

**ACTIVITIES and FORMATIVE ASSESSMENTS USED DURING THE  
SESSION**

**ENGAGING THE STRUGGLING LEARNER:  
Technology Can Help!**

**Thank you for coming!!!!**

**Please email me with questions, comments or more dialog on  
how we can help Ordinary Students Do Extraordinary Things!**

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# Understanding Quadratic Functions in Vertex Form

(aka Mastering the Art of Angry Birds)

$$y = a(x - h)^2 + k$$

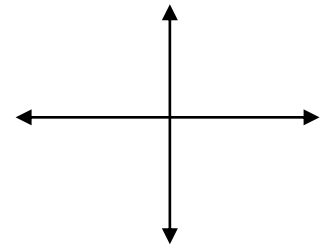
Use your calculator to graph and answer the following. Note: For 2-5, you will be graphing 2 functions, the "original" and a new one. Sketch your "original function" in colored pencil.

## 1. Exploring "a"

1. Graph  $y = x^2$  on your calculator in  $Y_1$ .

a) What direction does the graph open? \_\_\_\_\_

b) What is the vertex of the graph? \_\_\_\_\_

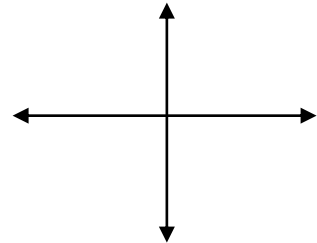


2. Graph  $y = 2x^2$  on your calculator in  $Y_2$ .

a) What direction does the graph open? \_\_\_\_\_

b) What is the vertex of the new graph? \_\_\_\_\_

c) How is your new graph different than our original function?

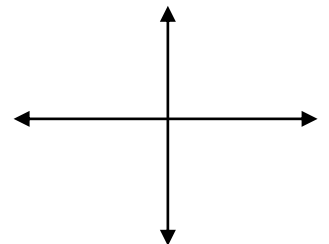


3. Graph  $y = \frac{1}{2}x^2$  on your calculator in  $Y_2$ .

a) What direction does the graph open? \_\_\_\_\_

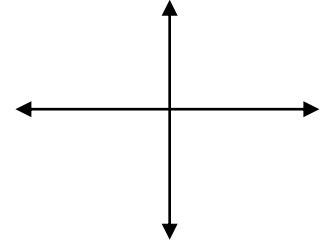
b) What is the vertex of the new graph? \_\_\_\_\_

c) How is your new graph different than our original function?



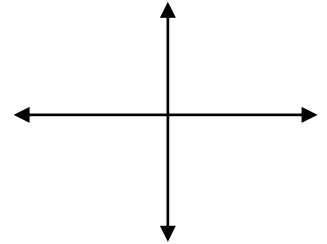
4. Graph  $y = -x^2$  on your calculator in  $Y_2$ .

- a) What direction does the graph open? \_\_\_\_\_
- b) What is the vertex of the new graph? \_\_\_\_\_
- c) How is your new graph different than our original function?



5. Graph  $y = -2x^2$  on your calculator in  $Y_2$ .

- a) What direction does the graph open? \_\_\_\_\_
- b) What is the vertex of the new graph? \_\_\_\_\_
- c) How is your new graph different than our original function?

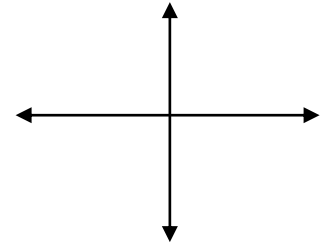


**ANALYSIS:** How does "a" affect our parabola?

## 2. Exploring "h"     $y = a(x - h)^2 + k$

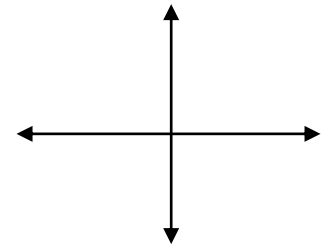
1. Graph  $y = x^2$  on your calculator in  $Y_1$ .

