Day 10: Transformations of Quadractics

Warm-Up:

11. Using the discriminant, determine the amount and type of solutions each equation will have. Then find the exact value of the solutions.

a. $x^2 + 4x + 5 = 0$ b^2-4ac $(4)^2-4(1)(5) = 16-20 = -4$ $\boxed{\text{2 imaginary solutions}}$ $\boxed{\frac{-4 \pm \sqrt{-4}}{2} = x}$

b. $x^2 - 2x + 1 = 0$ b^2-4ac $(-2)^2-4(1)(1) = 4-4=0$ $\boxed{\text{1 real rational solution}}$ $\frac{2 \pm \sqrt{0}}{2}$ $\boxed{1 = x}$

c. $2x^2 - 3x - 10 = 0$ b^2-4ac $(-3)^2-4(2)(-10) = 9+80=89$ $\boxed{\text{2 real irrational solutions}}$ $\boxed{x = \frac{3 \pm \sqrt{89}}{4}}$

Quadratic Graphs

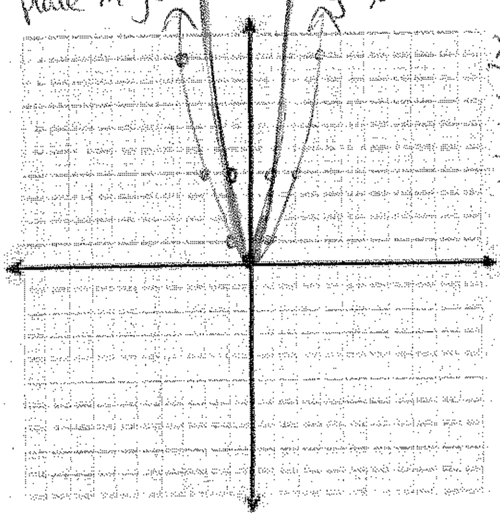
In your graphing calculator, graph the function $y = x^2$ (the quadratic parent function). Then graph each function below. Compare the new graph to the parent graph and write your observations about the location of the vertex, the overall shape, and the slope of the sides of the new graph in the blanks at the right.

Part A: The Effect of *a*

Parent $y=x^2$ has vertex $(0,0)$
↳ place in y_1 and make it bold

1. $y = 4x^2$

place in y_2



x	y_1	y_2
-4	16	64
-3	9	36
-2	4	16
-1	1	4
0	0	0
1	1	4
2	4	16
3	9	36
4	16	64

how do y-values differ?

