Name _____ **Date** _____ **Band** _____

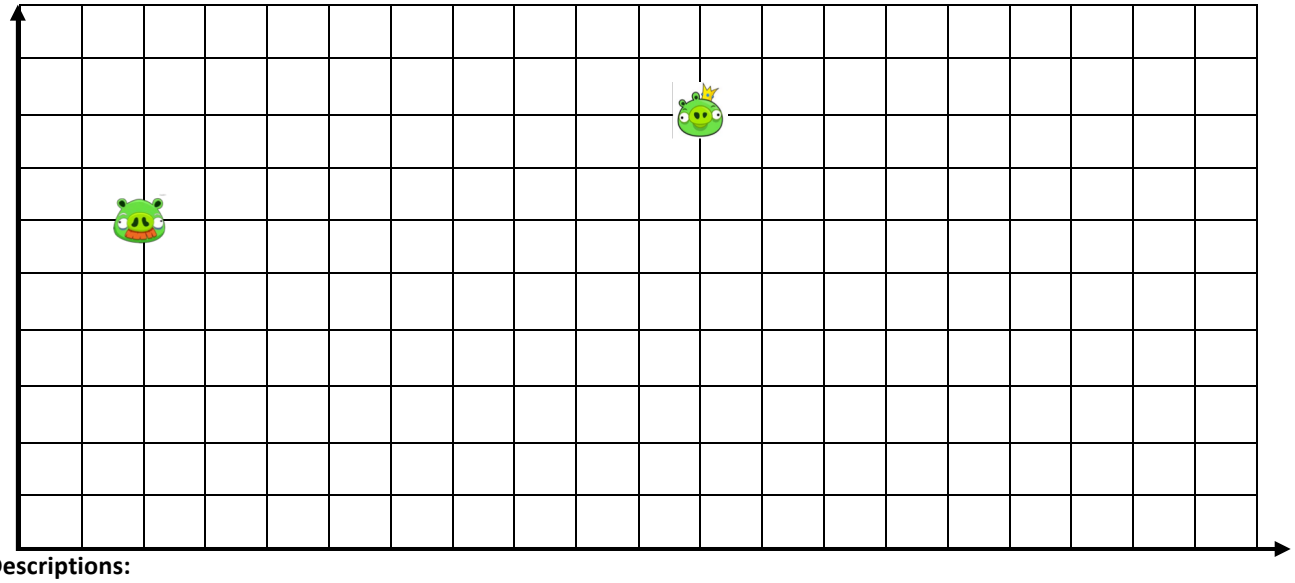
Algebra I PBA Project

"The Parabolic Edition"

Level 1:

On Your Mark, Get Set, Goooo!

Below is a description of each Bird's flight path (Yellow, Blue, Black). Use the space below the desciption to show any work you need in order to graph the bird's path. All paths should be graphed on the same coordinate grid below. Each square unit represents 1 yard on the y-axis and 1 second for the x-axis. Clearly mark each point on the graph.



Flight Descriptions:

Yellow Bird's flight path can be modeled by the quadratic equation: $y = -2x^2 + 12x - 10$	Blue Bird starts his flight from point (0, 0). His flight path reaches a maximum value of 5 yards and lands at point (20, 0)	Black Bird's flight path can be modeled by the quadratic function: $y = -.25(x - 9)^2 + 9$

Level 1, Activity Questions:

If King Pig is located at (11, 8) which Angry Bird hit him? *Prove your answer.*	Which bird reached the highest altittude? What is its maximum height? How much higher was this than the lowest altitude?	Which bird was in the air the longest? How long was it in the air? How long did it take before that bird began to descend?