- a) Sketch a graph of the function.
- b) What is the vertex of the graph? \_\_\_\_\_



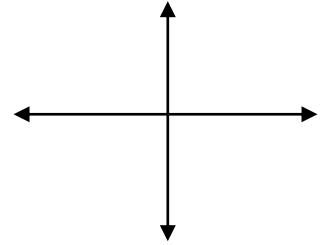
2. Graph  $y = (x - 1)^2$  on your calculator in  $Y_2$ .

- a) Sketch a graph of both functions.
- b) How does the new graph move? Left or Right? \_\_\_\_\_
- c) What was the SIGN of the 1?
- d) What is the vertex of the new graph? \_\_\_\_\_



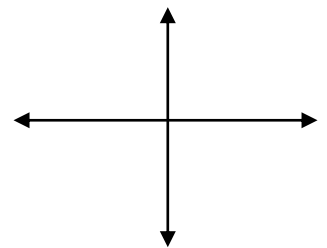
3. Graph  $y = (x - 5)^2$  on your calculator in  $Y_2$ .

- a) Sketch a graph of both functions.
- b) How does the new graph move? Left or Right? \_\_\_\_\_
- c) What was the SIGN of the 5?
- d) What is the vertex of the new graph? \_\_\_\_\_



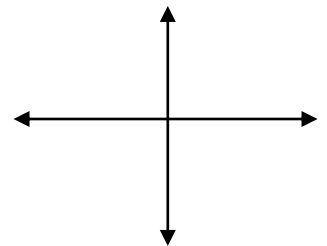
4. Graph  $y = (x + 3)^2$  on your calculator in  $Y_2$ .

- a) Sketch a graph of both functions.
- b) How does the new graph move? Left or Right? \_\_\_\_\_
- c) What was the SIGN of the 3?
- d) What is the vertex of the new graph? \_\_\_\_\_



5. Graph  $y = (x + 7)^2$  on your calculator in  $Y_2$ .

- a) Sketch a graph of both functions.
- b) How does the new graph move? Left or Right? \_\_\_\_\_
- c) What was the SIGN of the 7?
- d) What is the vertex of the new graph? \_\_\_\_\_



**ANALYSIS:** How does "h" affect our parabola?

When we have  $(x - h)^2$ , what direction does the graph move?

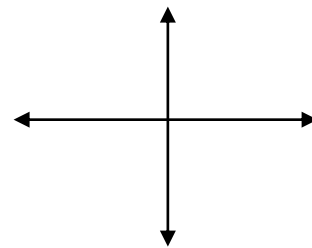
When we have  $(x + h)^2$ , what direction does the graph move?

**WHY** is this true?

**1. Exploring "k"      $y = a(x - h)^2 + k$**

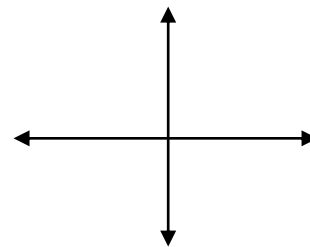
1. Graph  $y = x^2$  on your calculator in  $Y_1$ .

- a) Sketch a graph of the function.
- b) What is the vertex of the graph? \_\_\_\_\_



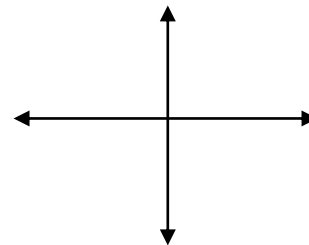
2. Graph  $y = x^2 - 1$  on your calculator in  $Y_2$ .

- a) Sketch a graph of both functions.
- b) How does the new graph move? Up or down? \_\_\_\_\_
- c) What is "h" for this quadratic? What is "k"?
- d) What is the vertex of the new graph? \_\_\_\_\_



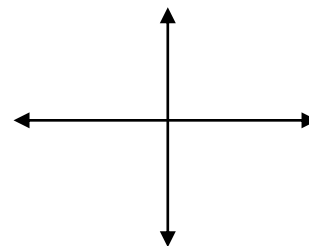
3. Graph  $y = x^2 - 5$  on your calculator in  $Y_2$ .