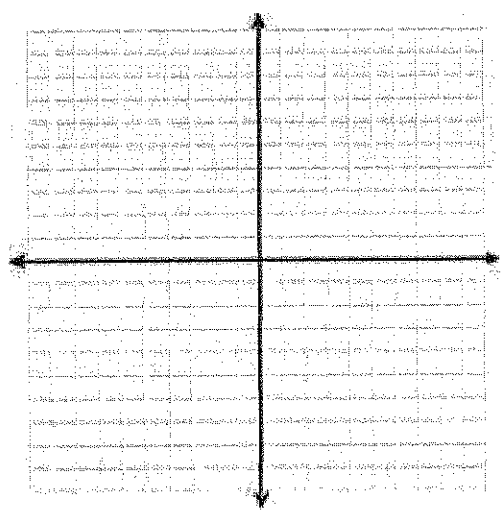
Vertex: $(0,0)$

Shape Change or Shift Change? : Shape change

What was the change? graph is 4x narrower

y-values where quadrupled so graph is 4 times narrower

2. $y = \frac{1}{4}x^2$

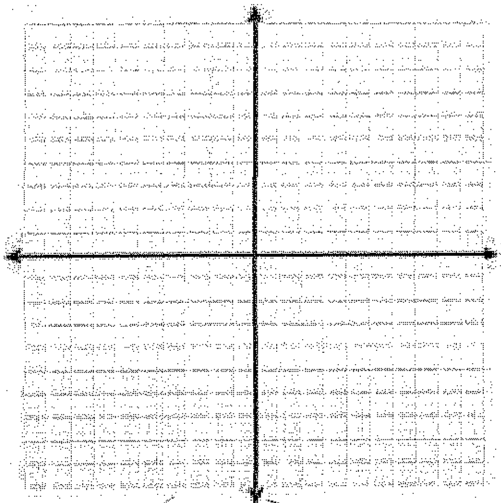


Vertex: $(0,0)$

Shape Change or Shift Change? : Shape change

What was the change? graph is 4x wider

3. $y = -4x^2$

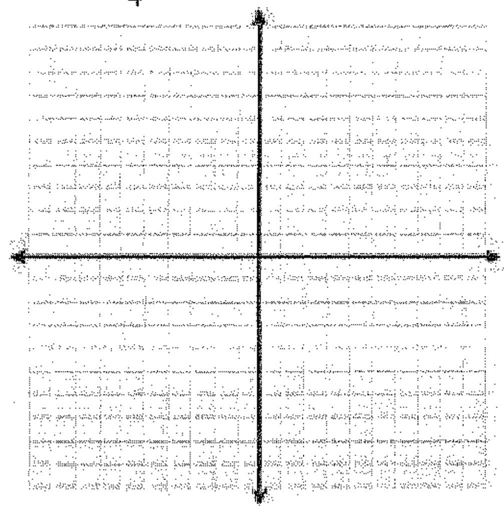


Vertex: (0, 0)

Shape Change or Shift Change? : shape change

What was the change? 4 times narrower, reflected over x-axis

4. $y = -\frac{1}{4}x^2$



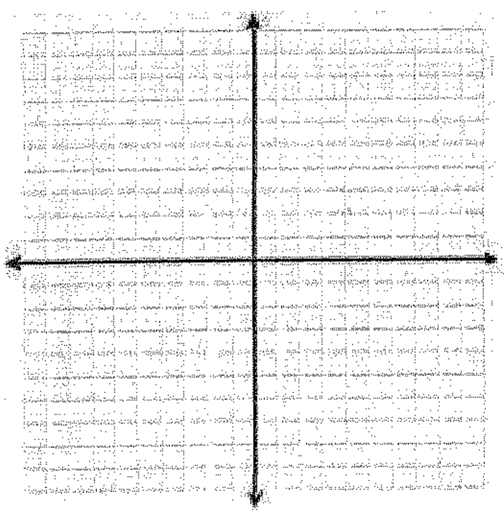
Vertex: (0, 0)

Shape Change or Shift Change? : shape change

What was the change? 4 times wider, reflected over x-axis

Part B: The Effect of *h*

5. $y = (x + 2)^2$

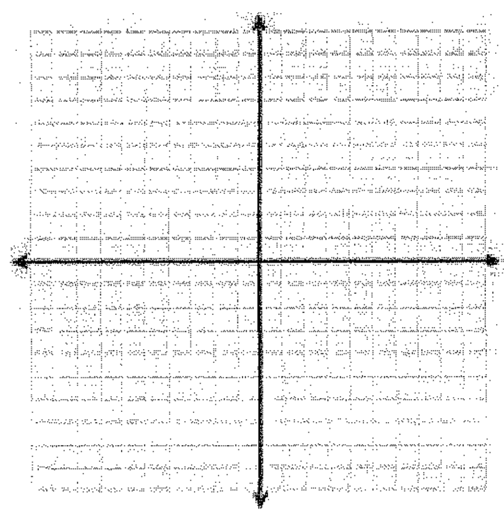


Vertex: (-2, 0)

Shape Change or Shift Change? : shift change

What was the change? left 2

6. $y = (x - 4)^2$

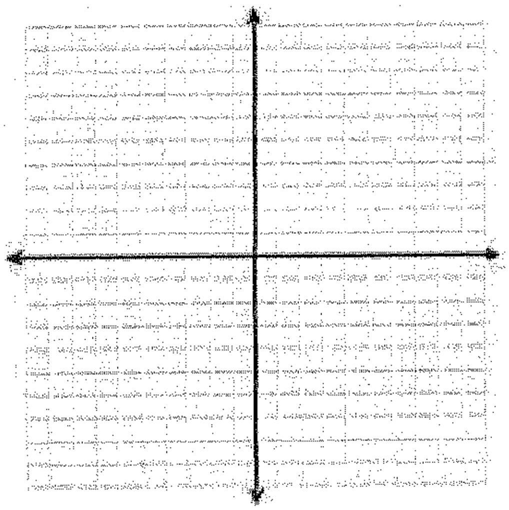


Vertex: (4, 0)

