Name: **Mr. Morton**

Date: _____ Pd: _____

ANGRY BIRDS

$$f(x) = -0.0516 \cdot x^2 + 1.156 \cdot x + 3.5$$

$(9, 8)$

$$h(x) = -0.0556 \cdot x^2 + 1 \cdot x + 3.5$$

Round 1: Projectiles and Parabolas

Look at the two trajectories above.

$$ax^2 + bx + c = 0$$

1. What is the same about the two equations?

   Both are Quadratics, ROXA, Parabolas. They share the same y-intercept.

2. What does the y-intercept represent? What part of the equation gives you the y-intercept?

   Height at launch. The "c" in standard form.

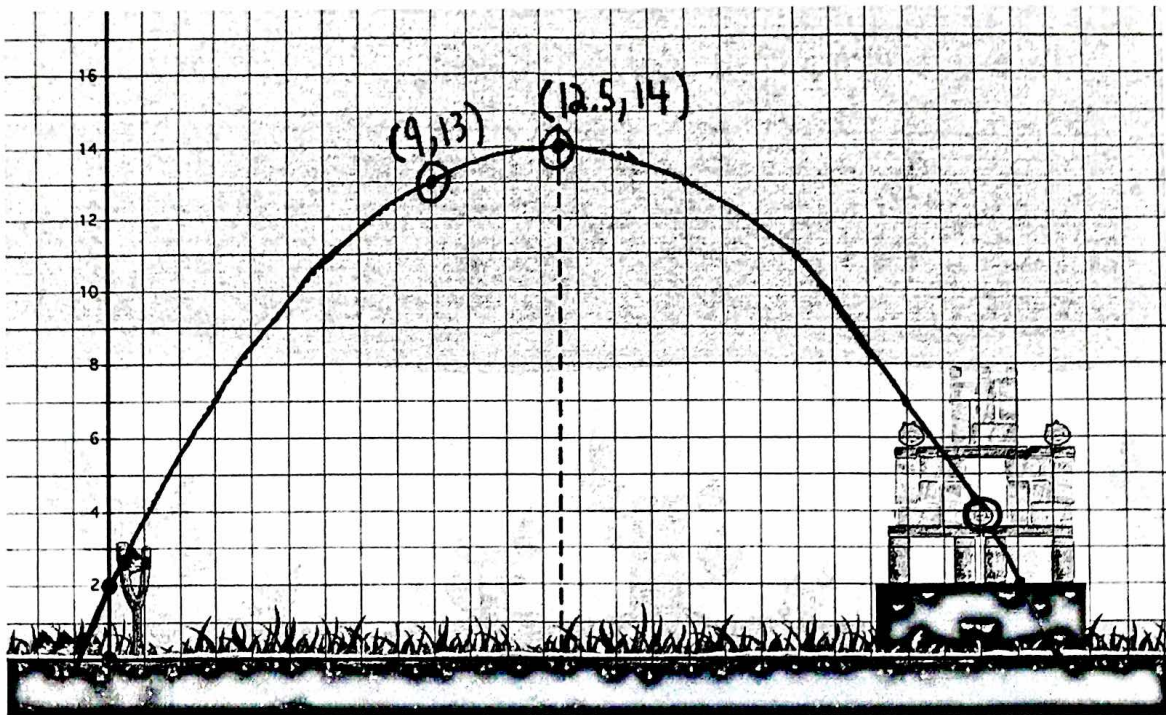3. What do the x-intercepts represent?

   Where the object hits the ground (x-axis).

4. The highest part of the bird's flight is represented by what part of the parabola?

   Vertex!

5. How far does Angry Bird fly in h(x)? How high does he go? How far away from the catapult is he when he is at his highest? When he is 15 feet away, how high is he flying?

   21 ft, 8 ft, 9 ft, 6 ft.

Round 2

1. When Angry Bird is 9 feet away, how high is he flying?

    13 ft.

2. The axis of symmetry is provided. What part of the parabola does this pass through? What does this part represent about Angry Bird's flight?

    Vertex ; Maximum Height.

3. How high does the bird fly?

    14 ft.

