Day 04 Graphing Quadratic Functions in Vertex Form

List everything you know about the Square Function below.

- It has either a max ↩ or a min ↪
- It has 2 solutions/roots/zeros
- The domain will always be ℝ or $(-\infty, \infty)$
- The range is affected by the k value
- It has an axis of symmetry which is always $x = h$

Graph each function on your calculator and fill in the table. What patterns do you notice?

a. $y = x^2$

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

Δx: 1

Δy: 1, 3, 5

b. $y = 2x^2$

x	y	
-3	18	
-2	8	
-1	2	
0	0	2
1	2	6
2	8	10
3	18	

Δx: 1

Δy: 2, 6, 10

c. $y = \frac{1}{2}x^2$

x	y	
-3	4.5	
-2	2	
-1	.5	
0	0	.5
1	.5	1.5
2	2	2.5
3	4.5	

Δx: 1

Δy: .5, 1.5, 2.5

d. $y = -3x^2$

x	y	
-3	-27	
-2	-12	
-1	-3	
0	0	-3
1	-3	-9
2	-12	-15
3	-27	

Δx

Δy: -3, -9, -15

What have you discovered about the square function so far?

- If a is positive, the parabola will go up and the vertex will be a minimum
- If a is negative, the parabola will go down and the vertex will be a maximum ↕
- If a is greater than 1, the parabola will stretch vertically
- If a is between 0 and 1, the parabola will compress vertically ↔

Steps to graphing a parabola when it is in vertex/graphic form: $f(x) = a(x - h)^2 + k$

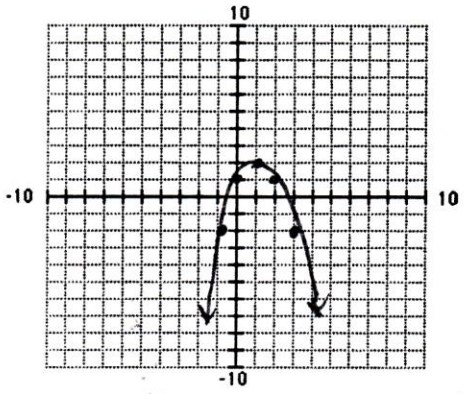
1. Find the vertex by shifting horizontally and vertically, which gives you the vertex (h, k).
2. Plot the vertex and determine whether the parabola opens up or down according to a.
3. Use the 1a, 3a, 5a shortcut to plot five "happy" points and draw the parabola

Each parabola described is a transformation of the parent function $f(x) = x^2$. Write an equation for each.

Description of the transformation	Equation of the new function
1. The parabola is shifted left 3 units and reflected across the x-axis	$f(x) = -(x+3)^2$
2. The parabola is shifted up 1 unit and stretched vertically by a factor of 4	$f(x) = 4x^2 + 1$
3. The parabola is shifted right 5 units and vertically compressed by a factor of .25	$f(x) = .25(x-5)^2$
4. The parabola is shifted left 4 and down 4 units and stretched vertically by a factor of 3	$f(x) = 3(x+4)^2 - 4$
5. The parabola is reflected across the x-axis, and shifted right 2 and down 3 units	$f(x) = -(x-2)^2 - 3$

Graph each quadratic function with 5 points. Then state the vertex, the equation of the axis of symmetry, and the domain and range in interval notation.

6. $f(x) = -(x-1)^2 + 2$



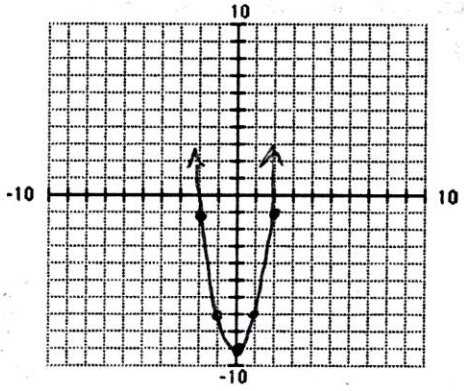
Vertex (1, 2)

Axis of symm. $x = 1$

Domain $(-\infty, \infty)$

Range $(-\infty, 2]$

7. $r(x) = 2x^2 - 9$



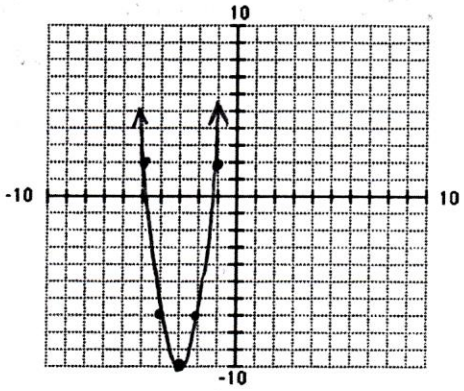
Vertex (0, -9)

Axis of symm. $x = 0$

Domain $(-\infty, \infty)$

Range $[-9, \infty)$

8. $i(x) = 3(x+3)^2 - 10$



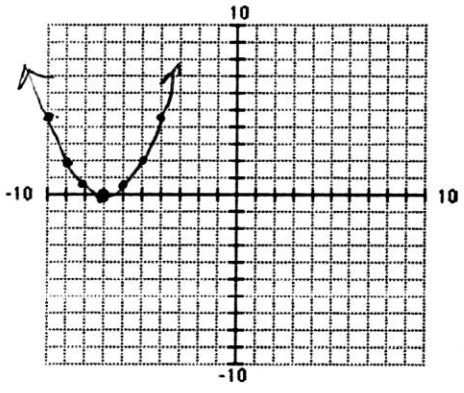
Vertex (-3, -10)

Axis of symm. $x = -3$

Domain $(-\infty, \infty)$

Range $[-10, \infty)$

9. $e(x) = \frac{1}{2}(x+7)^2$



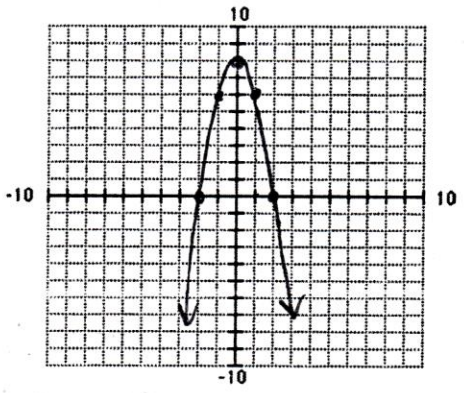
Vertex (-7, 0)

Axis of symm. $x = -7$

Domain $(-\infty, \infty)$

Range $[0, \infty)$

10. $n(x) = -2x^2 + 8$



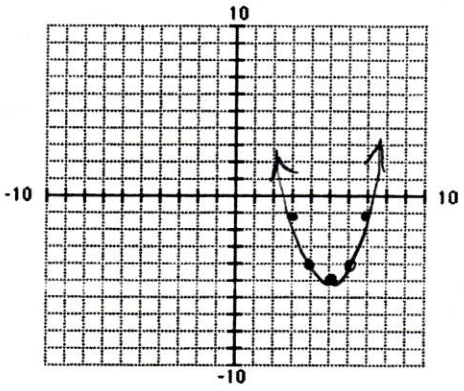
Vertex (0, 8)

Axis of symm. $x = 0$

Domain $(-\infty, \infty)$

Range $(-\infty, 8]$

11. $d(x) = (x-5)^2 - 5$



Vertex (5, -5)

Axis of symm. $x = 5$

Domain $(-\infty, \infty)$

Range $[-5, \infty)$