Pre-Calculus 11

Graphing $y = x^2 + q$ and $y = (x - p)^2$

Example) Use a table of values for $-3 \le x \le 3$ to sketch each of the quadratic functions on the same grid. State the vertex of each function.

i) $y = x^2$

x	y
-3	9
-2	4
-1	1
0	0
1	1
2	4
3	9

(0,0)

ii) $y = x^2 + 3$

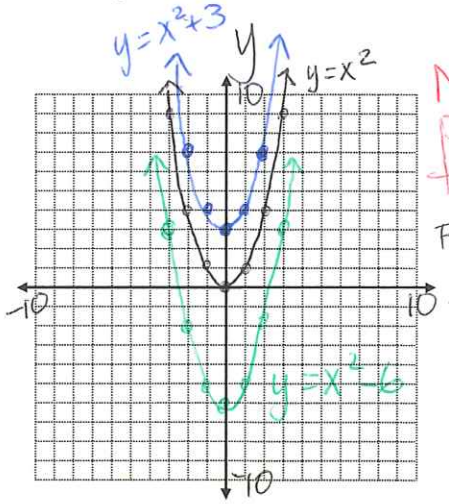
x	y
-3	12
-2	7
-1	4
0	3
1	4
2	7
3	12

(0,3)

iii) $y = x^2 - 6$

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

(0,-6)



Notice the pattern of the parabola

From vertex:
over 1, up 1
over 1, up 3
over 1, up 5
over 1, up 7
etc.

Observations:

When the value of **q** is positive, the function is translated up.

When the value of **q** is negative, the function is translated down.

Example) State the vertex of each parabola.

a) $y = x^2 + 4$ (0,4)

b) $y = x^2 - 2$ (0,-2)

c) $y = x^2 + 8$ (0,8)

Finding x and y-intercepts:

In order to find the **x-intercept** of a function, substitute y = 0 into the equation of the function.

In order to find the **y-intercept** of a function, substitute x = 0 into the equation of the function.

Example) State the x-intercept(s) of each function.

a) $y = x^2 + 7$

$0 = x^2 + 7$
$-7 = x^2$
No solution.
∴ no x-intercepts.

b) $y = x^2 - 9$

$0 = x^2 - 9$
$9 = x^2$
$x = \pm 3$
coords: (-3,0) and (3,0)

Example) Use a table of values for $-5 \le x \le 5$ to sketch each of the quadratic functions on the same grid. State the vertex of each function.

i) $y = x^2$

(0, 0)

ii) $y = (x+3)^2$

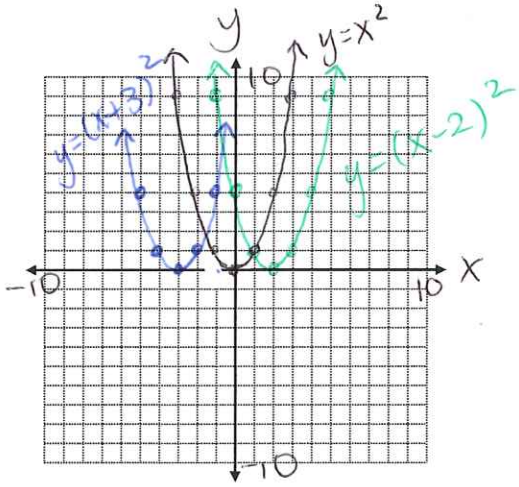
x	y
-5	4
-4	1
-3	0
-2	1
-1	4
0	9
1	16
2	25
3	
4	
5	

(-3, 0)

iii) $y = (x-2)^2$

x	y
-5	49
-4	36
-3	25
-2	16
-1	9
0	4
1	1
2	0
3	1
4	4
5	9

(2, 0)



Observations:

When the value of **p** is positive, the function is translated left

When the value of **p** is negative, the function is translated right

Example) State the vertex of each parabola.

a) $y = (x-4)^2$

(4, 0)

b) $y = (x+2)^2$

(-2, 0)

c) $y = x^2 + 5$

(0, 5)

Example) Without creating a table of values, sketch each parabola on the same grid.
Note: This is called "using transformations" to graph.

a) $y = x^2 + 1$

b) $y = x^2 - 7$

c) $y = (x-8)^2$