

Name \_\_\_\_\_

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## Lesson 1: Modeling Linear Relationships

### Exit Ticket

A rental car company offers a rental package for a midsize car. The cost is comprised of a fixed \$30 administrative fee for the cleaning and maintenance of the car plus a rental cost of \$35 per day.

- Using  $x$  for the number of days and  $y$  for the total cost in dollars, construct a function to model the relationship between the number of days and the total cost of renting a midsize car.
- The same company is advertising a deal on compact car rentals. The linear function  $y = 30x + 15$  can be used to model the relationship between the number of days ( $x$ ) and the total cost ( $y$ ) of renting a compact car.
  - What is the fixed administrative fee?
  - What is the rental cost per day?

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## Lesson 2: Interpreting Rate of Change and Initial Value

### Exit Ticket

In 2008, a collector of sports memorabilia purchased 5 specific baseball cards as an investment. Let  $y$  represent each card's resale value (in dollars) and  $x$  represent the number of years since purchase. Each of the cards' resale values after 0, 1, 2, 3, and 4 years could be modeled by linear equations as follows:

Card A:  $y = 5 - 0.7x$

Card B:  $y = 4 + 2.6x$

Card C:  $y = 10 + 0.9x$

Card D:  $y = 10 - 1.1x$

Card E:  $y = 8 + 0.25x$

1. Which card(s) are decreasing in value each year? How can you tell?
2. Which card(s) had the greatest initial values at purchase (at 0 years)?
3. Which card(s) is increasing in value the fastest from year to year? How can you tell?
4. If you were to graph the equations of the resale values of Card B and Card C, which card's graph line would be steeper? Explain.
5. Write a sentence explaining the 0.9 value in Card C's equation.

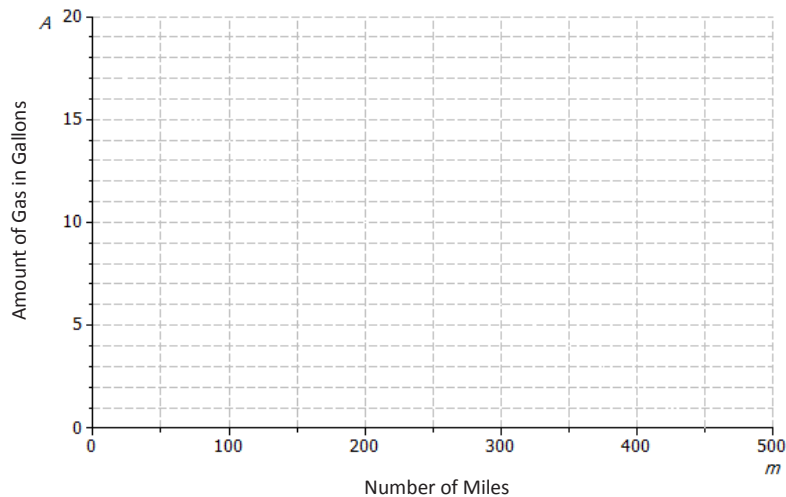
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## Lesson 3: Representations of a Line

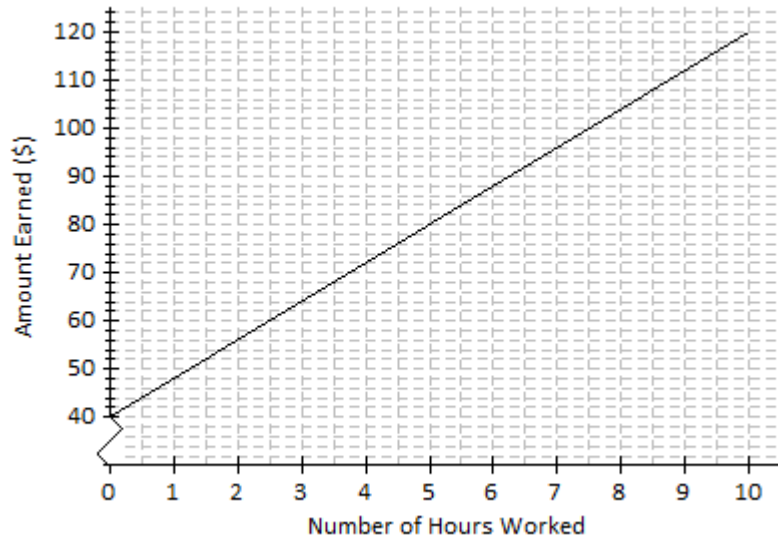
### Exit Ticket

1. A car starts a journey with 18 gallons of fuel. Assuming a constant rate, the car will consume 0.04 gallons for every mile driven. Let  $A$  represent the amount of gas in the tank (in gallons) and  $m$  represent the number of miles driven.



