

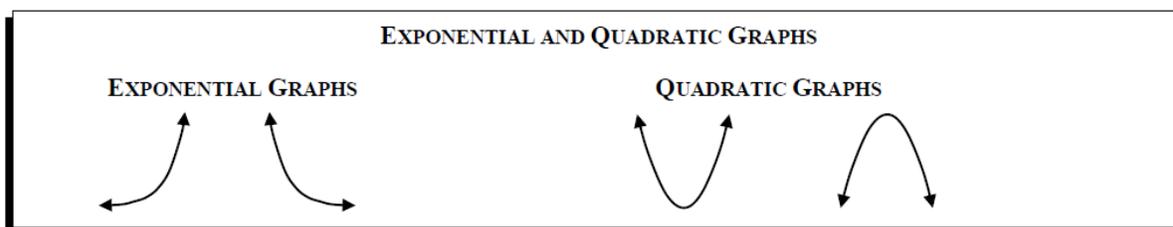
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## 12.8 NOTES: Exponential and Quadratic Regression

Algebra 1

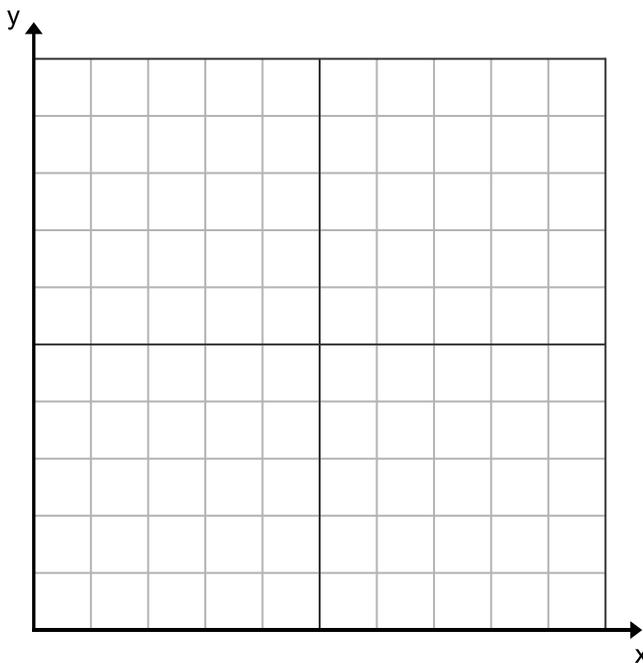
In the last lesson we fit \_\_\_\_\_ data sets with **lines of best fit**. Sometimes, though, linear models are not the best choice. We can fit **bivariate data** to all sorts of curves, the most common of which are \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_. Today we will focus on exponential and quadratic curves.



Exercise 1: The following table shows the spread of the flu in New York City during the first week of December in 2014.

- a. Graph the following data and decide which function would best represent the data.

Days	Cases
0	8
1	12
3	17
4	25
6	40
7	68



Just as the \_\_\_\_\_ indicates how \_\_\_\_\_ the relationship is between sets of data; the \_\_\_\_\_ indicates which \_\_\_\_\_ is the best fit. **The closer  $r^2$  is to 1, the better the fit.**

- b. Enter the data into your calculator and run three regressions (linear, exponential, and quadratic). What is the **Coefficient of Determination,  $r^2$** , for each (*round to the nearest thousandth*)?

Linear:  $r^2 =$  \_\_\_\_\_

Quadratic:  $r^2 =$  \_\_\_\_\_

Exponential:  $r^2 =$  \_\_\_\_\_

Which function best models the data? \_\_\_\_\_

- c. Write the regression equation that best models the data (*round values to the nearest hundredth*).
- d. Use the regression equation to predict the number of flu cases New York City can expect in 14 days (*round to the nearest whole #*).
- e. According to your model, by what percent are the flu cases increasing on a daily basis?
- f. On which day can New York City expect to see 1,000 cases?

Exercise 2: The cost per “widget” produced by a factory generally decreases the more widgets that are produced. However, after a certain number, costs tend to swing back in the other direction and slowly increase. The trick for manufactures is to find that optimal number to maximize their efficiency. Below is data collected by a small manufacturer that produces tie dye t-shirts.

# of T-Shirts	35	88	110	135	154	190
Cost per T-Shirt (\$)	9.32	2.63	1.42	1.32	2.12	5.50

- a. Enter the data into your calculator and create a scatter plot. Sketch it. What function do you think would fit the data the best?

