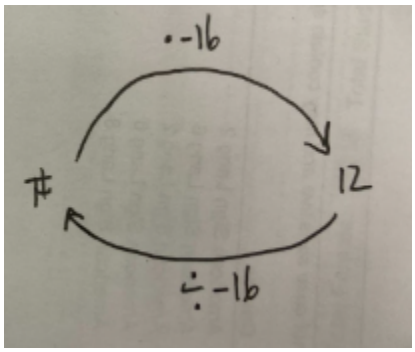
Projectiles Lesson #3: Writing Quadratic Equations Name _____

1. Hazen launched a foam ball that followed the path represented by the model $y = -0.5(x - 3)(x - 11)$ where x = distance from the wall in feet and y = height in feet.
   a. How far from the wall does Hazen's foam ball start and land? Explain how you know.

   b. Calculate y when x = 7. What does that tell you about Hazen's foam ball?

   c. Hazen decides to keep the same starting and landing locations but wants the foam ball to reach a maximum height of 12 feet. Explain why Hazen needs to find a new LEADING COEFFICIENT (that is the number in front of the parentheses, in the first model -0.5).

   d. Here is what Hazen decided to do:
   $y = \#(x - 3)(x - 11)$
   $12 = \#(7 - 3)(7 - 11)$
   $12 = \#(-16)$



   What is the value of Hazen's new LEADING COEFFICIENT?

   e. Show that this leading coefficient describes a pathway for a ball with a maximum height of 12 feet.

   f. Use a similar strategy to find the LEADING COEFFICIENT that will keep Hazen's starting and landing points the same as above and make his foam ball reach a maximum height of 5 feet.

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2. Practice: Find the QUADRATIC MODEL, $y = \#(x - \#)(x - \#)$, that fits each description below. Show your steps.
    a. Tanner wants to launch a foam ball that starts 5 feet from the wall, lands 11 feet from the wall and reaches a maximum height of 18 feet.

    b. Lani wants to launch a foam ball that starts 2 feet from the wall, lands 15 feet from the wall and reaches a maximum height of 20 feet.

    c. Stella wants to launch a foam ball that starts 6 feet from the wall and reaches a maximum height of 10 feet when the foam ball is 11 feet from the wall.

3. DOMAIN describes all the possible x-values (distances from the wall) in a particular situation; RANGE describes all possible y-values (heights) for that catapult launch. For example in the catapult launch from Question #1 (shown in the graph), the DOMAIN is $3 \leq x \leq 11$ and the RANGE is $0 \leq y \leq 8$. What does the DOMAIN tell you about the path of the ball?

    What does the RANGE tell you about the path of the ball?

4. For each situation in Question #2, write the appropriate DOMAIN and RANGE for the models.
    a. Domain: $\leq x \leq$ Range: $\leq y \leq$

    b. Domain: $\leq x \leq$ Range: $\leq y \leq$

    c. Domain: $\leq x \leq$ Range: $\leq y \leq$

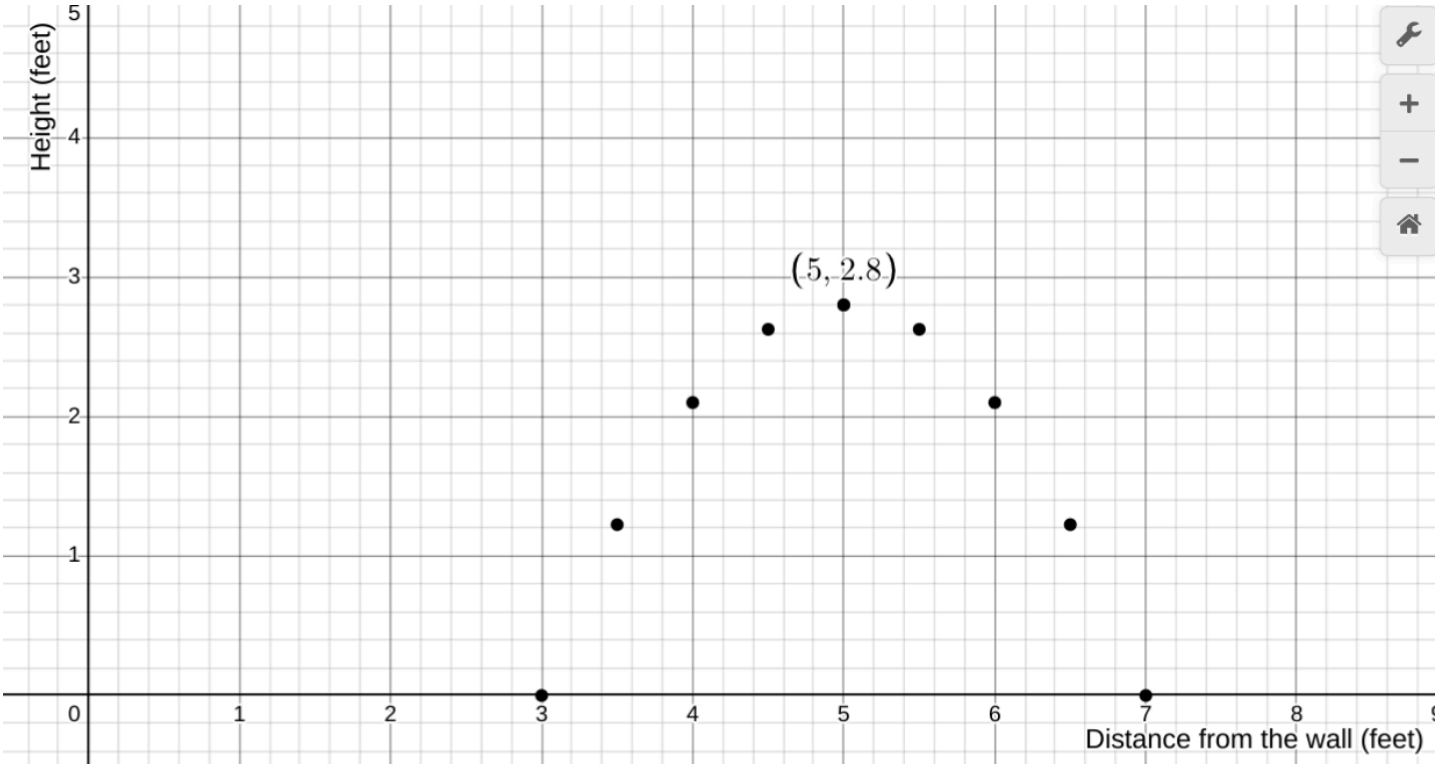
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When finished get Part 2 from the counter.

