

Angry Bird Quadratics

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Goal

- The students will find the equation of a parabola from three points on the parabola by constructing their own Angry Birds level.

Objective

- Given graph paper and angry bird cutouts, the students will create their own level of Angry Birds with the block and pig cutouts and construct two parabolas that will knock down the structure that they created.

Materials

- Graph paper
- Pencils
- Angry Bird cut outs
- Block cutouts
- Tape

Prerequisites

- The students should know how to find the equation of a parabola when given three points on it.
- The students should know how to find the axis of symmetry.

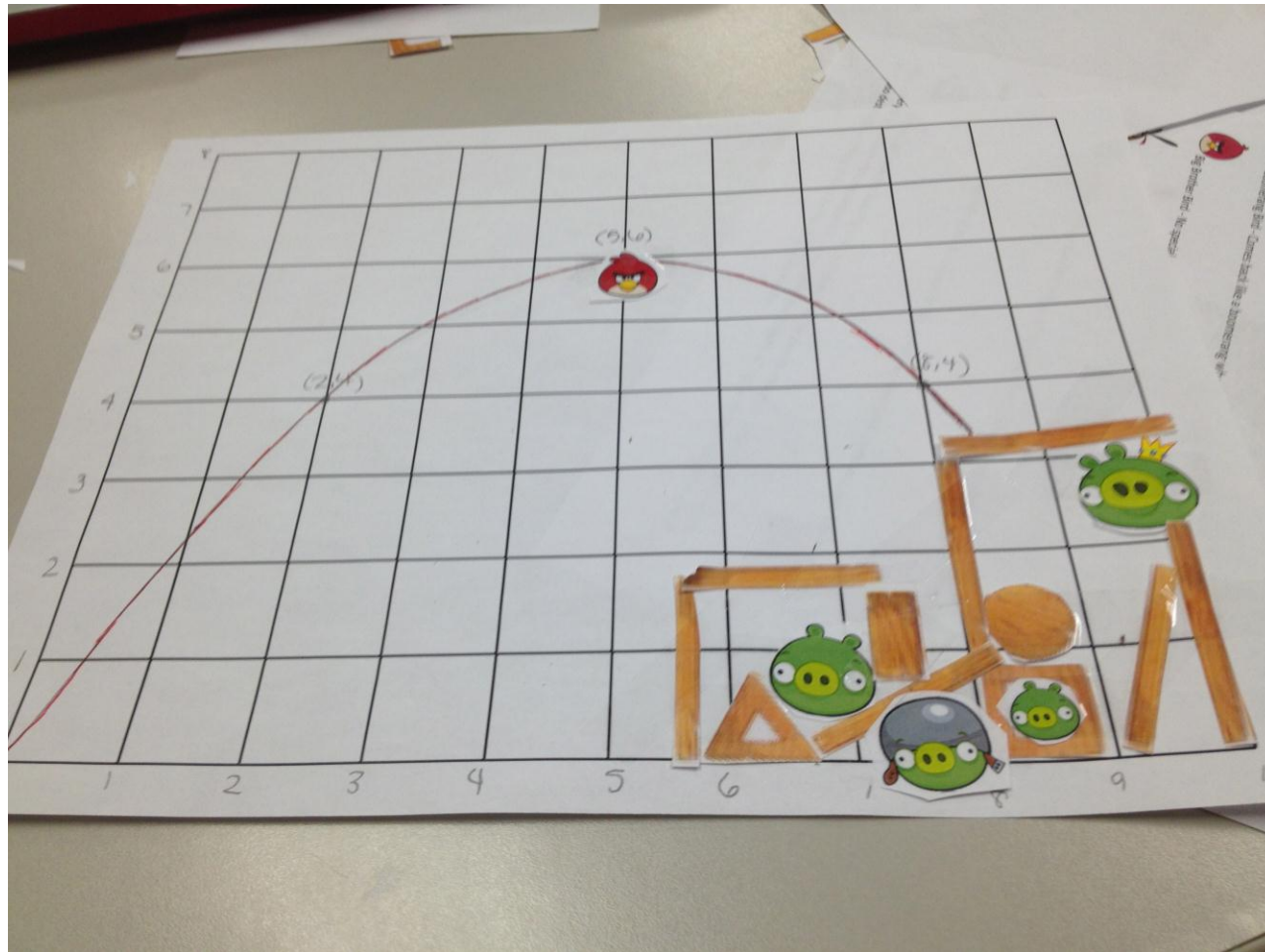
Criteria

- The student must use two different types of birds.
- They must go in two different paths.
- They must describe the way they think the blocks will fall once hit by the birds.

