Egyptian E-Learning University

(EELU)

Mathematics 1

Section 1

Evaluate the given function at the given values:-

1-f (x) =x^2; f(0), f (5)

Ans.

Simply substitute with the given value of “x” in the function “f(x)”

0 , 25

2 - G(t)= $\frac{t}{t-2}$; G (0) ,G (1), G (-1) ,G (3)

Answer : 0,-1, 1/3, 3,

3 - $h(z) = 3z$; $h(0)$, $h(8)$, $h(-1/27)$, $h(1000)$

Ans. 0, 2, -1/3 , 3000

Domain & Range

The following examples represent equations involving x and y are given for each problem determine whether y is a function of x with domain = (∞,-∞) =R :-

Ex.1

(X-6) = 2 (Y- 3)

$$x - 6 = 2y - 6$$
$$x - 6 + 6 = 2y$$
$$y = \frac{x}{2}$$

$$since\ for\ every\ value\ of\ x\ there\ is\ a\ unique\ value\ of\ y$$
$$therefore\ y\ is\ a\ function\ of\ x$$

Ex.2

$$X^2 - 3Y = 4$$

$$x^2 - 4 = 3y$$
$$y = \frac{1}{3}(x^2 - 4)$$

$since\ for\ every\ value\ of\ x\ there\ is\ a\ unique\ value\ of\ y$
$therefore\ y\ is\ a\ function\ of\ x$

Ex.3

$$X - 3Y^2 = 4 \qquad y^2 = \frac{1}{3}(x-4)$$

$$y = \pm\sqrt{\frac{1}{3}(x-4)}$$

$\textit{since there are two values of } y \textit{ for a given value of } x$
$\textit{therefore } y \textit{ is not a function of } x$

$Domain : \frac{1}{3}(x-4) \geq 0$

$x \geq 4$

$Domain: [4, \infty[$

Ex.4

$$Y = |X| - 4$$

$$In\ case\ x < 0 \quad or\ x > 0$$
$$y = -x - 4 \quad or \quad y = x - 4$$

$since\ in\ both\ cases\ for\ every\ value\ of\ x\ there\ is\ a\ unique\ value\ of\ y$
$therefore\ y\ is\ a\ function\ of\ x$