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Projectile Lesson #3 – Part 2 Name_____

Leona designed a launch with her catapult that would follow the path shown below:



Find the Quadratic Model: y = ____ (x - _____)(x - _____) that fits this launch. Show all of your steps.

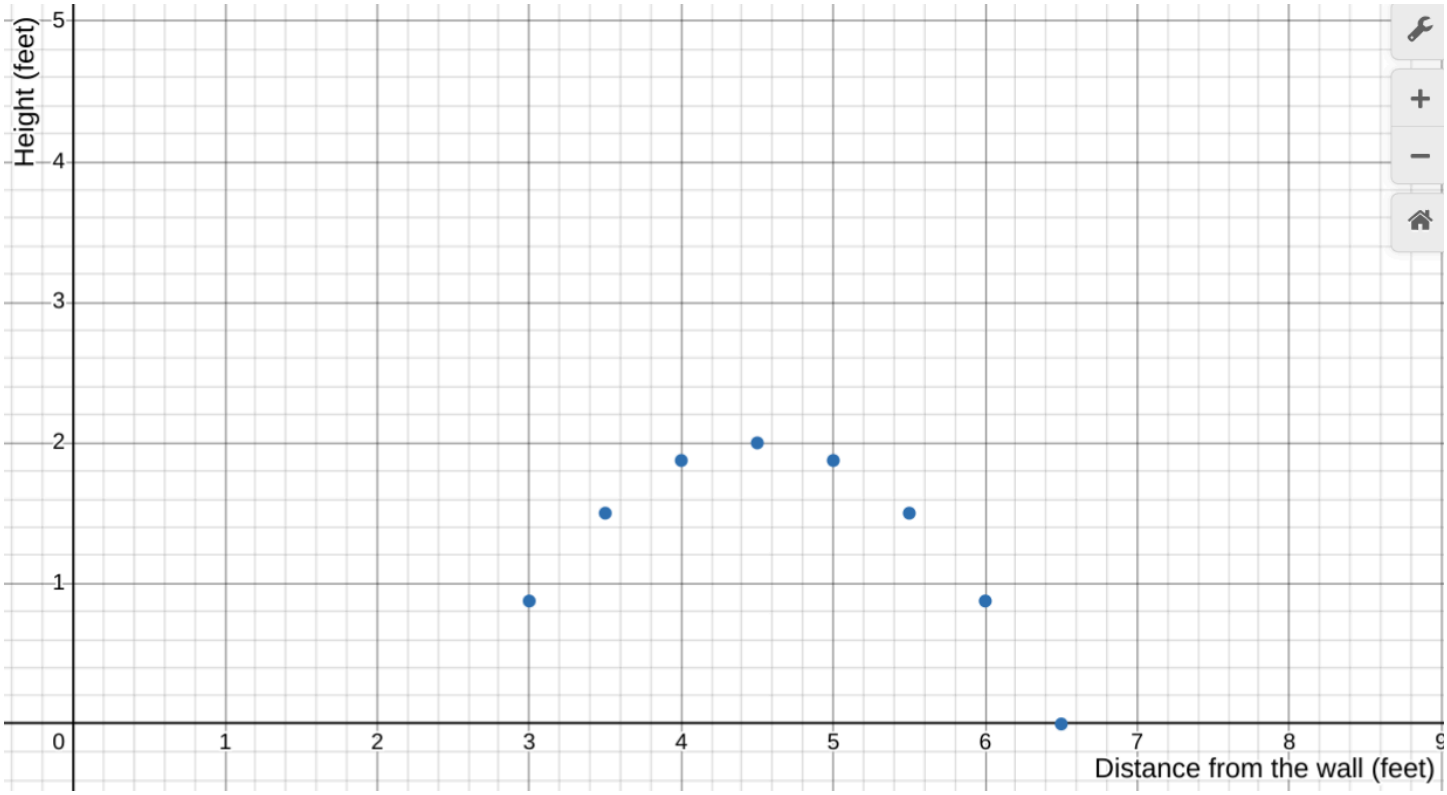
Use this model to complete the table:

x	3	3.5	4	4.5	5	5.5	6	6.5
y								

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Turn Page Over

Leona's actual launch with the catapult (as captured by the iPad software) looked like this:



Use the graph to complete the table (be as precise as you can:

x	3	3.5	4	4.5	5	5.5	6	6.5
y								

- We would like to know the % accuracy of Leona's launch compared to her design. There are several ways we could do this but for simplicity:
  - First, calculate the mean height for Leona's designed launch:

    Mean Designed Height = _____

  - Now calculate the mean height for Leona's actual launch:

    Mean Actual Height = _____

  - What % of the Mean Designed Height is the Mean Actual Height? Show your calculations.

  - What does this % tell you about the accuracy of Leona's Actual Launch compared to her design? Be specific and use the % you calculated in your explanation.

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