Procedure

1. Create the level by using the blocks given. (Shouldn't be more than 5 minutes)
2. Plot three points that you know the bird will have to travel to land where you want it.
3. Find the equation of the parabola that passes through those three points.
4. Draw what you think will happen after the bird is launched.
5. Repeat steps 2-4 for the second parabola.

Step 2: Plot the three points for the first bird to travel.



Step 3: Find the equation of the parabola that passes through the three points.

Work Space:
 Find the parabola that passes through the 3 points
 (2,4) (5,6) (8,4) $x = -\frac{b}{2a}$

$\textcircled{1} 4 = a(2)^2 + b(2) + c \rightarrow 4 = 4a + 2b + c$
 $\textcircled{2} 6 = a(5)^2 + b(5) + c \rightarrow 6 = 25a + 5b + c$
 $\textcircled{3} 4 = a(8)^2 + b(8) + c \rightarrow 4 = 64a + 8b + c$

$\textcircled{1} 4 = 4a + 2b + c$
 $\textcircled{2} -6 = 25a + 5b + c$
 $\textcircled{3} -4 = 64a + 8b + c$

$\textcircled{1} -2 = -21a - 3b$
 $\textcircled{2} 2 = -39a - 3b$

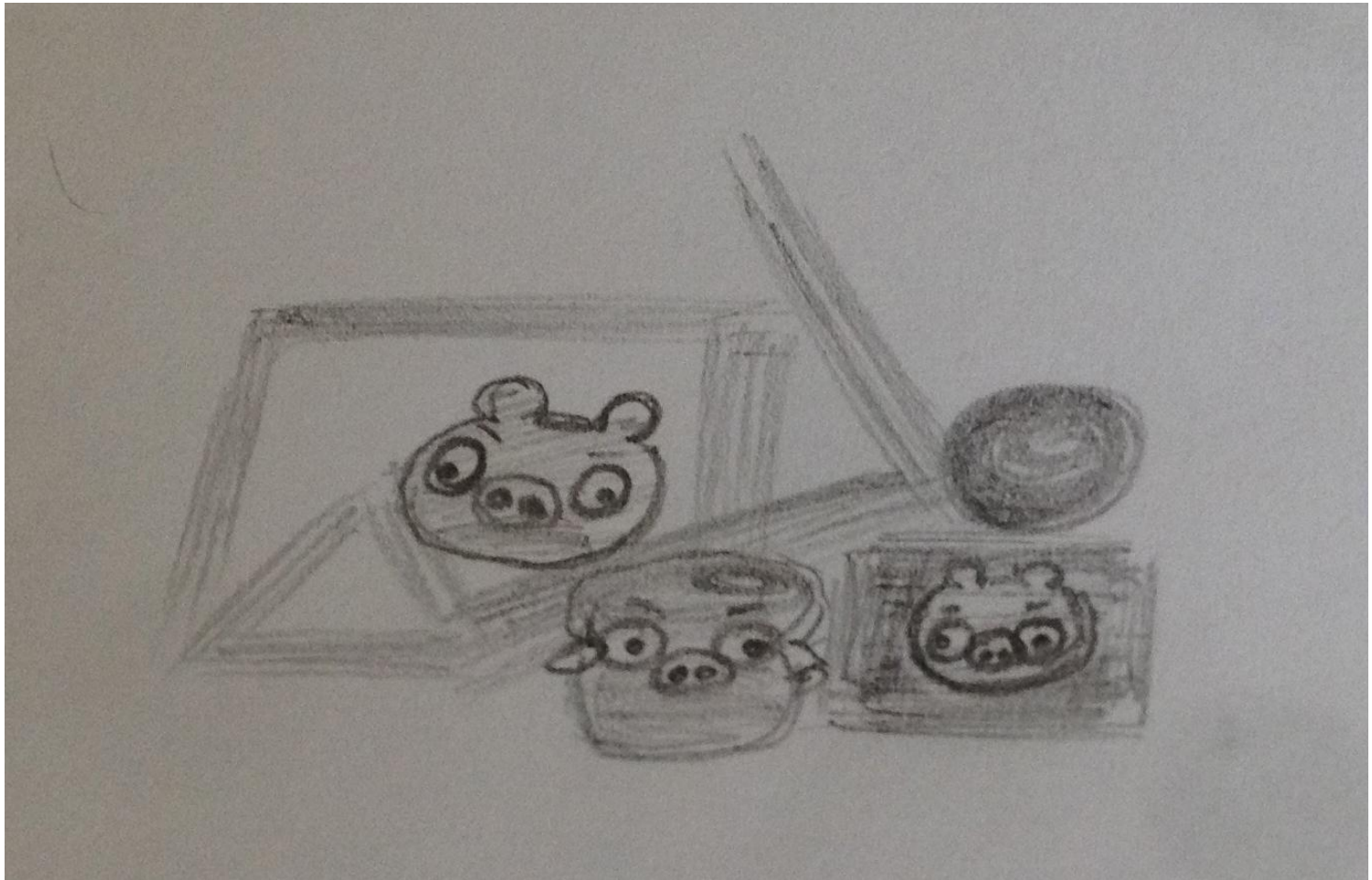
$\frac{-4}{18} = \frac{18a}{18}$
 $\frac{14}{18}$
 $\boxed{a = -\frac{4}{18}}$