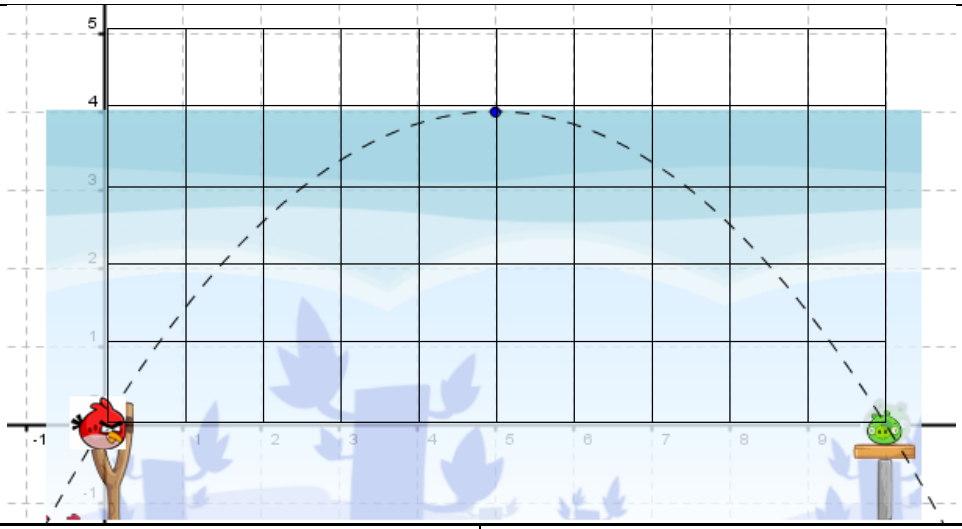
Level 2:

I'm Coming For You!

Red Bird starts at (0, 0). King Pig is at (10, 0). Red Bird must pass through the vertex of the parabola, (5, 4).

Write the quadratic function that represents Red Bird's flight path in vertex and intercept form.

[Hint: It is okay to get a fraction!] – Each square unit represents 1 yard on the y-axis and 1 second for the x-axis.



Show all of your work for Vertex Form:	Show all of your work for Intercept Form:
Vertex Equation: y = _____	Intercept Equation: y = _____

Level 2, Activity Questions:

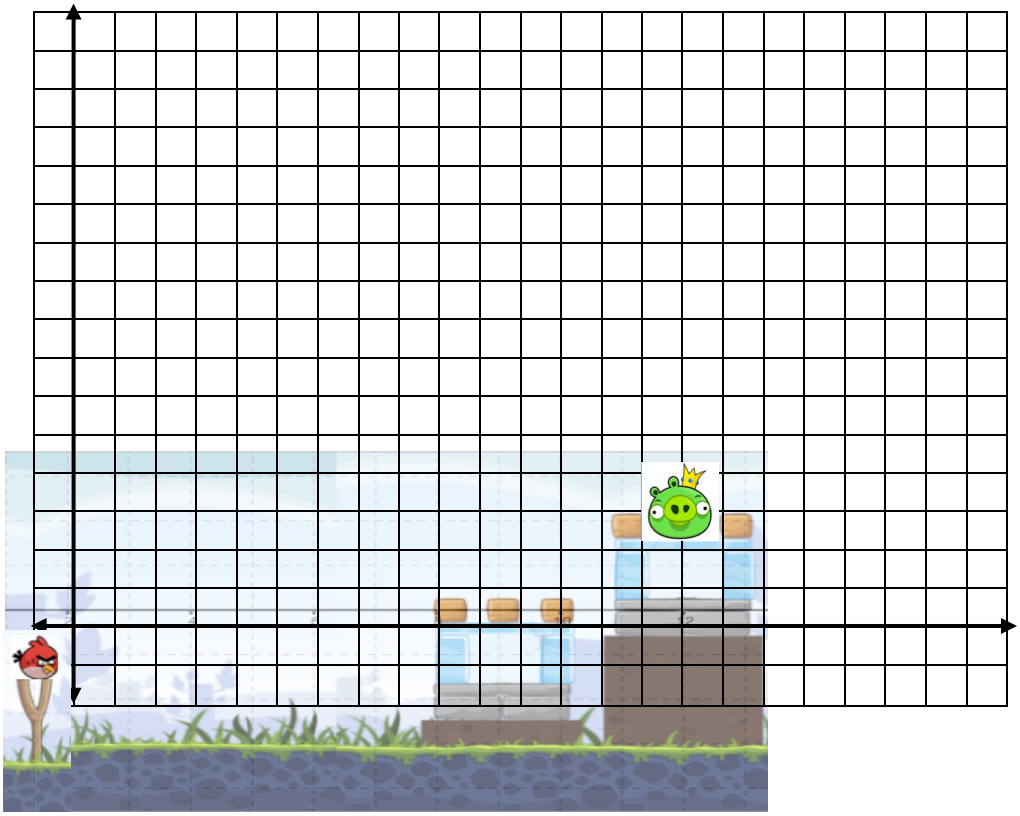
- How far was the Red Bird after 2 seconds? Use either the vertex or intercept equation to determine your answer.