- a) Sketch a graph of both functions.
- b) How does the new graph move? Up or down? \_\_\_\_\_
- c) What is "h" for this quadratic? What is "k"?
- d) What is the vertex of the new graph? \_\_\_\_\_



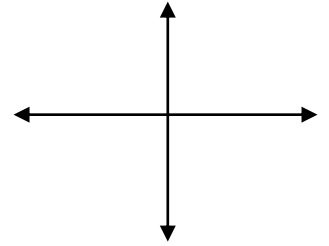
4. Graph  $y = x^2 + 3$  on your calculator in  $Y_2$ .

- a) Sketch a graph of both functions.
- b) How does the new graph move? Up or down? \_\_\_\_\_
- c) What is "h" for this quadratic? What is "k"?
- d) What is the vertex of the new graph? \_\_\_\_\_



5. Graph  $y = x^2 + 7$  on your calculator in  $Y_2$ .

- a) Sketch a graph of both functions.
- b) How does the new graph move? Up or down? \_\_\_\_\_
- c) What is "h" for this quadratic? What is "k"?
- d) What is the vertex of the new graph? \_\_\_\_\_



**ANALYSIS:** How does "k" affect our parabola?

### Putting It ALL Together -

1. Graph  $y = x^2$  on your calculator in  $Y_1$ .

2. Graph  $y = (x - 3)^2 - 4$  on you calculator in  $Y_2$ .

- a) What direction does the graph open? \_\_\_\_\_
- b) Is it "stretched tall," "shrunk and squatty," or normal? \_\_\_\_\_
- c) How does the graph move? (left/right, up/down) \_\_\_\_\_
- d) What is the vertex of the graph? \_\_\_\_\_

3. Graph  $y = -\frac{1}{2}(x - 2)^2 - 3$  on you calculator in  $Y_2$ .

- a) What direction does the graph open? \_\_\_\_\_
- b) Is it "stretched tall," "shrunk and squatty," or normal? \_\_\_\_\_
- c) How does the graph move? (left/right, up/down) \_\_\_\_\_
- d) What is the vertex of the graph? \_\_\_\_\_

4. Graph  $y = -2(x + 5)^2 + 7$  on you calculator in  $Y_2$ .

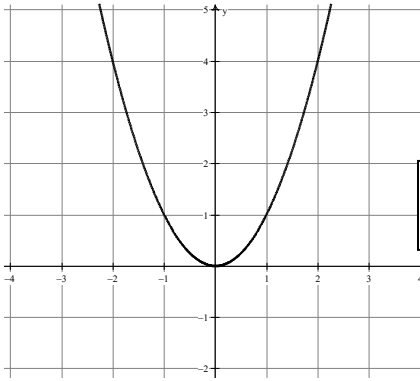
- a) What direction does the graph open? \_\_\_\_\_
- b) Is it "stretched tall," "shrunk and squatty," or normal? \_\_\_\_\_
- c) How does the graph move? (left/right, up/down) \_\_\_\_\_
- d) What is the vertex of the graph? \_\_\_\_\_

5. Graph  $y = (x + 6)^2 - 4$  on you calculator in  $Y_2$ .

- a) What direction does the graph open? \_\_\_\_\_
- b) Is it "stretched tall," "shrunk and squatty," or normal? \_\_\_\_\_
- c) How does the graph move? (left/right, up/down) \_\_\_\_\_
- d) What is the vertex of the graph? \_\_\_\_\_