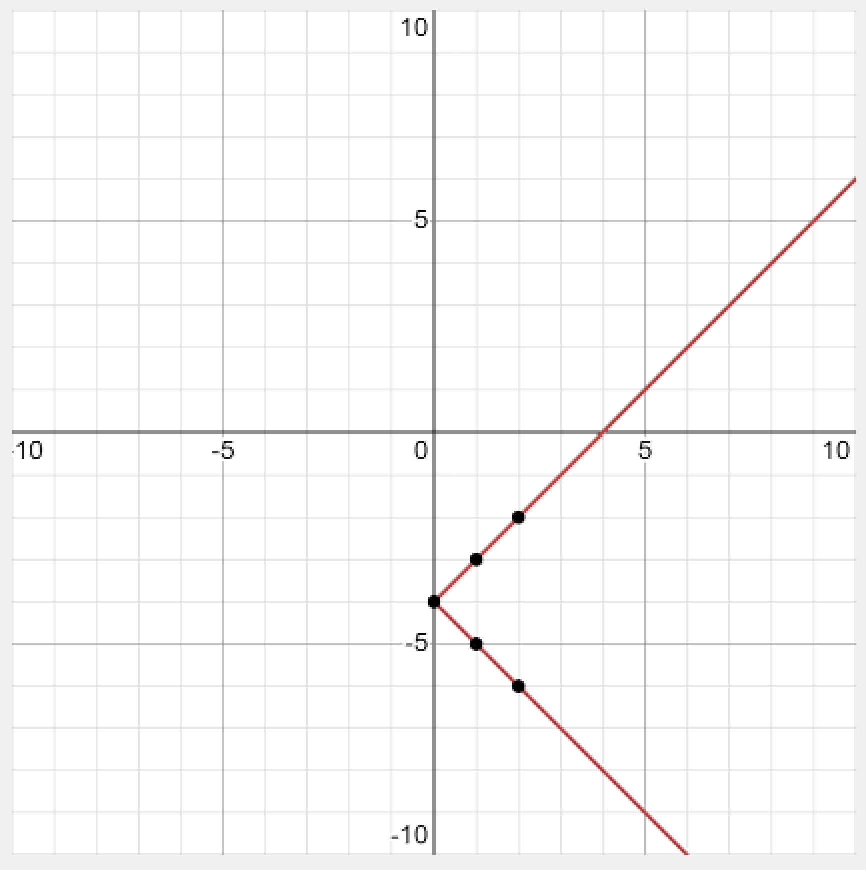
Ex.5 $|Y+4| = X$

$In\ case\ y+4<0 \quad or \quad y+4>0$
$y<-4 \quad or \quad y>-4$
$-y-4=x \quad or \quad y+4=x$
$y=-x-4 \quad or \quad y=(x-4)$

Make a table with few points to graph the function :-

x	y
0	-4
1	-3
1	-5
2	-2
2	-6

$since\ there\ are\ two\ values\ of\ y\ for\ a\ given\ value\ of\ x$
$therefore\ y\ is\ not\ a\ function\ of\ x$
with the domain (∞,-∞) =R



$From\ graphing\ the\ function\ we\ could\ obtain\ it's\ domain\ which\ is\ [0,\infty[$

Find the domain of the given functions:

1) $f(x) = 2x - 3$

Domain:$(-\infty, \infty)$

2) $h(u) = \frac{1}{1+u}$

$1 + u = 0$
$u = -1$
Domain: $(-\infty, \infty)$ -{-1}

3) $y = f(x) = \frac{2x+3}{3x+4}$

$3x + 4 = 0$

$x = \dfrac{-4}{3}$

Domain: $(-\infty, \infty)$ -{$\frac{-4}{3}$}

General Examples:-

a- Evaluate the given expression at the given values.
b- Find the domain of the function

1) $f(x) = \frac{1}{(x+4)}$ $, find\ f(-3)$

a – (1)

b –

$Denomenator = 0$

$(x + 4) = 0$

$x = -4$

Domain: $(-\infty, \infty)$-{-4}

a- Evaluate the given expression at the given values.
b- Find the domain of the function
c- Find the range.

2) $f(x) = \frac{12}{x(x+4)}\ , find\ f(2)$

a – (1)

b –

$Denomenator = 0$

$x(x + 4) = 0$

$x = 0\ or\ x = -4$

Domain: $(-\infty, \infty)$-{0.-4}

C- Range calculation :-

$$y = \frac{12}{x(x+4)}$$
$$x(x+4)y = 12$$
$$yx^2 + 4yx - 12 \ = 0$$
$$Discriminant \geq 0$$
$$b^2 - 4ac \geq 0$$
$$16y^2 + 48y \geq 0$$

$y^2 + 3y \geq 0$

Let’s solve this inequality step−by−step.

Let’s find the critical points of the inequality.

$y^2 + 3y = 0$

y(y+3)=0(Factor left side of equation)

y=0 or y+3=0(Set factors equal to 0)