- If it was not mandatory to go through the vertex $(5,4)$, do you think the above path was the only path Red Bird could take to hit King Pig? If yes, why? If no, describe a new path with an equation written in any form.

Level 3:

How Will I Get That Pig?!

Use what you know about quadratic functions and parabolas to determine what the best quadratic function would be to result in a hit. Use any method you like, but ***be sure to explain*** why you know or believe your chosen equation results in a hit. Note that Red bird starts at the origin and King Pig is located at $(15,3)$. [Your whole parabola does not need to fit on the graph, but I should be able to see *at least 5 points*.]



Equation: _____

Level 3, Activity Questions:

- Explain the steps you took to determine Red Bird's flight path - (Explain your method).

- *Use your equation* to prove that your flight path will hit King Pig?

Level 4:

You're Almost Mine! Use Geogebra software to experiment with parabolic pathways that will lead to a hit.

Activity 1: Jedi Training (http://www.teachmathematics.net/page/16049/angry-birds-1**)**

You are the chosen one! Are you ready for Angry Birds Star Wars? In this game you will need to enter the 'Pork Side.' Harness 'The Force' and your supernatural powers to help Luke Skywalker and Chewbacca correctly aim their path and eliminate the evil pigs. You will quickly realize that space travel takes parabolic paths so any knowledge that you have gained about quadratic graphs will stand in a good stead. Take care, Young Jedi, to use 'The Force' for good.

Step 1: Scroll down to 'Jedi Training.'

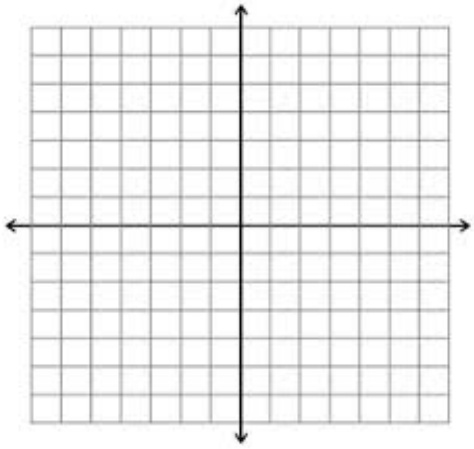
Step 2: Move the black slider left and right.

What happens to the shape and position of the graph $y = ax^2$

as a increases? _____

Draw an example of a graph:

Equation: _____

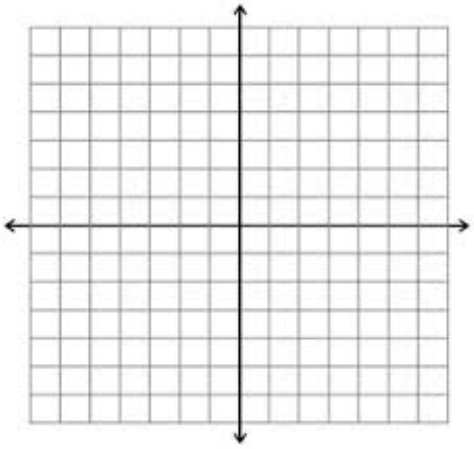


What happens to the shape and position of the graph $y = ax^2$

as a decreases? _____

Draw an example of a graph:

Equation: _____



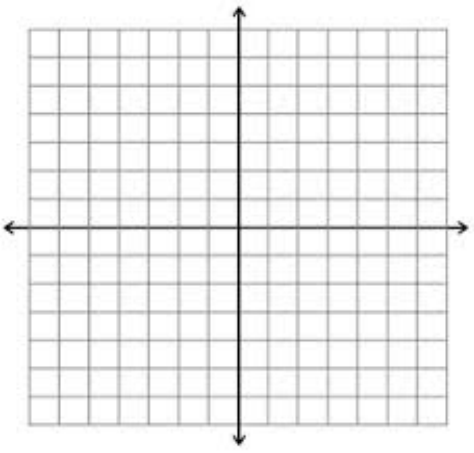
Step 3: Change the inputs in the white boxes.

