Domain
Functions

Cluster Statement
Construct and compare linear, quadratic, and exponential models and solve problems

Standard
A.CED.2 Create linear and exponential equations in two variables to represent relationships between quantities, graph equations on coordinate axis with labels and scales.

Purpose/Big Idea:
Students will be able to compare data in a table and graph to see the changes in linear and exponential expressions as *x* increases; students will recognize that linear expressions increase at a constant rate (additively) while exponential functions increase multiplicatively. The activity described in this lesson seed would best be used as the introduction in a lesson plan which targets the creation of exponential equations in two variables.

Materials:
- Student activity worksheet
- graphing calculator

Description of how to use the activity:
Students will make a prediction about which model (linear or exponential) will produce the most money at the end of a five week period. Students will complete the chart, describing any patterns they discover. Students determine if their prediction was accurate and answer corresponding questions. Students will use the graphing calculator (or graph paper) to compare the graphs of linear and exponential functions.

Guiding Questions:

- Guiding questions are within the activity. Students will be making predictions between the two models.
- After computing the prize money for 5 weeks, students should note that Model 1 awards a greater amount of money. However, as students continue to collect data throughout the weeks, students should determine that the exponential growth in the second model will surpass the linear model around week 13.
- Students may determine the following formulas for the models:
  - Model 1: $10 + $5 x (number of weeks)
  - Model 2: $.01 x $2^{\text{(number of weeks)}}$
- Upon completion, the teacher should ensure that the students understand how linear and exponential data change and compare to each other when the independent variable is the same.

In this activity, you will compare linear and exponential relationships. Examine the following two scenarios and make a prediction about which model will produce the greatest amount of money:

Model 1: A prize will be awarded that begins with $10 and increases by $5 each week for 20 weeks

Model 2: A prize will be awarded that begins with $0.01 and doubles each week for 20 weeks.

1. In the space below, make a prediction about which model you believe will generate the greatest amount of money. Explain your reasoning:

Complete the chart below for the first 6 weeks:

Week #	Model 1 Amount of Prize Money Awarded	Model 2 Amount of Prize Money Awarded
0		
1		
2		
3		
4		
5		

2. After computing the prize money awarded for more and more weeks, Annie begins to believe that the method for awarding the prize described in Model 2 (begins with $0.01 and doubles each week) will result in a prize of a greater amount of money. How could Annie verify this belief?

Complete the chart below for weeks 6-10:

Week #	Model 1	Model 2
	Amount of Prize Money Awarded	Amount of Prize Money Awarded
6		
7		
8		
9		
10		

3. Describe the patterns that are displayed in the "Amount of Prize Money Awarded" by:

Model 1

Model 2

Complete the chart below for the next 10 weeks:

Week #	Model 1	Model 2
	Amount of Prize Money Awarded	Amount of Prize Money Awarded
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

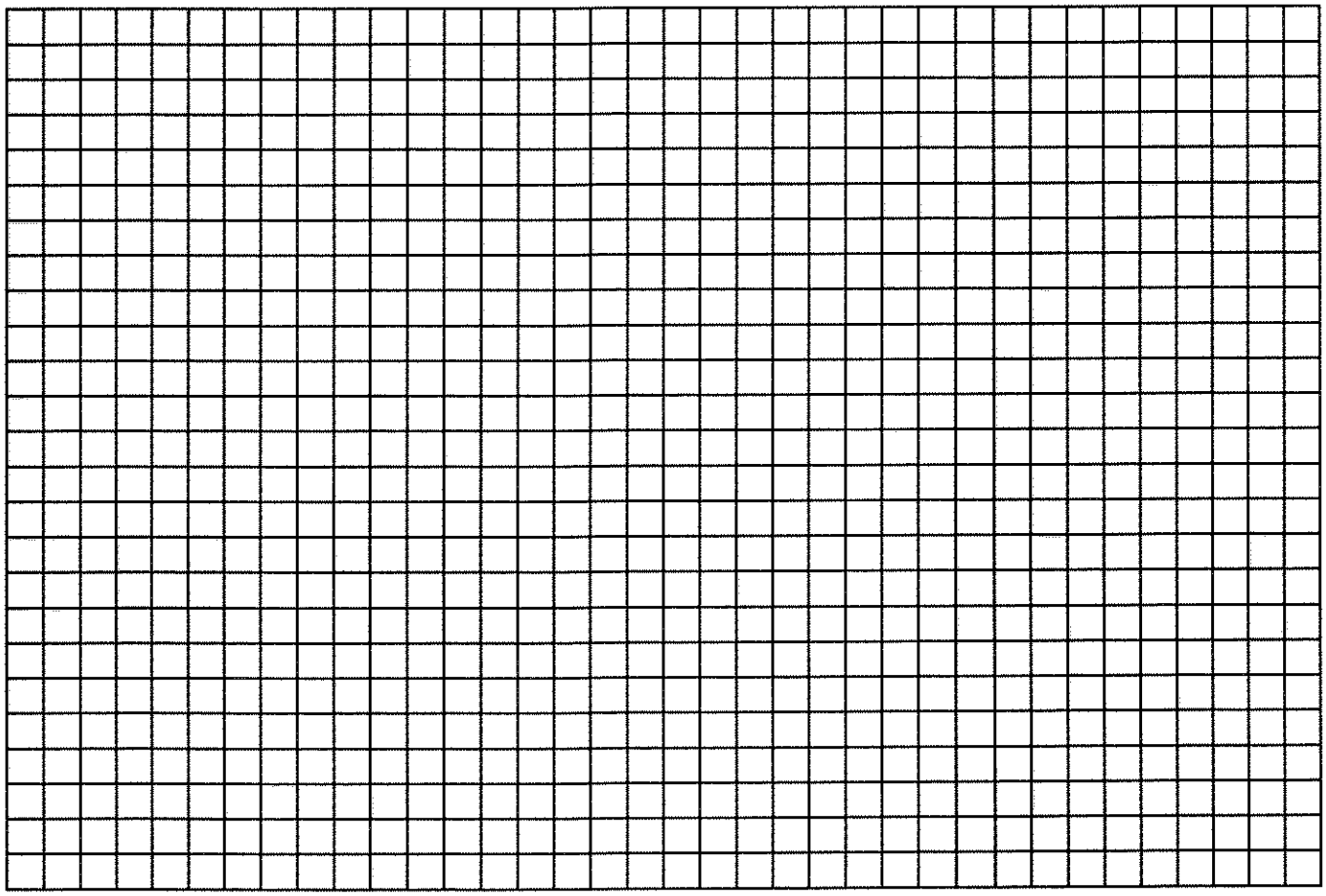
4. Use the "Prize Money Awarded" data to determine after how many weeks does Model 2 award more money than Model 1.

5. Predict how much prize money would be awarded at the end of 25 weeks for each model.

   Model 1:

   Model 2:

6. Graphing
   - Using two different colors, plot the week versus Amount of Prize Money Awarded data for each model. Label the axes, scales and title of the graph appropriately.



7. Connect the dots in each scatter plot to form a curve. Approximate the coordinates of the point of intersection of the two curves. What does this point represent in the context of this problem?

8. Describe the differences between how quickly the "Amount of Prize Money Awarded" changes for the two models.