y=0 or y=−3

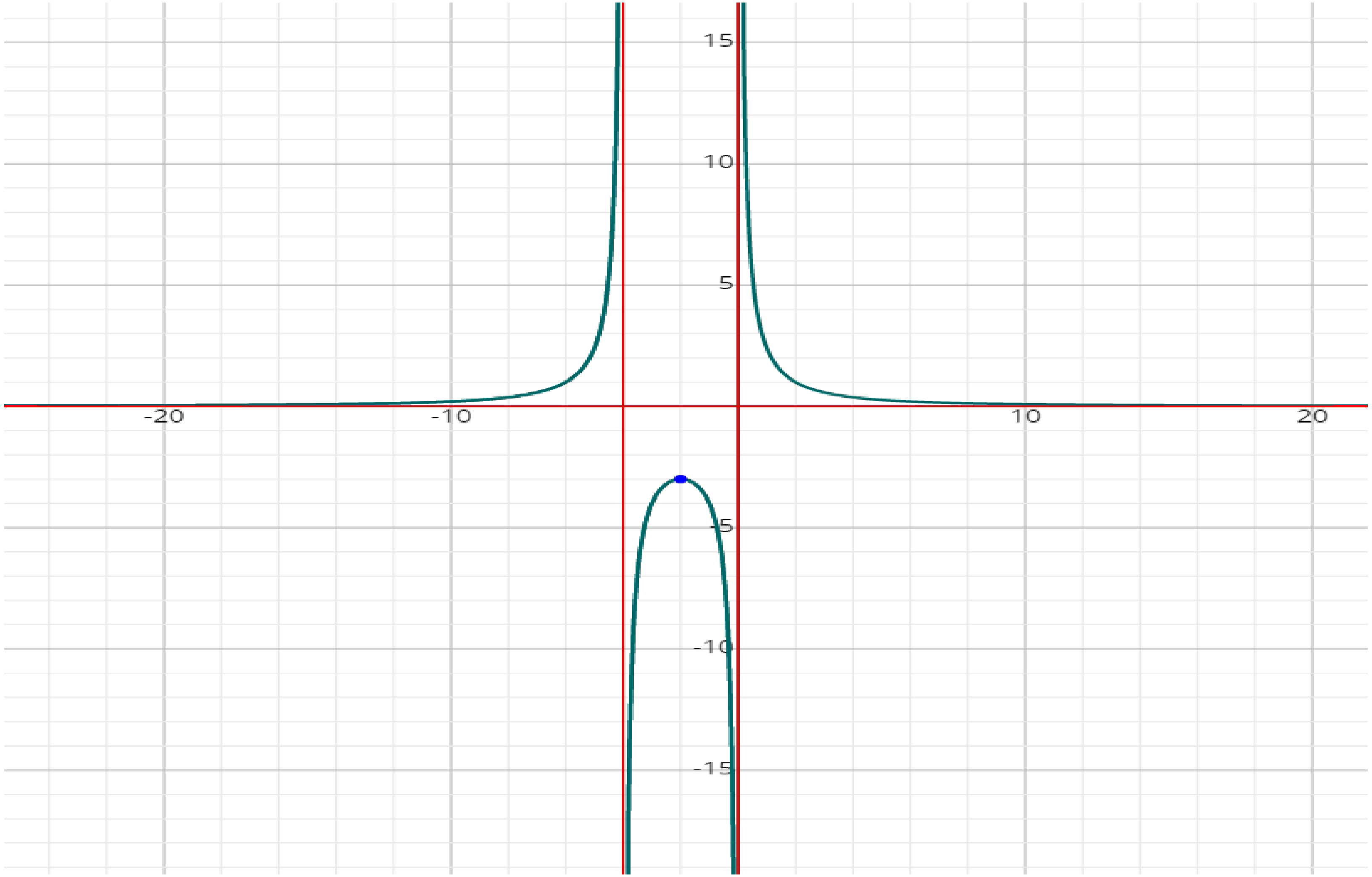
Check intervals in between critical points. (Test values in the intervals to see if they work.)

- y≤−3(Works in original inequality)
- −3≤y≤0(Doesn’t work in original inequality)
- y≥0(Works in original inequality)

y≤−3 or y > 0

$Range = \{y \in R: y \leq -3 \ \ or \ \ y > \ 0\}$

The following is the graph of the previous function :-
(just for your information)



3) $f(x) = |x+2|$, find f(-5)

a – (3)

b – Domain: $(-\infty, \infty)$
$\text{Which means } that\ if\ we\ subsititue\ for\ any\ value\ of\ x\ from$
$(-\infty, \infty)\ there\ is\ a\ unique\ value\ of\ y$

c – Range: [0,∞[which means that as the values of x changes from "- ∞" to "∞" y which is "f(x)" changes from "0" to "∞"

Remember the following...