$\textcircled{2} 6 = 25a + 5b + c$
 $\textcircled{3} -4 = 64a + 8b + c$
 $\textcircled{5} 2 = -39a - 3b$

$\rightarrow \textcircled{1} -2 = -21(-\frac{4}{18}) - 3b$
 $-2 = 14/3 - 3b$
 $-\frac{20}{3} = -3b$
 $\frac{-20}{-3} = \frac{-3b}{-3}$
 $\boxed{b = 20/9}$

$\textcircled{1} 4 = 4(-\frac{4}{18}) + 2(\frac{20}{9}) + c$
 $4 = -\frac{8}{9} + \frac{40}{9} + c$
 $+\frac{8}{9} - \frac{40}{9} + \frac{8}{9} - \frac{40}{9}$
 $\frac{4}{9} = c$
 $\boxed{\frac{4}{9} = c}$

Step 4: Draw what you think the blocks will look like after the first bird hits.



Step 5: Repeat steps 2-4 for the second parabola.



Work Space:

(5,4) (8,5) (12,4)

$$\textcircled{1} 4 = a(5)^2 + b(5) + c \rightarrow 4 = 25a + 5b + c$$

$$\textcircled{2} 5 = a(8)^2 + b(8) + c \rightarrow 5 = 64a + 8b + c$$

$$\textcircled{3} 4 = a(12)^2 + b(12) + c \rightarrow 4 = 144a + 12b + c$$

$$\textcircled{1} 4 = 25a + 5b + c$$

$$\textcircled{2} 5 = 64a + 8b + c$$

$$\textcircled{2} - (5 = 64a + 8b + c)$$

$$\textcircled{3} - (4 = 144a + 12b + c)$$

$$\textcircled{4} -1 = -39a - 3b$$

$$\textcircled{5} 1 = -80a - 4b$$

$$4(-1 = -39a - 3b)$$

$$3(1 = -80a - 4b)$$

$$-4 = -156a - 12b$$

$$3 = -240a - 12b$$

$$- (3 = -240a - 12b)$$

$$\textcircled{6} 1 = -80\left(\frac{1}{84}\right) - 4b$$

$$1 = 20\frac{1}{3} - 4b$$

$$\frac{-7}{84} = \frac{84a}{84}$$

$$a = -\frac{7}{84}$$

$$\frac{-20\frac{1}{3} - 2\frac{1}{3}}{-17\frac{1}{3}} = \frac{-40\frac{1}{3}}{-17\frac{1}{3}}$$

$$b = \frac{17}{12}$$

axis of symmetry

$$x = -\frac{b}{2a}$$

$$x = \frac{-\left(\frac{17}{12}\right)}{2\left(-\frac{7}{84}\right)} = \frac{17}{2}$$