4. Reflect points over the axis of symmetry to complete the parabola. Do you hit any pigs?
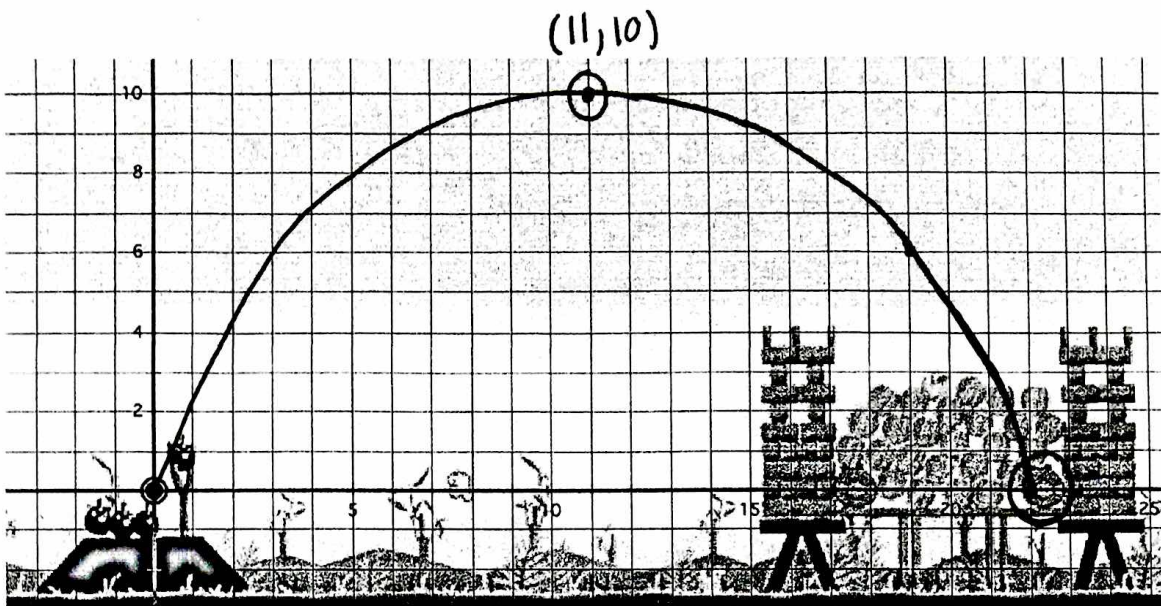
    YES!

5. How far would Angry Bird fly if he did not hit any obstacles?

    ~ 26 ft.

6. Without solving for the whole equation, what is "c" value in standard form? Is "a" positive or negative?

    y-intercept is (0,2) ; c=2 ; a is negative.

(11,10)

Round 3

1. Angry bird and hungry pig #1 are 18 feet away from each other. If angry bird and hungry pig are at the same height (y-value) when angry bird is catapulted, at what distance away is Angry Bird the highest? Think about symmetry.

   9 feet away.

2. Angry Bird wants to hit the pig #2 on the right. The equation representing his flight is:

$$y = -.082x^2 + 1.83x + 0$$

$$-0.082x^2 + 1.83x = 0$$

Using the picture, what is the y-intercept?

   (0,0)

$$-x(0.082x - 1.83) = 0$$

Using the picture, what are the x-intercepts?

   (0,0) and (22,0)

Where is the axis of symmetry? You may use the picture to visualize, but show your algebraic work using $x = \frac{-b}{2a}$. Round to the nearest integer.