1 - $a^n x\, a^m = a^{n+m}$

2 - $(a^m)^n = a^{mn}$

3 - $\frac{a^n}{a^m} = a^{n-m}$

4 - $a^0 = 1$

5 – $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$

Solve each of the following equations by factoring:-

Ex.1 $x^5+2x^4-3x^3= 0$

$$\therefore\ x^3(x^2+2x-3)=0$$

$$\therefore x^3=0 \quad \text{or} \quad x^2+2x-3=0$$

$$\therefore x=0 \quad \text{or} \quad (x+3)(x-1)=0$$

$$\therefore x=0 \quad \text{or} \quad x=-3 \quad \text{or} \quad x=1$$

Ex.2 $5x^3-20x=0$

$$\therefore x(5x^2-20)=0$$

$$\therefore x=0 \quad \text{or} \quad 5x^2=20$$

$$\therefore x=0 \quad \text{or} \quad x^2=4$$

$$\therefore x=0 \quad \text{or} \quad x=-2 \quad \text{or} \quad x=2$$

Ex.3

$$3x^{5/2} - 6x^{3/2} = 9x^{1/2}$$

$$\therefore 3x^{\frac{5}{2}} - 6x^{\frac{3}{2}} = 9x^{\frac{1}{2}}$$
$$\therefore 3x^{\frac{5}{2}-\frac{1}{2}} - 6x^{\frac{3}{2}-\frac{1}{2}} = 9x^{\frac{1}{2}-\frac{1}{2}}$$
$$Dividing\ both\ sides\ by : x^{\frac{1}{2}}$$

$$\therefore 3x^2 - 6x = 9$$
$$\therefore x^2 - 2x = 3$$
$$\therefore x^2 - 2x - 3 = 0$$
$$\therefore (x+1)(x-3) = 0$$
$$\therefore x = -1 \quad \text{or} \quad x = 3$$

Find functions "f(x)" and "g(x)" such that f(x)*g(x) = h(x) where "h(x)" is given

Ex.1 $h(x) = (x-1/x)^2$

$$h(x) = \left(\frac{x-1}{x}\right)^2$$

$$h(x) = \left(\frac{x-1}{x}\right)^2 = (x-1)^2 . \left(\frac{1}{x}\right)^2 = f(x).g(x)$$

Ans. $F(x) = (x-1)^2$, $g(x) = 1/x^2$

Ex.2 h(x) = - 3/ x^2+ 9 /x^4– 27 /x^6

$$h(x) = \frac{-3}{x^2} + \frac{9}{x^4} - \frac{27}{x^6}$$

$$h(x) = \frac{-3}{x^2}\left(1 - \frac{3}{x^2} + \frac{9}{x^4}\right)$$

$$h(x) = g(x)f(x)$$

Ans. F(x)= 1-3/x^2+9 /x^4 , ; g (x)= -3/ x^2

Use a calculator to evaluate the given values:

Ex.1 $f(x) = 1.25x^2 - 3.74x + 14.38$: $f(2.34)$, $f(-1.89)$. $f(10.6)$.

Ans. 12.473 , 25.914, 115.186

Ex.2 $f(x) = (x - 16) / (x + 3.4) + (x^2 + 5.8) / (6.2 - x^2)$: $f(5.8)$, $f(-23.4)$

ans. -2.546 , 0.948

Graph of Functions:

Choose suitable points for graphing the function.

1- Plot any points where the graph crosses or touches the axes. These points are often easy to find by setting $x = 0$ and $f(x) = 0$ in the equation of $f(x)$.

2- Plot a few points near the origin. When the value of x are small, the values of $f(x)$ are often easy to compute or estimate.

3- Graph the function at or near any endpoints of its domain.

Graph of Functions:

Graph the function:-

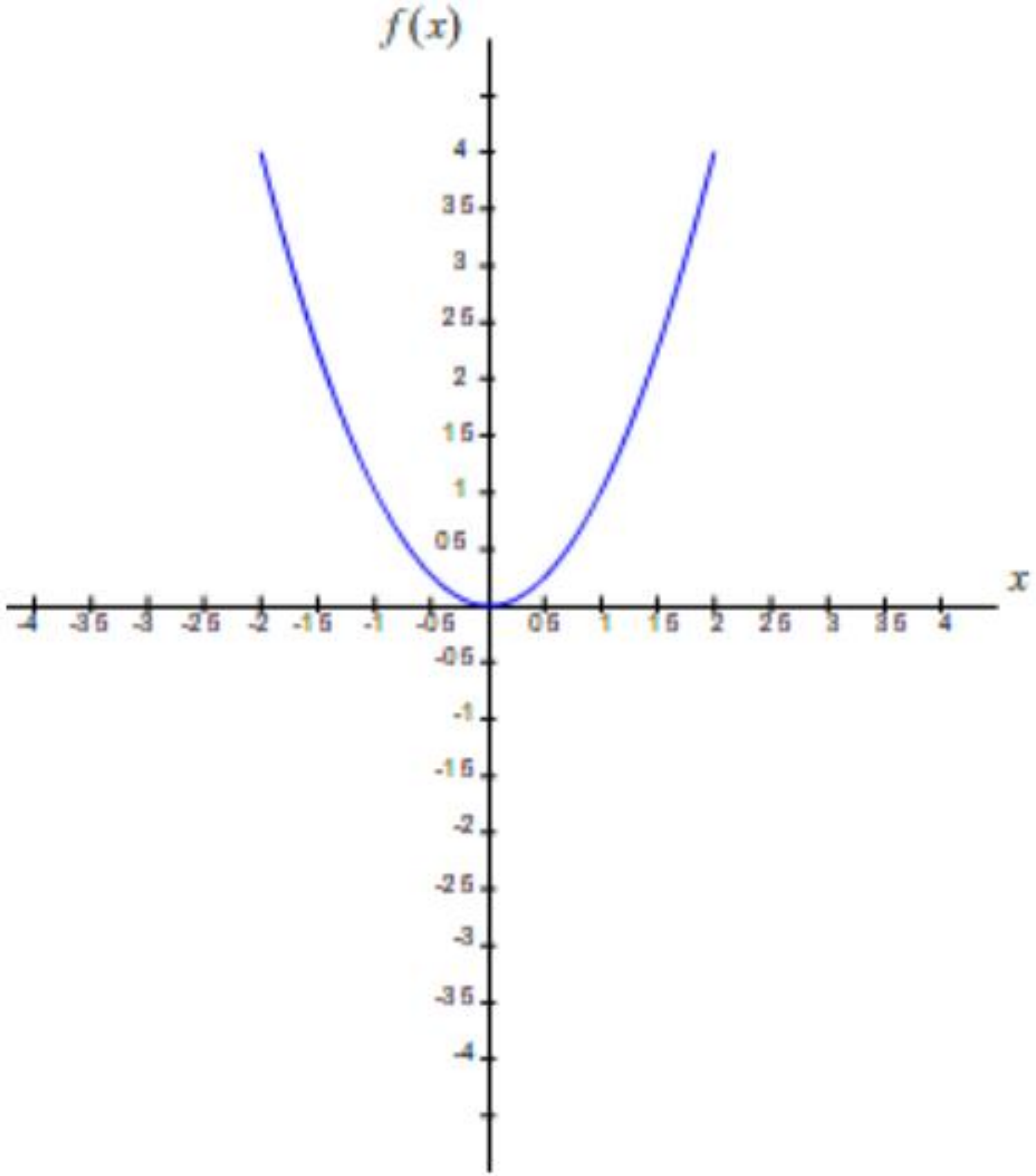
$f(x) = x^2$ over the interval $-2 \le x \le 2$

1- We make a table of input-output pairs for the function.

2- We plot the corresponding points to learn the shape of the graph.

3- We sketch the graph by connecting the point.

