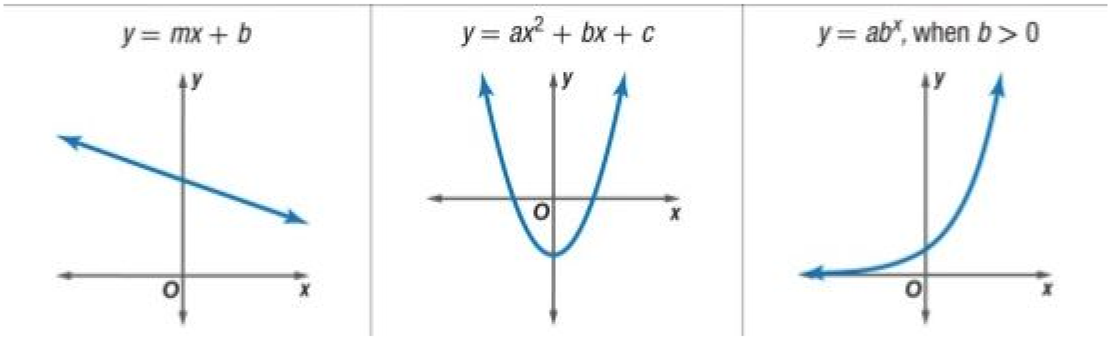
Student Activity Sheet - “What goes up, must come down!”

Based on classroom discussion:

Label each function



Predict what type of model would best fit the data we will be collecting? ________________________

Predict what the concavity of the parabola for this data ? _____________________________

Predict and reason what the domain and range for this data ?

____

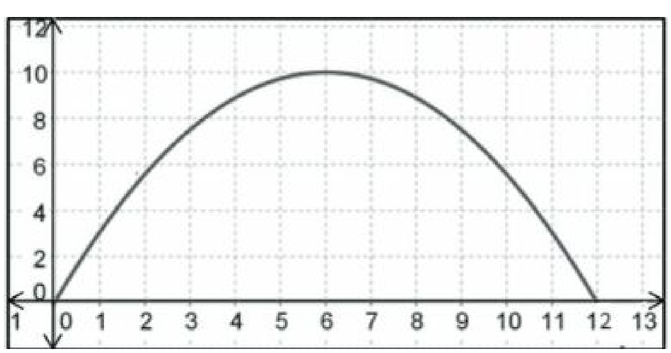
____

Collect materials and go a station.

- Determine the person who will throw the ball and measure the height that they will throw the ball from (initial height) and record on the data sheet.
- Determine where your “markers” will stand and record their positions in the appropriate table.
- When the thrower releases the ball, the “markers” will stop their stopwatch and mark the position of the ball with a post it at the height it reached as it passed them. (This may take multiple attempts so that everyone is able to record the time and height in a single throw.)

  Modification: If “markers” are unable to record both the height and the time, have an additional person watch the thrower using the “lap” function on a stopwatch as the ball passes each person.
- Record the heights and times that the ball reached in the table provided.
- Once all data is collected return to classroom with your group to complete the activity.

Reminder: Measurements are to be recorded in feet and seconds



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The aspects below are the same for the entire activity. The vertical height of the ball will be recorded in all tables as the y-values. The time and horizontal distances will be recorded in the appropriate x-value column.

The height of the ball at the initial (starting) position: ____

The height of the ball at the final position: ____

Duration of the ball being thrown:

Trial 1: ____________________ Trial 2: ____________________________

Distance ball lands from initial position:

Trial 1: ____________________ Trial 2: ____________________________

Part 1: Distance and Height

Independent Variable : x-axis	
Dependent Variable : y-axis	

Trial 1		**Trial 2**	
Independent Variable: x-value	Dependent Variable: y-value	Independent Variable: x-value	Dependent Variable: y-value

Take the average of the two trials to create the table and graph.

x								
y								

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Graph the (x,y) coordinate pairs from Part 1

- Label axes
- Use appropriate scale

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Part 2: Time and Height

Independent Variable : x-axis	
Dependent Variable : y-axis	

Trial 1		**Trial 2**	
Independent Variable: x-value	Dependent Variable: y-value	Independent Variable: x-value	Dependent Variable: y-value

Take the average of the two trials to create the table and graph.

x								
y								

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Graph the (x,y) coordinate pairs from Part 2

- Label axes
- Use appropriate scale

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Using the **calculator cheat sheet**, determine the quadratic regression equation for the set of data.

The general equation for a quadratic function: ______________________________________

Quadratic Regression from Calculator from Part 1

a	
b	
c	
r	
r^2	

The quadratic equation for the data collected: ______________________________________

Quadratic Regression from Calculator from Part 2

a	
b	
c	
r	
r^2	

The quadratic equation for the data collected: ______________________________________

Given these quadratic equations: (Label Part 1 and Part 2)

Do the equations created seem plausible for the experiment conducted? Explain.

Does the concavity of the parabolas align with your prediction? Why or Why not? (Explain what parts of the equation determine that concavity.)

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What is the time in which the ball will reach its maximum height? (Hint: Axis of Symmetry/Vertex)

What is the maximum height the ball will reach ? (Hint: Plug in appropriate values)

From what we know about the correlation coefficient, what does it say about the model we have created ?

Predict why the r -value might not be accurate for a quadratic regression:

What aspects of the activity could create a more accurate quadratic equation? Explain.

Identify the similarities and/or differences in the equations and describe the effect each variable has on the equation.

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Extension:

We talked about the function relating height and time. Where h is height of the ball, t is the time in seconds, v_0 is the initial velocity in feet per second, h_0 is the initial height in feet, and -16 is the gravity constant in feet per second. Use the data collected from the activity to determine the quadratic equation based on these values.

$$h(t) = -16t^2 + v_0 t + h_0$$

Initial Velocity: v_0	
Initial Height: h_0	
Time (Duration) : t	

Calculate the initial velocity:

What is the quadratic equation calculated: ____

Given this quadratic equation:

What is the time in which the ball will reach its maximum height? (Hint: Axis of Symmetry/Vertex)

What is the maximum height the ball will reach ? (Hint: Plug in appropriate values)

Which equation do you think is a more accurate representation and why? (Part 2 and the equation above)