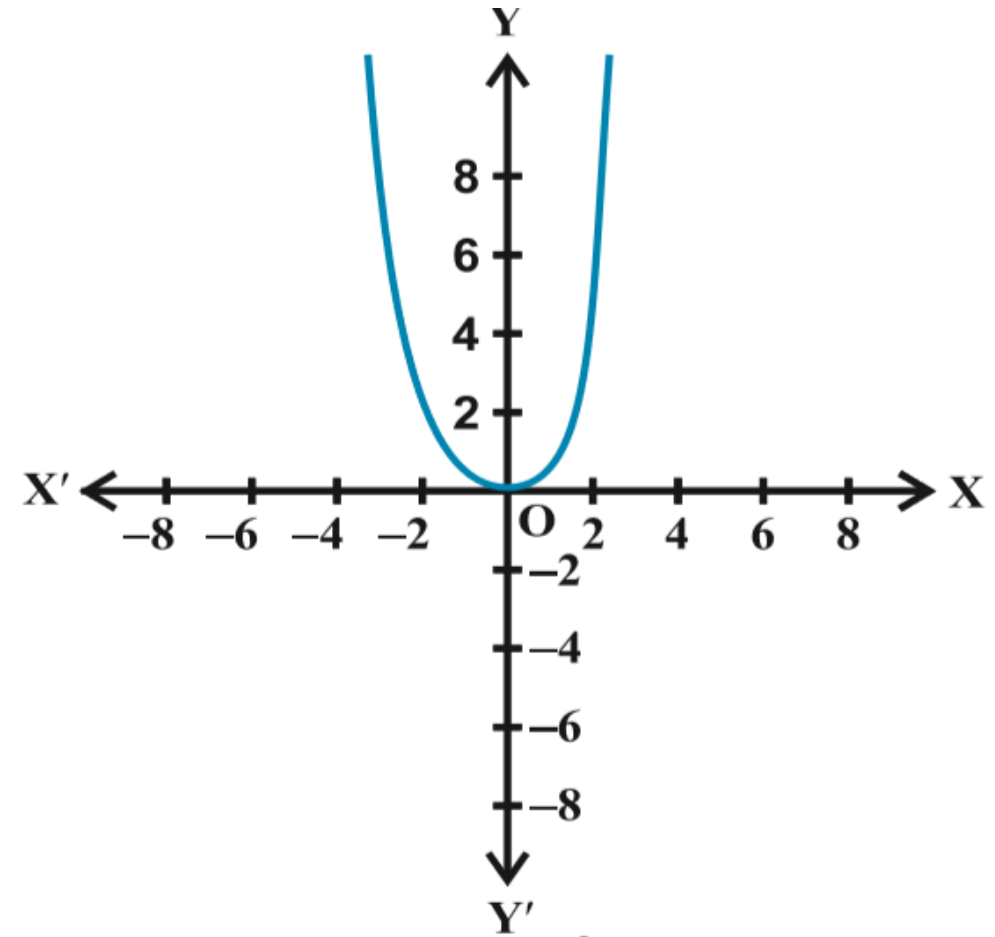Draw the graph of

$f(x) = x + 10$

$f(x) = x + 10$

ii) Quadratic Function

Example:

Draw the graph of $f(x) = x^2$
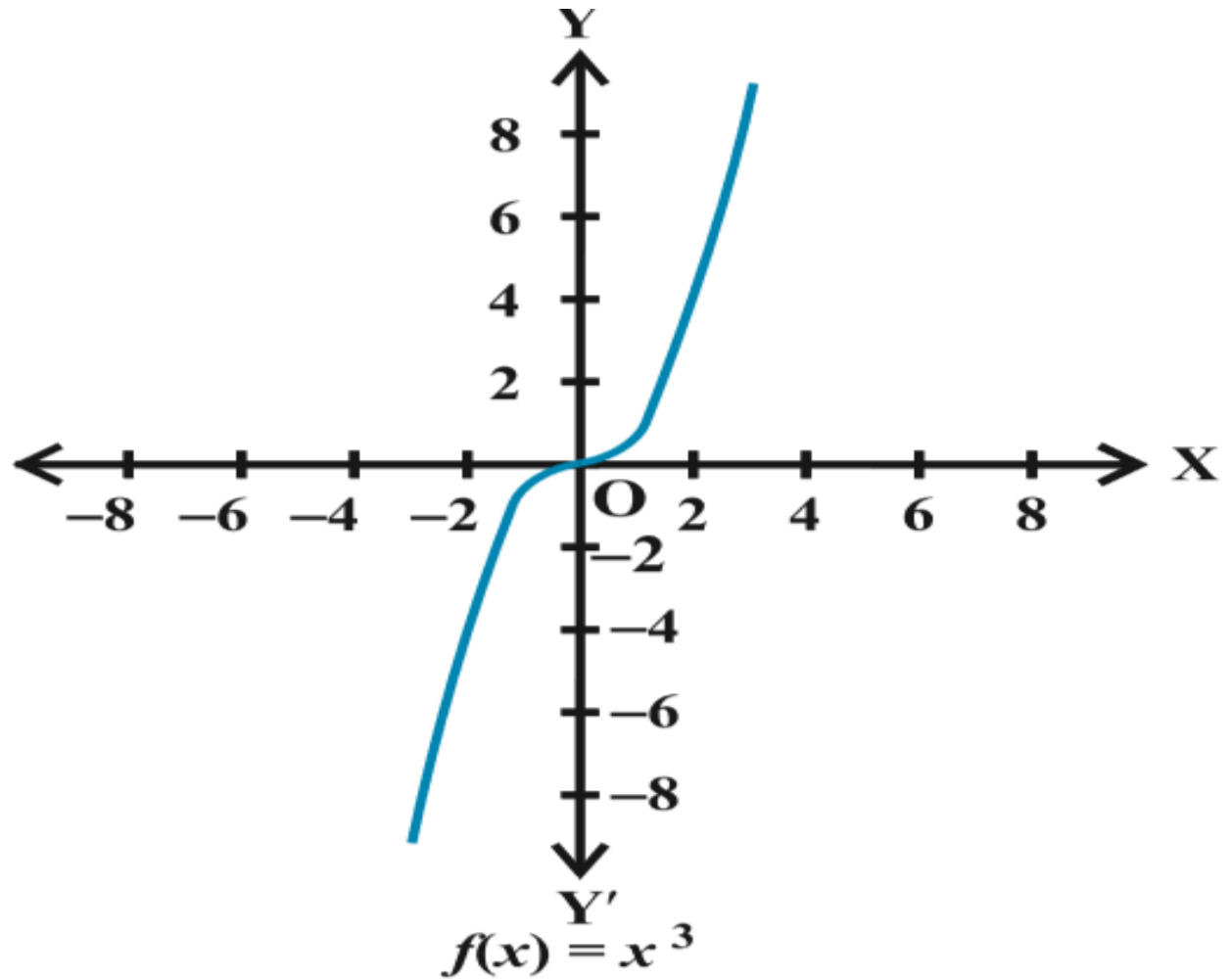
Note: The graph of a quadratic function

    is a parabola

iii) Cubic Function :

Example:

Draw the graph of the function

$f(x) = x^3, x \in R.$

$f(x) = x^3$

4) Rational functions:

A function f: R → R is said to be rational function if $f(x) = \dfrac{g(x)}{h(x)}$, where g(x) and h(x) are polynomial functions of x, where h(x) ≠ 0.