- a. How much gas is in the tank if 0 miles have been driven? How would this be represented on the axes above?
- b. What is the rate of change that relates the amount of gas in the tank to the number of miles driven? Explain what it means within the context of the problem.
- c. On the axes above, draw the line, or the graph, of the linear function that relates  $A$  to  $m$ .
- d. Write the linear function that models the relationship between the number of miles driven and the amount of gas in the tank.

2. Andrew works in a restaurant. The graph below shows the relationship between the amount Andrew earns and the number of hours he works.



- a. If Andrew works for 7 hours, approximately how much does he earn?
- b. Estimate how long Andrew has to work in order to earn \$64.
- c. What is the rate of change of the function given by the graph? Interpret the value within the context of the problem.

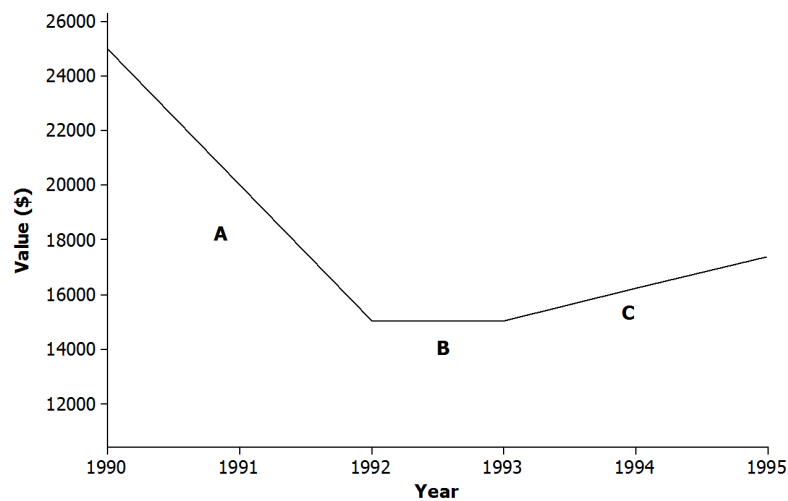
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## Lesson 4: Increasing and Decreasing Functions

### Exit Ticket

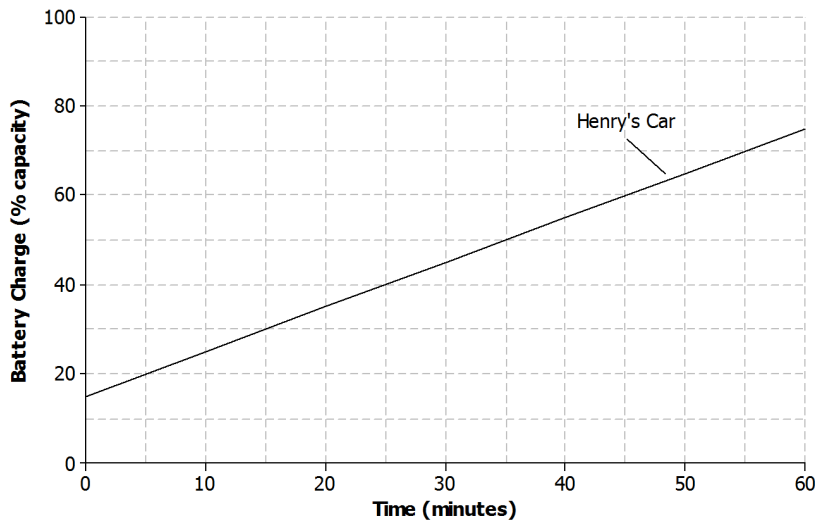
1. The graph below shows the relationship between a car's value and time.



Match each part of the graph (A, B, and C) to its verbal description. Explain the reasoning behind your choice.

- The value of the car holds steady due to a positive consumer report on the same model.
- There is a shortage of used cars on the market, and the value of the car rises at a constant rate.
- The value of the car depreciates at a constant rate.

2. Henry and Roxy both drive electric cars that need to be recharged before use. Henry uses a standard charger at his home to recharge his car. The graph below represents the relationship between the battery charge and the amount of time it has been connected to the power source for Henry’s car.



- a. Describe how Henry’s car battery is being recharged with respect to time.
  
- b. Roxy has a supercharger at her home that can charge about half of the battery in 20 minutes. There is no remaining charge left when she begins recharging the battery. Sketch a graph that represents the relationship between the battery charge and the amount of time on the axes above. Assume the relationship is linear.
  