Shape Change or Shift Change? : shift change

What was the change? right 4

7. $y = -(x+5)^2$

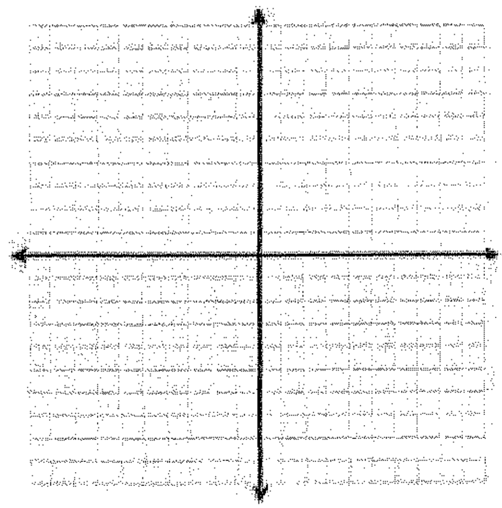


Vertex: (-5, 0)

Shape Change or Shift Change? : Shift change + reflection

What was the change? left 5 + reflected in x-axis

8. $y = -(x-6)^2$



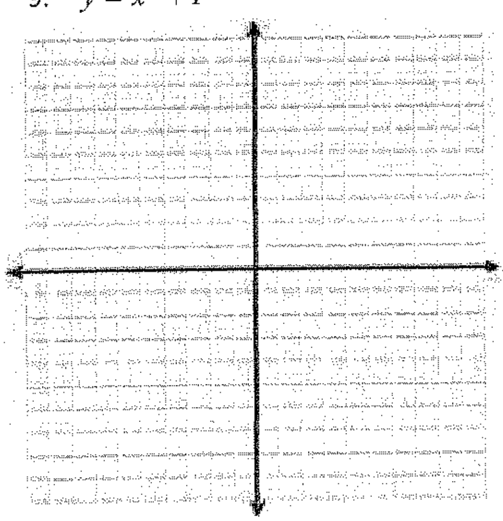
Vertex: (6, 0)

Shape Change or Shift Change? : shift change + reflection

What was the change? right 6 + reflected over x-axis

Part C: The Effect of *k*

9. $y = x^2 + 1$

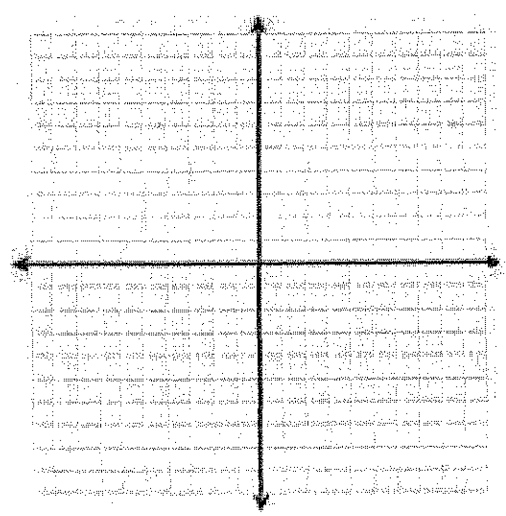


Vertex: (0, 1)