What happens to the shape and position of the graph $y = (x - a)(x - b)$ as a and b change?

_____

Draw an example of a graph:

Equation: _____



Activity 2: Take aim and shoot those pigs!

Step 1: Scroll up to 'Level 1'

For Levels 1-4:

1. Enter a quadratic equation.
2. Press play to fire.

Step 2: What quadratic equation resulted in a hit?

Step 3: How did you adjust your equation using your Jedi Training from Activity 1?

Level 1: **Equation:** _____ How did you adjust your equation using your Jedi Training from Activity 1?	**Level 2:** **Equation:** _____ How did you adjust your equation using your Jedi Training from Activity 1?
Level 3: **Equation:** _____ How did you adjust your equation using your Jedi Training from Activity 1?	**Level 4:** **Equation:** _____ How did you adjust your equation using your Jedi Training from Activity 1?

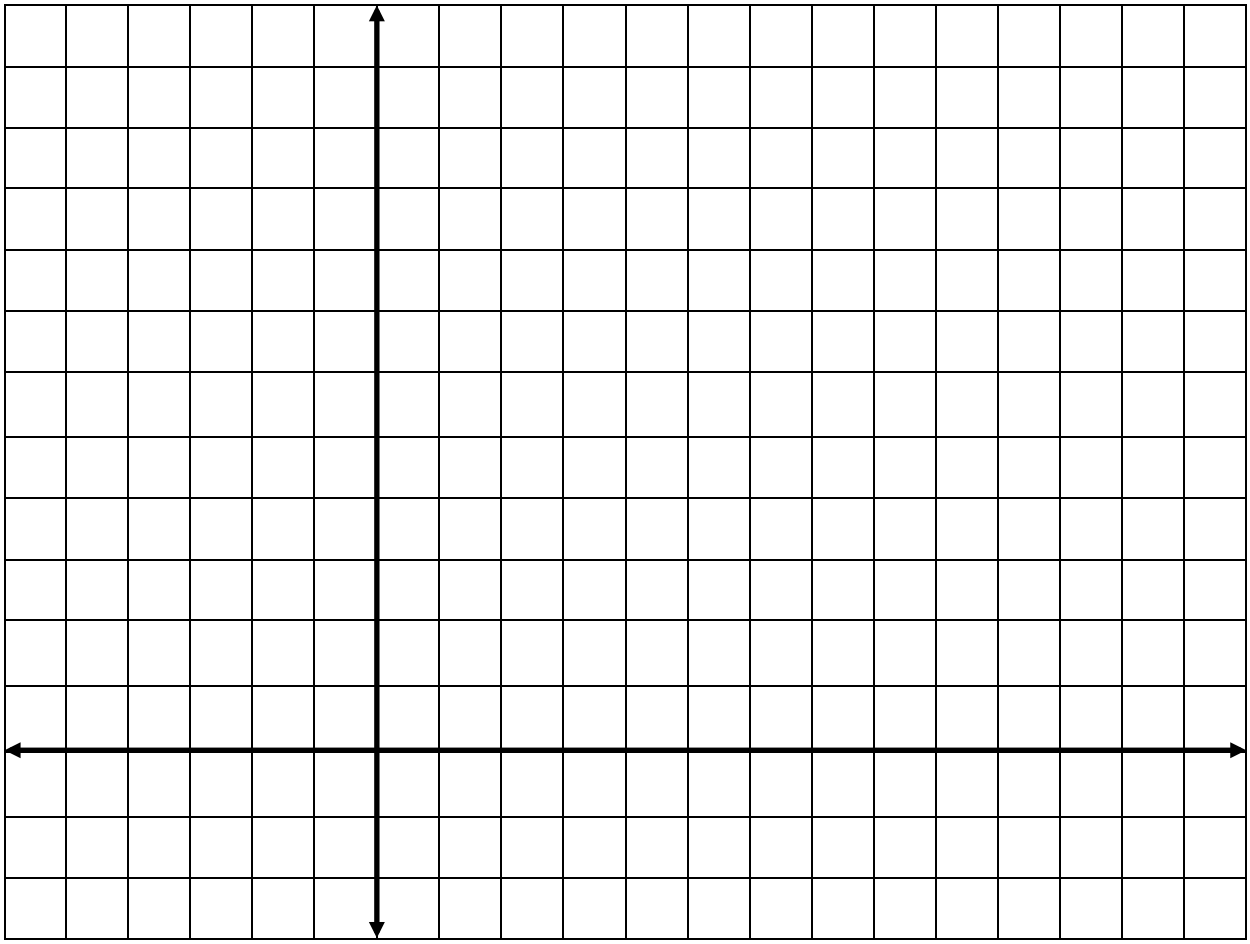
OPTIONAL: Challenge Yourself! (http://www.teachmathematics.net/page/11419/angry-birds-2)