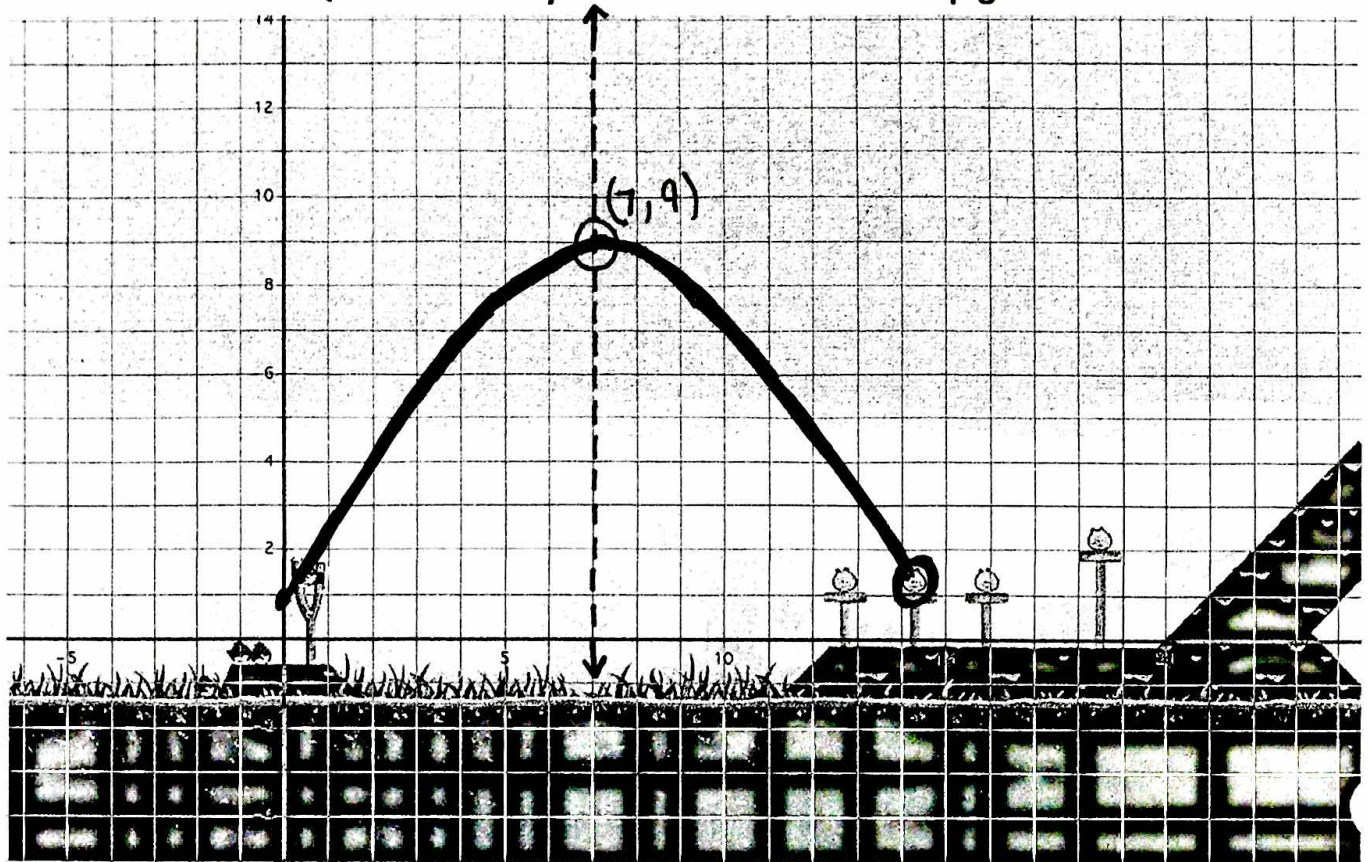$$x = \frac{-b}{2a} = \frac{-(1.83)}{2(-0.082)} = 11.16 \approx 11 \qquad \boxed{x = 11}$$

How high does Angry Bird fly (rounded to the nearest integer)?

$$-0.082(11)^2 + 1.83(11) = 10.2 \approx 10 \qquad \boxed{10 \text{ ft}}$$

Sketch the graph of Angry Bird's flight. ✓

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Question: Can you make the bird hit the pigs?

(7,9)

Take a minute to work in small groups with the people around you. Sketch a graph that you think would make you hit the <u>second pig</u> in this picture.

Use your sketch to find the following information. Your answers may be approximated based on the sketch.

1. the equation for the axis of symmetry $X = 7.$

2. the coordinates of the vertex and the meaning of the vertex $(7,9).$

4. the y-intercept and the meaning of the y-intercept $(0,1);$ starting height.

5. how far the bird traveled before it hit the pig   14 ft.

6. where the bird would have hit the ground if there were no obstacles.   15 ft.

7. how far away from the slingshot the bird was when it was 5 feet high $\approx 2-3$ ft.

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Suppose some very "Angry Birds" are attacking some "pigs" in a castle by using a slingshot to launch themselves at castle walls. Depending on the angle that they are launched at, they will either shoot long and far or high and short. The data about how each slingshot launches each bird is listed below:

Slingshot A		Slingshot B	Slingshot C
Distance the bird is from the slingshot (in meters)	Height of the bird (in meters)		

Slingshot A

Distance the bird is from the slings hot (in meters)	Height of the bird (in meters)
10	20
20	30
30	30
40	20
50	**0**

Slingshot B

Height ≈ 47 ft

31-32 Distance

Slingshot C

$$y = -0.015x^2 + 0.975x$$

Where x is the distance the bird is from the slingshot and y is the height of the bird.

$$y = -x(0.015x - 0.975)$$
$$0 = -x(0.015x - 0.975)$$

$$x = 0 \;/\; x = 65$$

1. How "far" will each slingshot launch each bird? If the castle is far away, which slingshot should they use and why? If the castle is near, which slingshot should they use and why?

    Slingshot C → far away.
    Slingshot B → near.

2. Analyze the slingshot data and compare to determine which slingshot shoots the birds the highest. Explain how you know.

    Slingshot B ≈ 47 ft high.

3. If the castle walls are 30 feet tall, which slingshot should you use and why?

    Either Slingshot A or B; Slingshot C will not go near 30 ft.

4. What are the pros and cons of using each Slingshot A, B, or C?

Slingshot A	Slingshot B	Slingshot C
Pro: average	Pro: highest	Pro: farthest
Con: not the best	Con: shortest	Con: not high