- a. What are the **coefficients of determination,  $r^2$** , for a linear model, quadratic model, and an exponential model? *Round to the nearest thousandth.*

Linear:  $r^2 =$

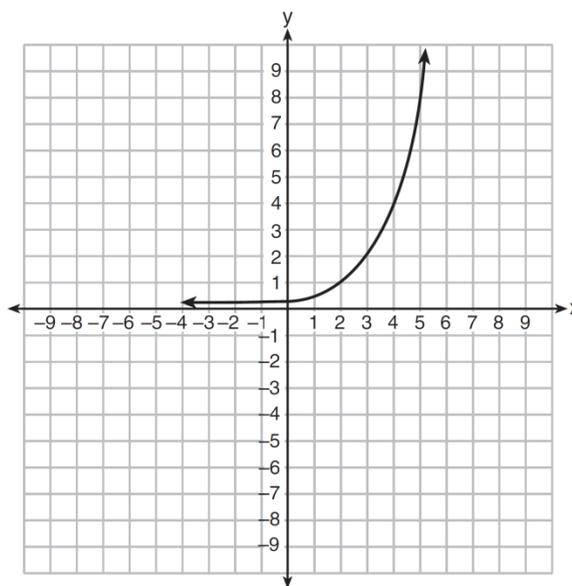
Quadratic:  $r^2 =$

Exponential:  $r^2 =$

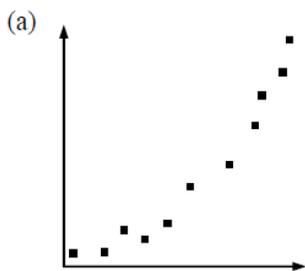
- b. Write the equation that best models the data. *Round the parameters to the nearest thousandth.*

- c. What is the optimal number of T-Shirts the manufacturer should produce in order to minimize the costs, and what is the cost per T-Shirt?

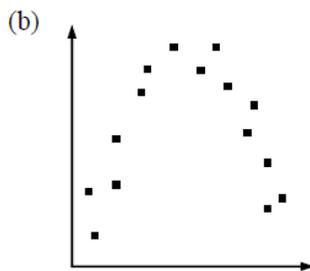
Exercise 3: Write an exponential equation for the graph shown below. Explain how you determined the equation. *January 2015 Regents Exam*



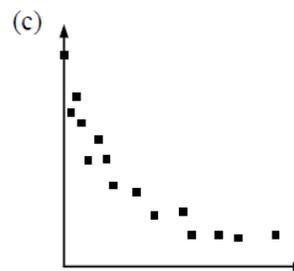
Exercise 4: For each scatter plot below determine which function would be the best fit.



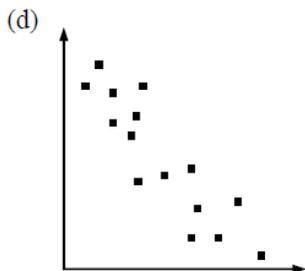
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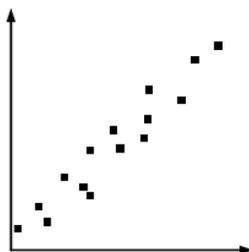
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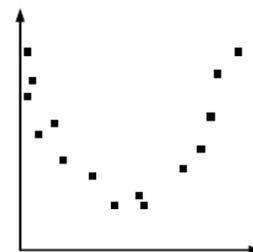
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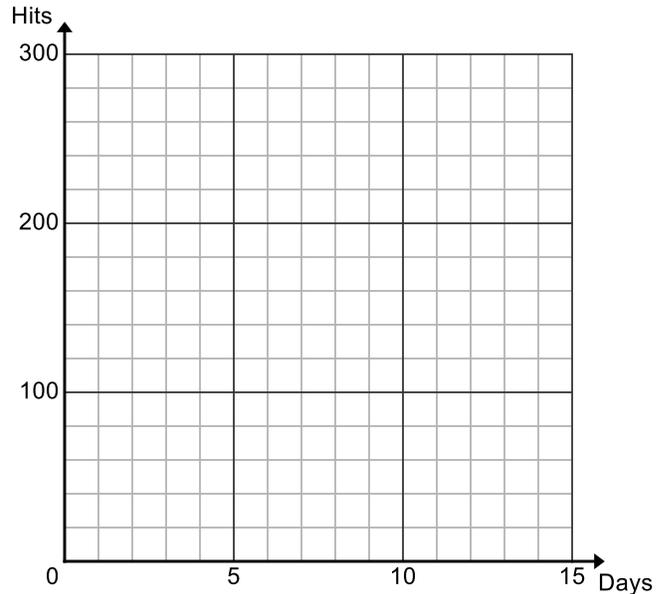
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### 12.8 HOMEWORK: Exponential and Quadratic Regression

Algebra 1

1. A marketing company is keeping track of the number of hits that a website receives on a daily basis. Data for the first 2 weeks is shown below.