The pigs have stolen the birds' eggs. That makes them angry, very angry. They take aim and launch themselves towards the pigs to get their revenge and reclaim their babies. You will be guiding the birds to ensure their aim is good. Enter the correct quadratic equation and birds fly on the right path and knock out the pigs. There are four levels to this game. Each successive level gets more difficult as the information makes the calculation more challenging. Before attempting this game, you should know and understand the basic properties of the quadratic function, finding zeros, the vertex and it might be helpful to be able to solve simultaneous equations.

Level 5:

You're In My Path Now! Create the next level in the angry birds game....

- You can set King Pig or Red Bird on props to fit into the scene.
- King Pig should NOT be sitting on the x-axis. Red Bird can start anywhere on the coordinate plane.
- Draw a parabola to represent the flight path Red Bird will make.
- Write the equation, in any form, of the flight path and identify the vertex as one of your points.
- Prove that the vertex "works" in your equation and that two additional points on your parabola work.



Red Bird Starting Point: _____ Vertex: _____

King Pig Starting Point: _____ Equation of Parabola: _____

I am showing that the vertex (,)works with my equation.	**I am showing that (,) is a point on my parabola and that it works with my equation.**	**I am showing that (,) is a point on my parabola and that it works with my equation.**

Grading Rubric:

CATEGORY	4	3	2	1
Completion	All problems are completed.	All but one of the problems are completed.	All but two of the problems are completed.	Several of the problems are not completed.
Neatness and Attractiveness	Exceptionally well designed, neat, and attractive. Colors that go well together are used to make the graph more readable.	Neat and relatively attractive.	Lines are neatly drawn but the graph appears quite plain.	Appears messy and "thrown together" in a hurry. Lines are visibly crooked.
Strategy/ Procedures	Typically, uses an efficient and effective strategy to solve the problem(s).	Typically, uses an effective strategy to solve the problem(s).	Sometimes uses an effective strategy to solve problems, but does not do it consistently.	Rarely uses an effective strategy to solve problems.
Diagrams and Sketches	Diagrams and/or sketches are clear and greatly add to the reader's understanding of the procedure(s).	Diagrams and/or sketches are clear and easy to understand.	Diagrams and/or sketches are somewhat difficult to understand.	Diagrams and/or sketches are difficult to understand or are not used.
Mathematical Concepts	Explanation shows complete understanding of the mathematical concepts used to solve the problem(s).	Explanation shows substantial understanding of the mathematical concepts used to solve the problem(s).	Explanation shows some understanding of the mathematical concepts needed to solve the problem(s).	Explanation shows very limited understanding of the underlying concepts needed to solve the problem(s) OR is not written.
Mathematical Errors	90-100% of the steps and solutions are correct.	Almost all (85-89%) of the steps and solutions are correct.	Most (70-84%) of the steps and solutions are correct.	Less than 70% of the steps and solutions are correct. OR There is no work to support the answers.

Comments: **Final Score:** **/ 24**