**Now generalize**...Fill in the table using your new knowledge.

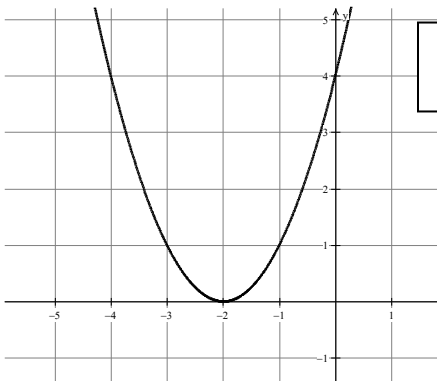
Function	Direction/Opening (up or down)	Vertex	Vertical Stretch or Shrink
1. $y = \frac{1}{4}(x + 4)^2 - 9$			
2. $y = -2(x + 1)^2 + 6$			
3. $y = 4(x - 3)^2 + 5$			
4. $y = -\frac{1}{2}(x - 7)^2 + 3$			
5. $y = 2(x + 4)^2 - 1$			



A

3

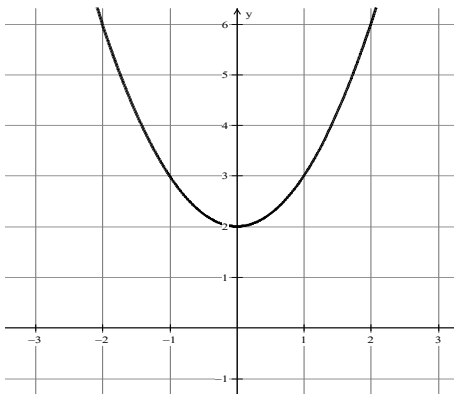
$$y = x^2$$



G

7

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

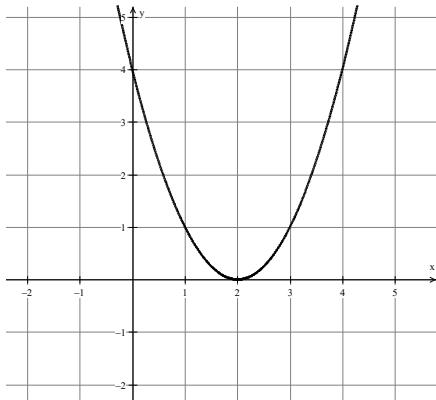


B

1

$$y = x^2 + 2$$

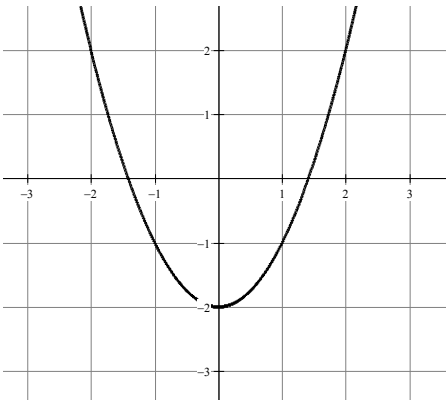




H

4

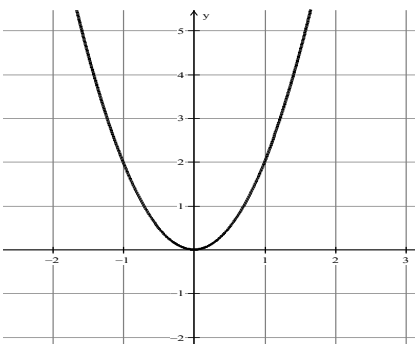
$$y = (x - 2)^2$$



C

8

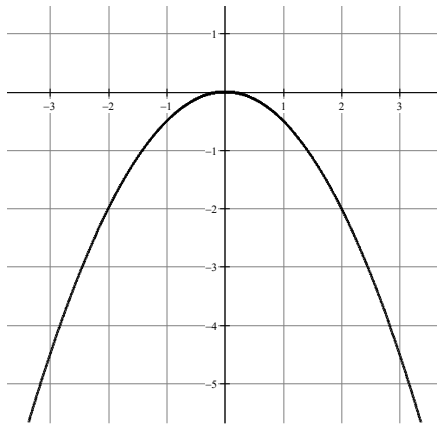
$$y = x^2 - 2$$



E

2

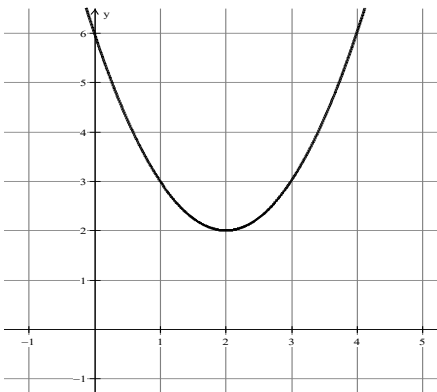
$$y = 2x^2$$



D

5

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



F

6

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

Name: \_\_\_\_\_