Shape Change or Shift Change? : shift change

What was the change? up 1

10. $y = x^2 - 2$

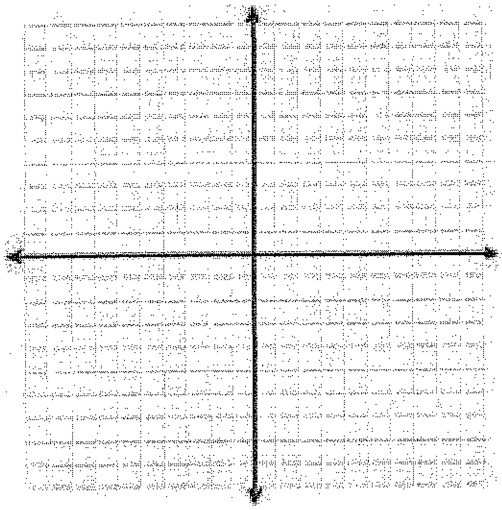


Vertex: (0, -2)

Shape Change or Shift Change? : shift change

What was the change? down 2

11. $y=-x^2+7$

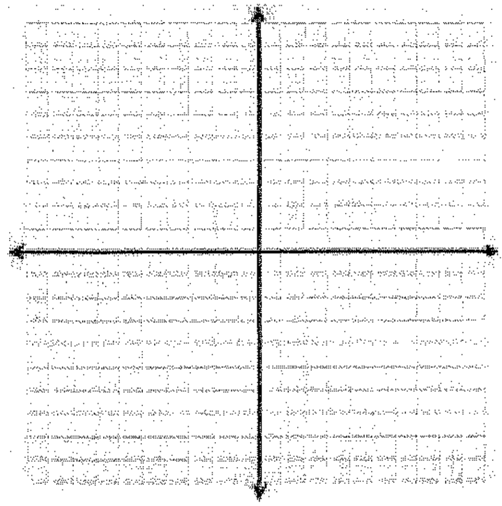


Vertex: (0, 7)

Shape Change or Shift Change? : shift change + reflection

What was the change? reflected over x-axis + up 7

12. $y=-x^2-10$



Vertex: (0, -10)

Shape Change or Shift Change? : shift change + reflection

What was the change? reflected over x axis + down 10

Practice

1) Use what you know about the connection between rules and graphs for quadratic functions to match the given functions with their graphs that appear below. Each graph is shown in the standard viewing window (-10 ≤ x ≤ 10 and -10 ≤ y ≤ 10)

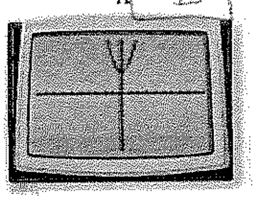
Rule I $y = x^2 - 4$ down 4

Rule II $y = 2x^2 + 4$ up 4, $\frac{1}{2}$ as wide

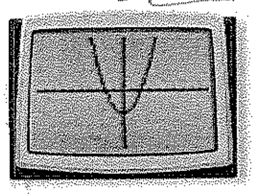
Rule III $y = -x^2 + 2x + 4$ y-int (0,4) frown parabola

Rule IV $y = -0.5x^2 + 4$ up 4, 2x as wide

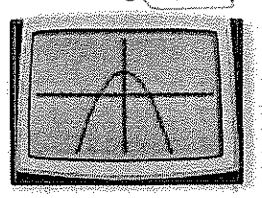
A Rule II



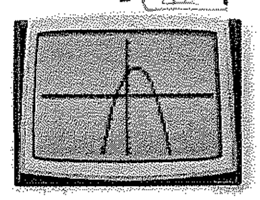
B Rule I



C Rule IV



D Rule III



2) In the discovery, you worked with several different quadratic functions. The function rules are restated in Parts a-d below. For each function, explain what you can learn about the shape and location of its graph by looking at the coefficients and constant term in the rule.

a. $h = 15 - 16t^2$ → y-int (0,15); up 15
from constant →
refl over x-axis
from coeff. → 16 times narrower

b. $h = 2 + 40t - 16t^2$ up 2; y-int (0,2) ← from constant
refl over x-axis ← from coeff.
16 times narrower ←

c. $y = 0.004x^2 - x + 80$
from constant → y-int (0,80); up 80
from coeff. → $a=\frac{4}{1000}=\frac{1}{250}$
↳ 250 times narrower

d. $d = 0.05s^2 + 1.1s$
from constant → c=0 → y-int (0,0)
from coeff → $a=0.05=\frac{5}{100}=\frac{1}{20}$
↳ 20 times narrower