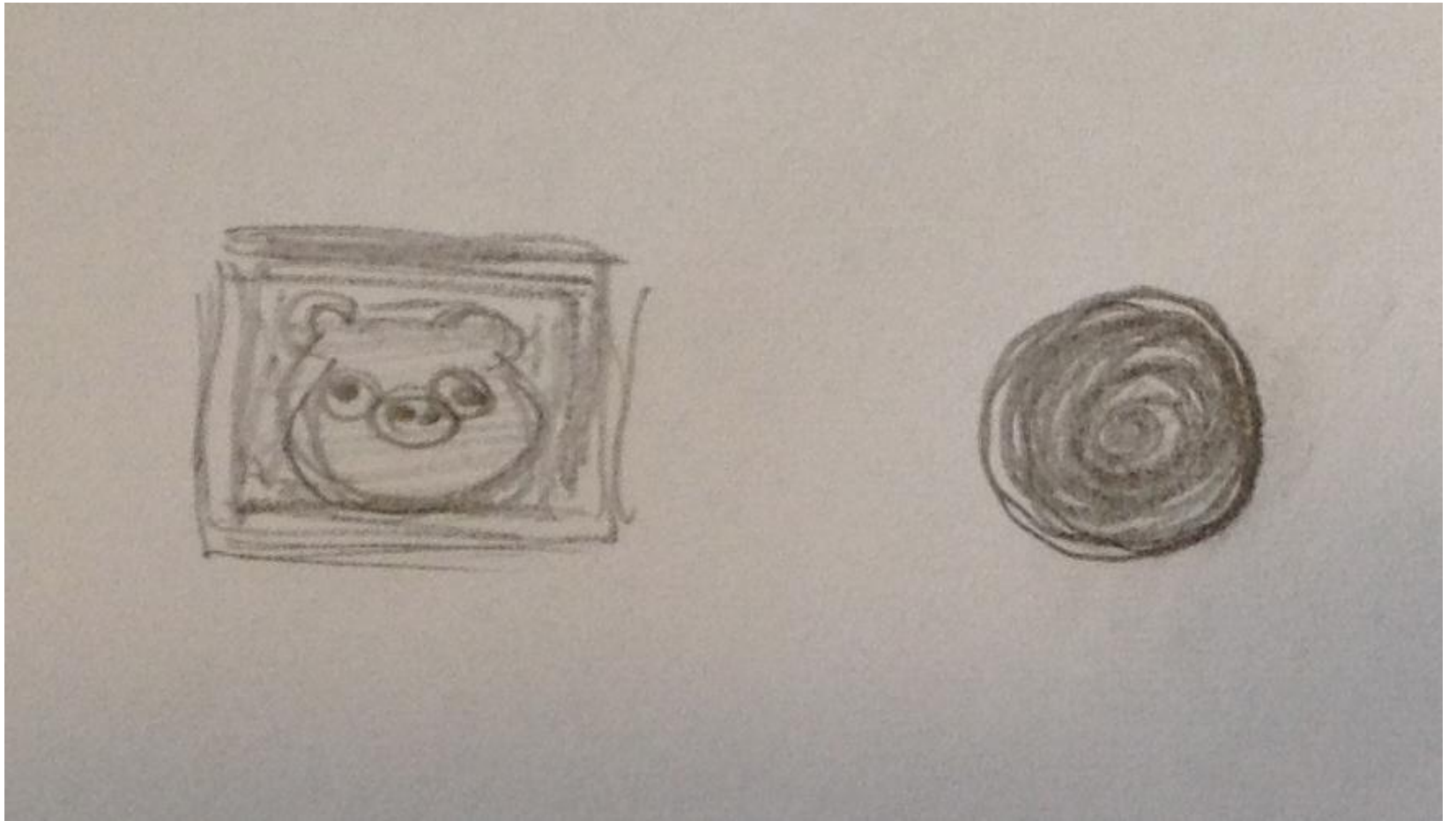
$$\textcircled{1} 4 = 25\left(-\frac{7}{84}\right) + 5\left(\frac{17}{12}\right) + c$$

$$4 = 5 + c$$

$$-5 - 5$$

$$\boxed{-1 = c}$$

$$\boxed{b = \frac{17}{12}}$$



Challenge the Students

- What angle does the bird need to be launched from to get the parabola that you constructed?
- How far down would you need to pull the sling shot to get it at the correct force to keep it on that path?

Other things you can do:

- Create a book from the students creations.
- Have the students create their own new type of bird that has a different specialty.

References

- <http://mrorr-isageek.com/?p=1894>
- http://angrybirds.wikia.com/wiki/Angry_Birds