## Quadratics in Vertex Form Formative Assessment

**Directions:** Begin each sort with the set of **ALL** cards. List the letters and numbers of quadratics that match each description. As an alternative, you may take a picture of the set of equations and graphs. Some cards will be listed in more than one category.

- 1) Find all **graphs and equations** with any **horizontal shift**.
  
  
  
  
  
  
  
  
  
  
- 2) Find all **graphs and equations** with any **vertical shift**.
  
  
  
  
  
  
  
  
  
  
- 3) Find all **graphs and equations** with any **vertical shrink**.
  
  
  
  
  
  
  
  
  
  
- 4) Find all **graphs and equations** with any **vertical stretch**.

**Show the teacher when you have completed these sorts!!!**

Now match each graph to its corresponding equation.

A     \_\_\_\_\_

E     \_\_\_\_\_

B     \_\_\_\_\_

F     \_\_\_\_\_

C     \_\_\_\_\_

G     \_\_\_\_\_

D     \_\_\_\_\_

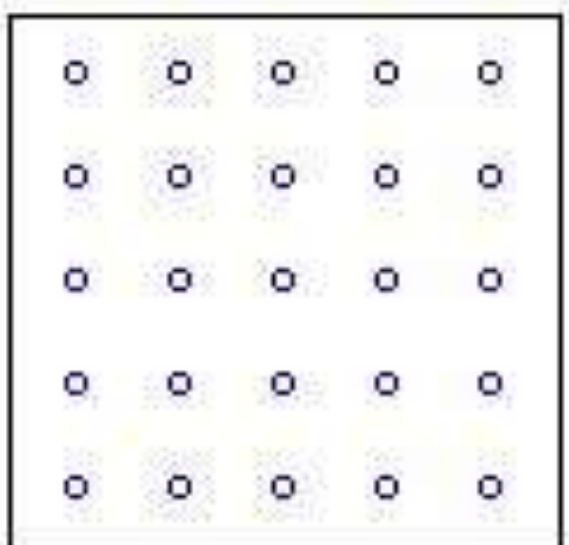
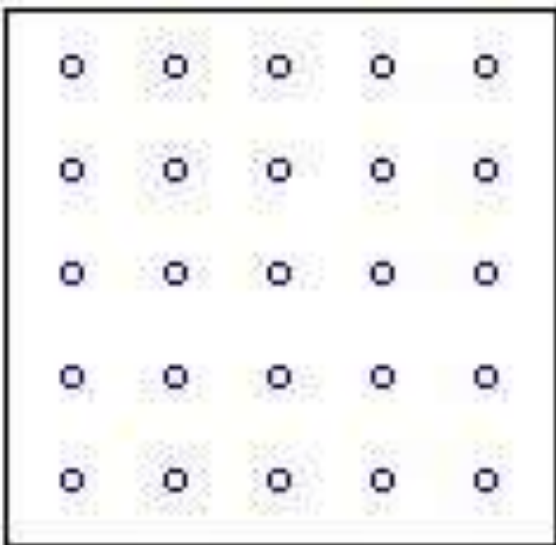
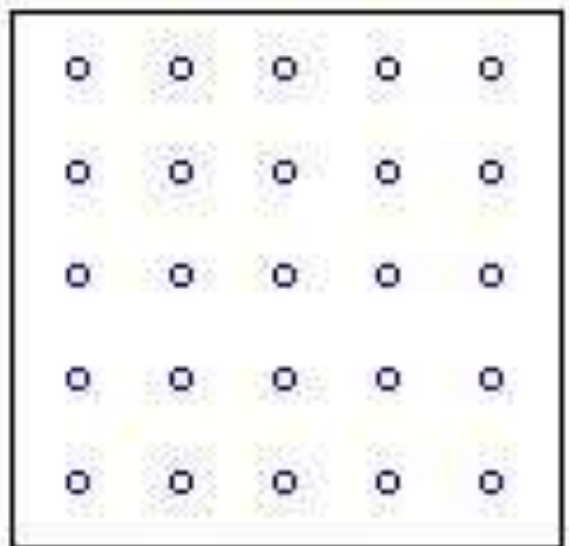
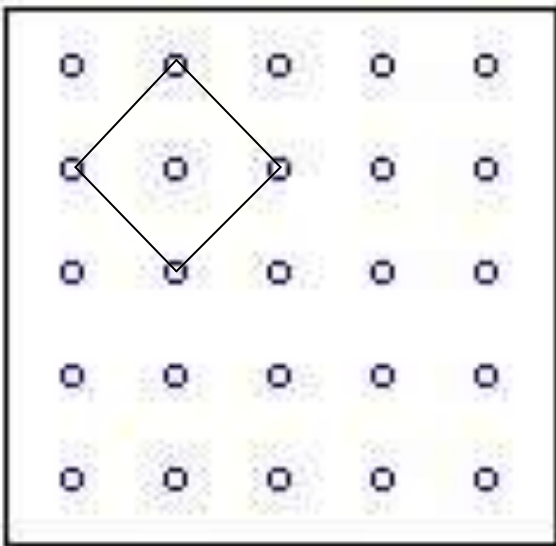
H     \_\_\_\_\_