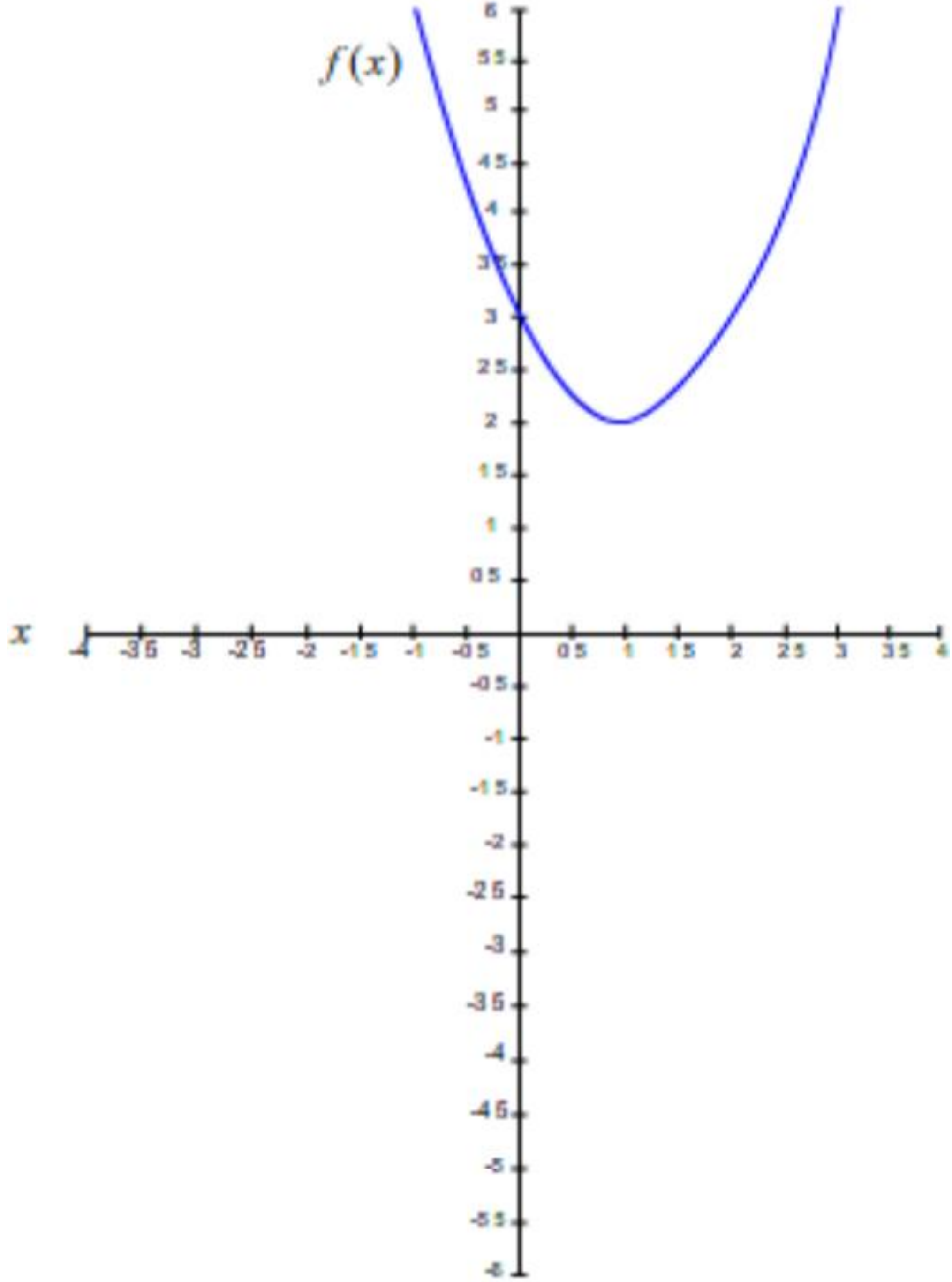
x	f(x)
-2	4
-1.75	3.0625
-1.5	2.25
-1	1
-0.5	0.25
0	0
0.5	0.25
1	1
1.5	2.25
1.75	3.0625
2	4



f(x)
x

Graph the function $f(x) = x^2 - 2x + 3$ over the interval -1 ≤ x ≤ 3

x	f(x)
-1	6
0	3
0.5	2.25
1	2
2	3
3	6



$f(x)$
x

$f(x) = 7 - (x-3)^2$ with domain equal to]- ∞, ∞[the range of f(x) is ....

$$f(x) = 7 - (x-3)^2$$

$$f(x) = 7 - [x^2 - 6x + 9]$$

$$f(x) = -x^2 + 6x - 2$$

a-]- ∞,7]