Days	Hits
1	70
3	43
6	75
9	132
12	194
14	300



- a. Create a scatter plot of the data.

- b. Enter the data into your calculator and run three regressions (linear, exponential, and quadratic). What is the **Coefficient of Determination,  $r^2$** , for each (*round to the nearest thousandth*)?

Linear:  $r^2 =$  \_\_\_\_\_

Quadratic:  $r^2 =$  \_\_\_\_\_

Exponential:  $r^2 =$  \_\_\_\_\_

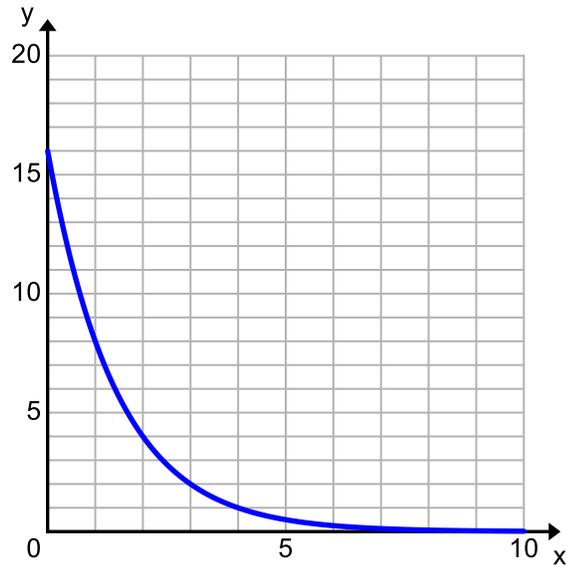
Which function best models the data? \_\_\_\_\_

- c. Write the regression equation that best models the data (*round parameters to the nearest hundredth*).

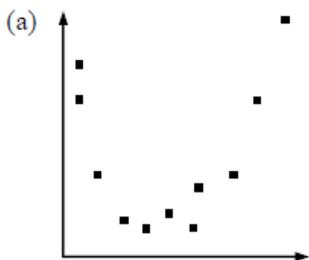
- d. Use the regression equation to predict the number of hits to the site on day 21 (*round to the nearest whole #*).

- e. About which day can they expect to see 1000 hits?

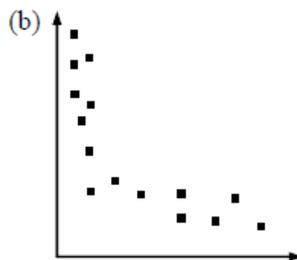
2. Write the equation associated with the graph below.



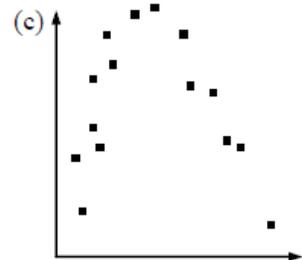
3. For each scatter plot below determine which function would be the best fit.



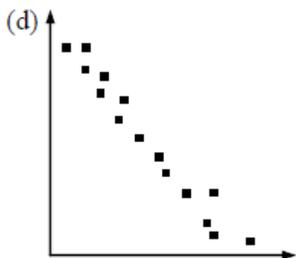
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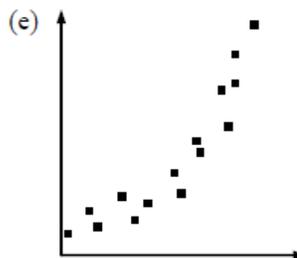
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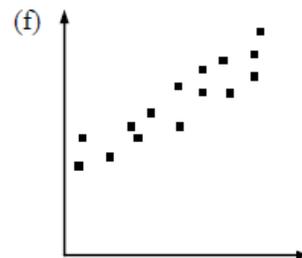
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