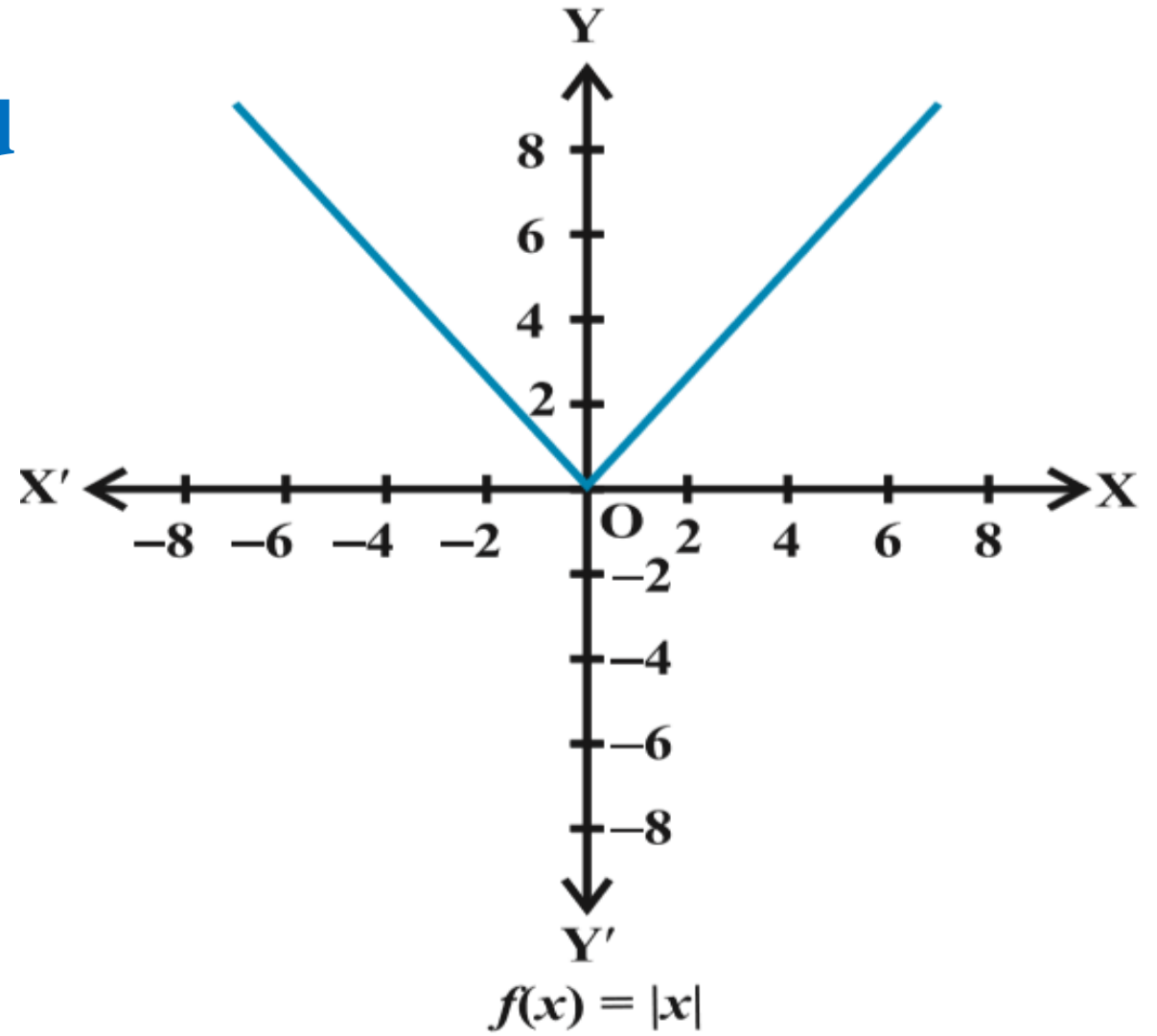Example : $f(x) = \dfrac{x+3}{x-4}$, x ≠ 4

5) The Modulus function

The function f : R → R defined

by $f(x) = |x|$ for each $x \in$ R

is called *modulus function*.

i.e. $f(x) = \begin{cases} x, & if \ x \geq 0 \\ -x, & if \ x < 0 \end{cases}$

Domain= R & Range = [0, ∞)

$f(x) = |x|$

6) **Signum function**:

The function f: R → R defined by

$$f(x) = \begin{cases} 1, & if\ x > 0 \\ 0, & if\ x = 0 \\ -1, & if\ x < 0 \end{cases}$$

is called the signum function.