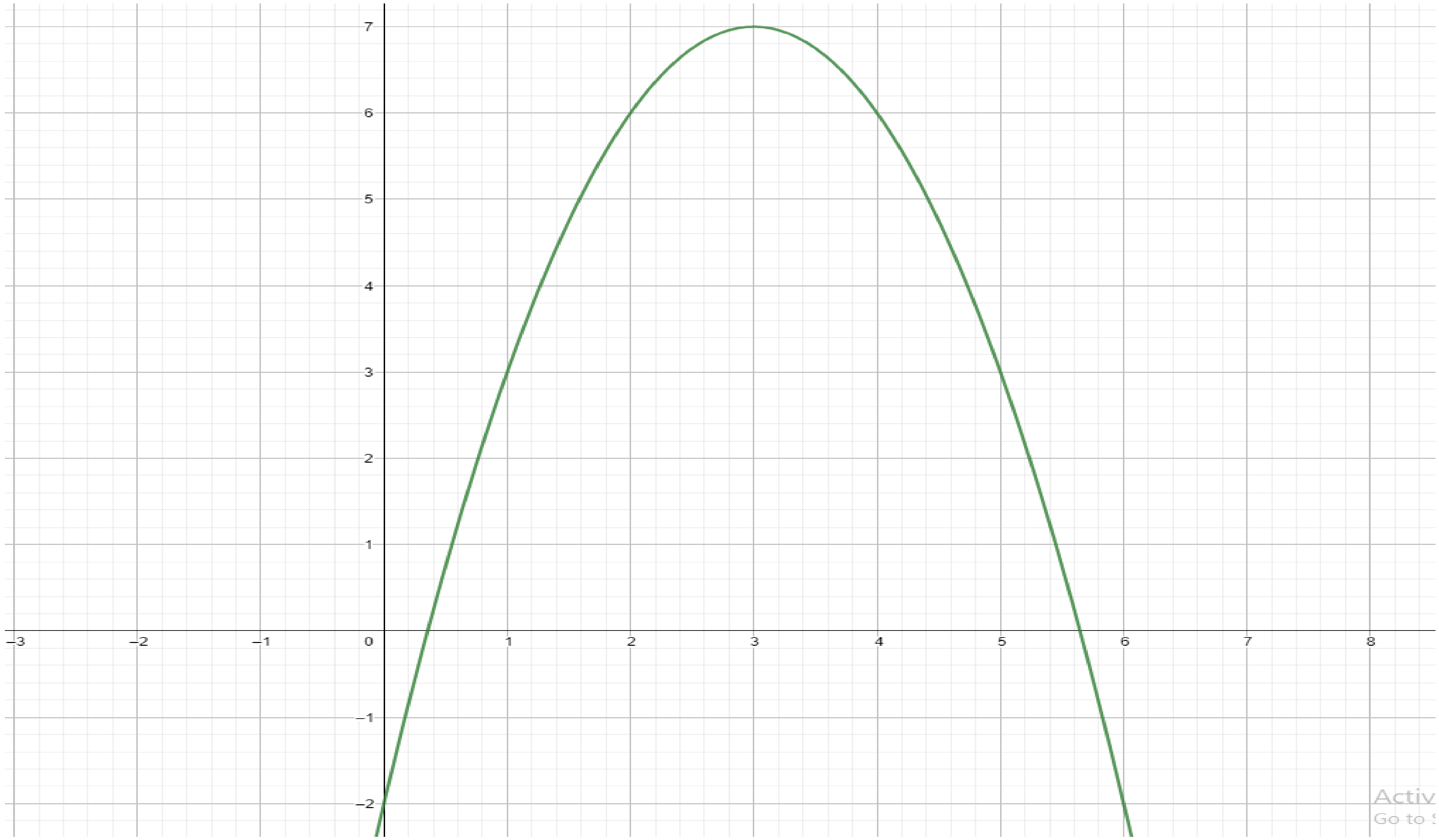
b-]- ∞, ∞[

c-]- 3,7]

d-]- ∞,7[

Ans. a

x	f(x)
-2	4
-1.75	3.0625
-1.5	2.25
-1	1
-0.5	0.25
0	0
0.5	0.25
1	1
1.5	2.25
1.75	3.0625
2	4


7
6
5
4
3
2
1
−1
−2
−3
−2
−1
0
1
2
3
4
5
6
7
8

MCQ:

If a set of points(x,y) corresponds to " y is a function of x " , then…………..

a- the graph can be drawn without lifting pencil from paper .

b- No vertical line cuts the graph in more than one place .

c- No horizontal line cuts the graph in more than one place.

d- All of the above.

Ans .b