## The Legacy of Pythagoras

$$(\text{leg})^2 + (\text{leg})^2 = (\text{hypotenuse})^2$$

Given a 5X5 Geoboard, comprised of 25 pegs, as shown, your task is to determine how many different sized squares can be created by connecting **4 pegs**. Note that some squares, as shown below, will be "slanted" squares.

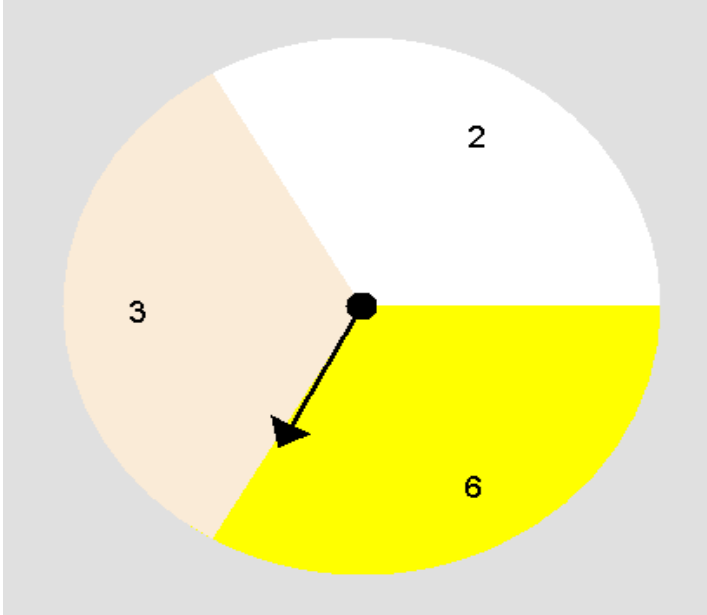
Sketch your drawings. Find the length of each side and the area.



# Probability and Fair Games

## Would you put your money on this one?

**Spinner A**



Spin both spinners and record the results. Create a fraction with the numerator from spinner A and denominator from Spinner B. Record your result as a rational number.

numerator	denominator	rational number

Player1	Player2

**Spinner B**