For signum function,

Domain = R & Range ={–1, 0, 1}
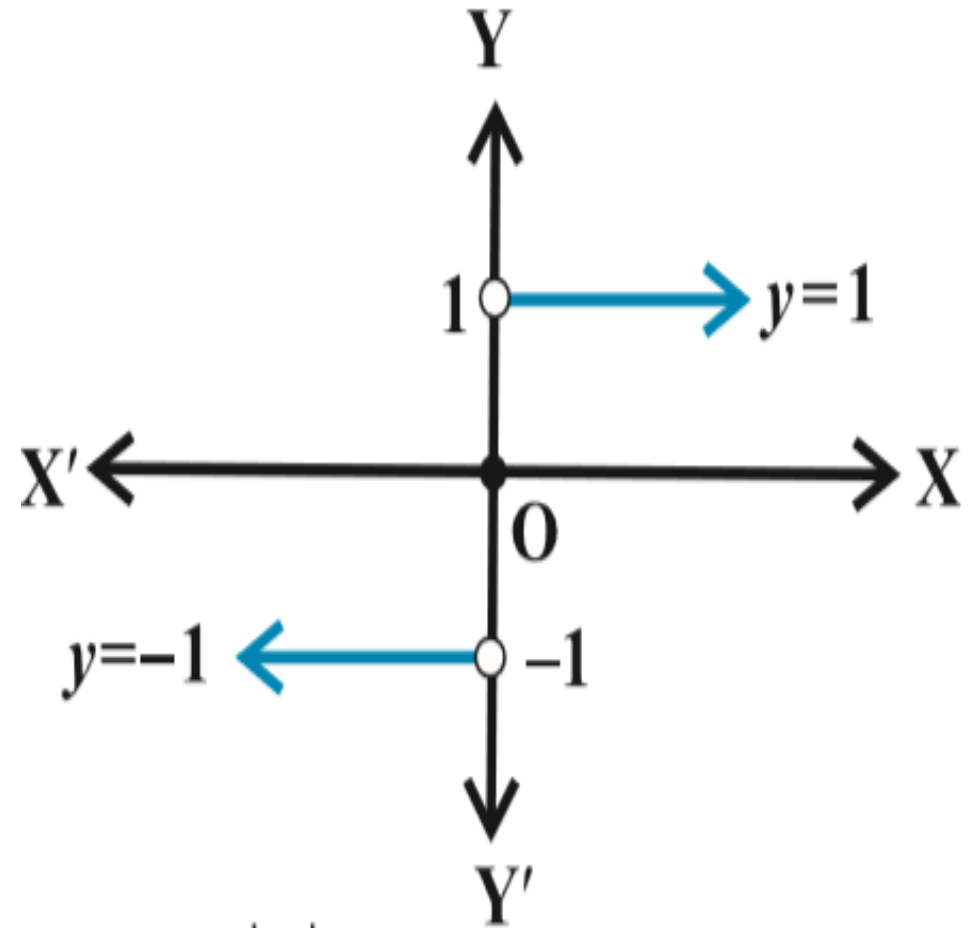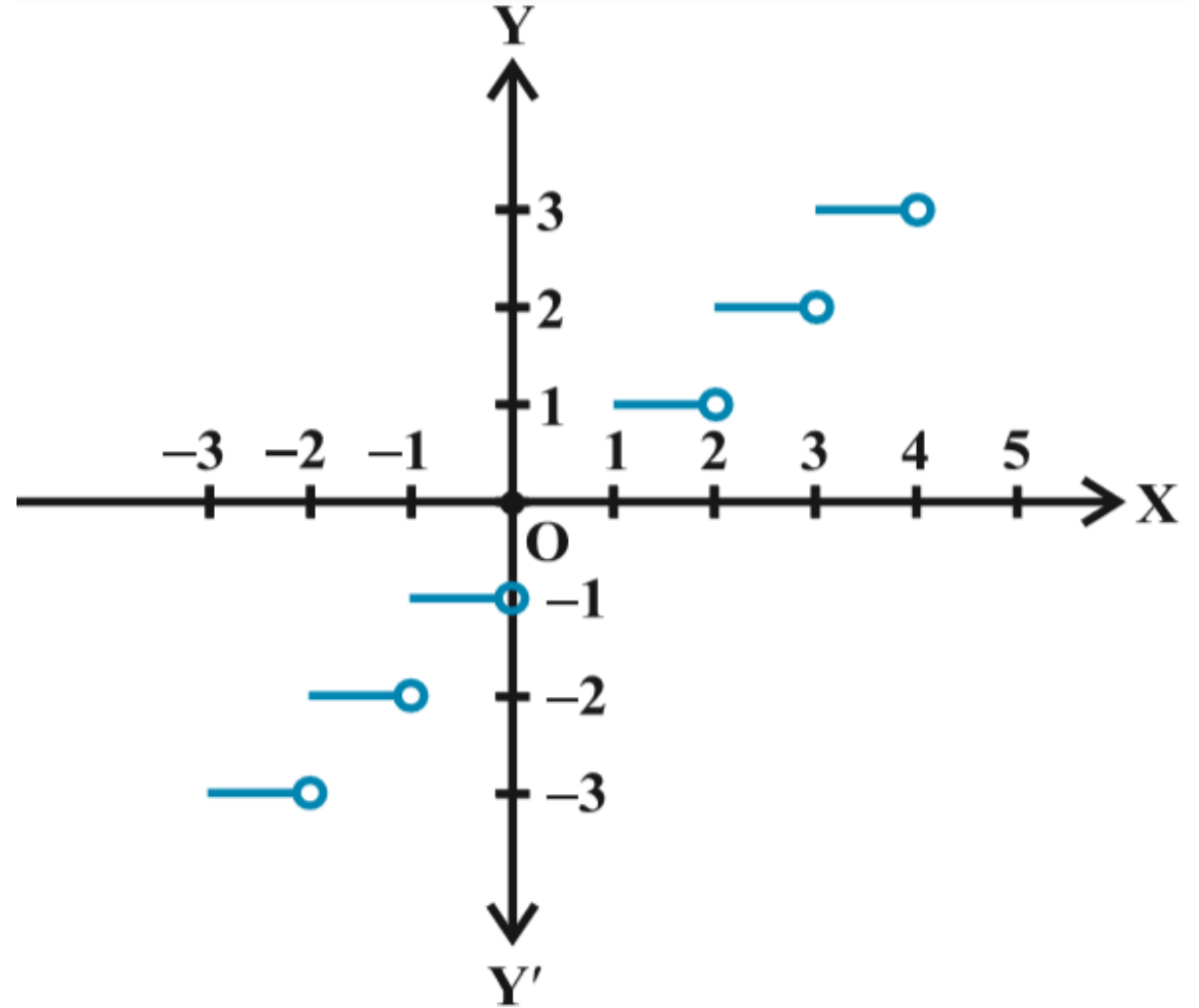
7) <u>Greatest integer function:</u>

The function f: **R** → **R** defined by $f(x) = [x]$, $x \in$ **R** is called the greatest integer function.

Here, $[x]$ denotes the greatest integer less than or equal to x.

For example,

$[-2.8] = -3$, $[2.8] = 2$

For greatest integer function, Domain = **R**, Range = **Z**

What have we learned today?

➢ **Function : A function f from a set A to a set B is a special relation in which, every element of set A has unique image in set B.**

➢ **A is the called the domain and B is the codomain of f .**

➢ **Range : The range of the function is the set of images.**

➢ **A real function has the set of real numbers or one of its subsets both as its domain and as its range.**

THANK YOU