- c. Which person’s car will be recharged to full capacity first? Explain.

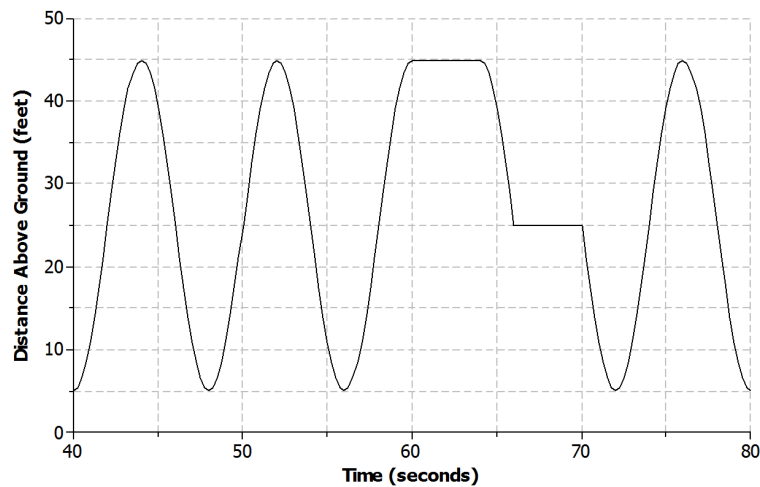
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## Lesson 5: Increasing and Decreasing Functions

### Exit Ticket

Lamar and his sister continue to ride the Ferris wheel. The graph below represents Lamar and his sister's distance above the ground with respect to time during the next 40 seconds of their ride.



- Name one interval where the function is increasing.
- Name one interval where the function is decreasing.
- Is the function linear or nonlinear? Explain.
- What could be happening during the interval of time from 60 to 64 seconds?
- Based on the graph, how many complete revolutions are made during this second interval?

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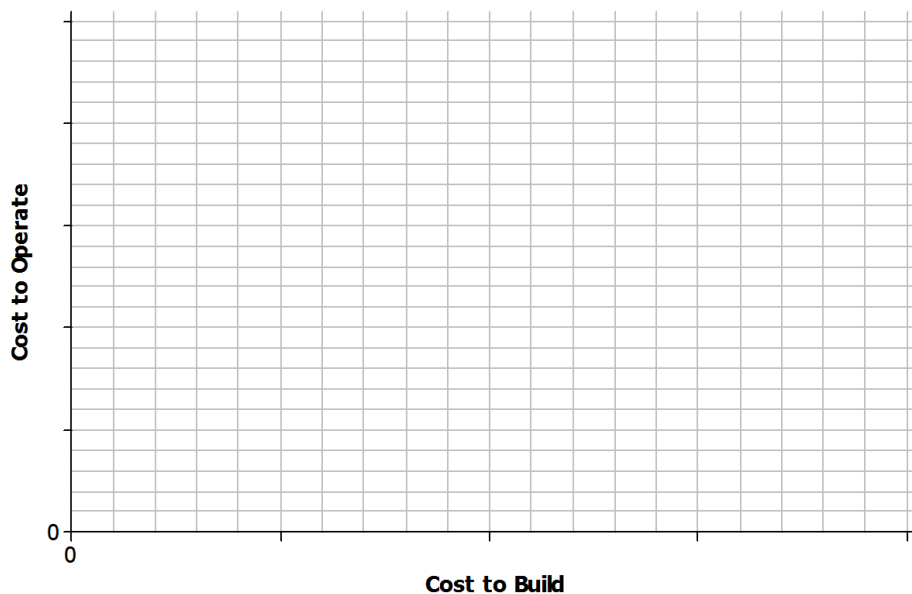
## Lesson 6: Scatter Plots

### Exit Ticket

Energy is measured in kilowatt hours. The table below shows the cost of building a facility to produce energy and the ongoing cost of operating the facility for five different types of energy.

Type of Energy	Cost to Operate (cents per kilowatt hour)	Cost to Build (dollars per kilowatt hour)
Hydroelectric	0.4	2,200
Wind	1.0	1,900
Nuclear	2.0	3,500
Coal	2.2	2,500
Natural Gas	4.8	1,000

- Construct a scatter plot of the cost to build the facility ( $x$ ) and the cost to operate the facility ( $y$ ). Use the grid below, and be sure to add an appropriate scale to the axes.
- Do you think that there is a statistical relationship between building cost and operating cost? If so, describe the nature of the relationship.





3. Based on the scatter plot, can you conclude that decreased building cost is the cause of increased operating cost? Explain.

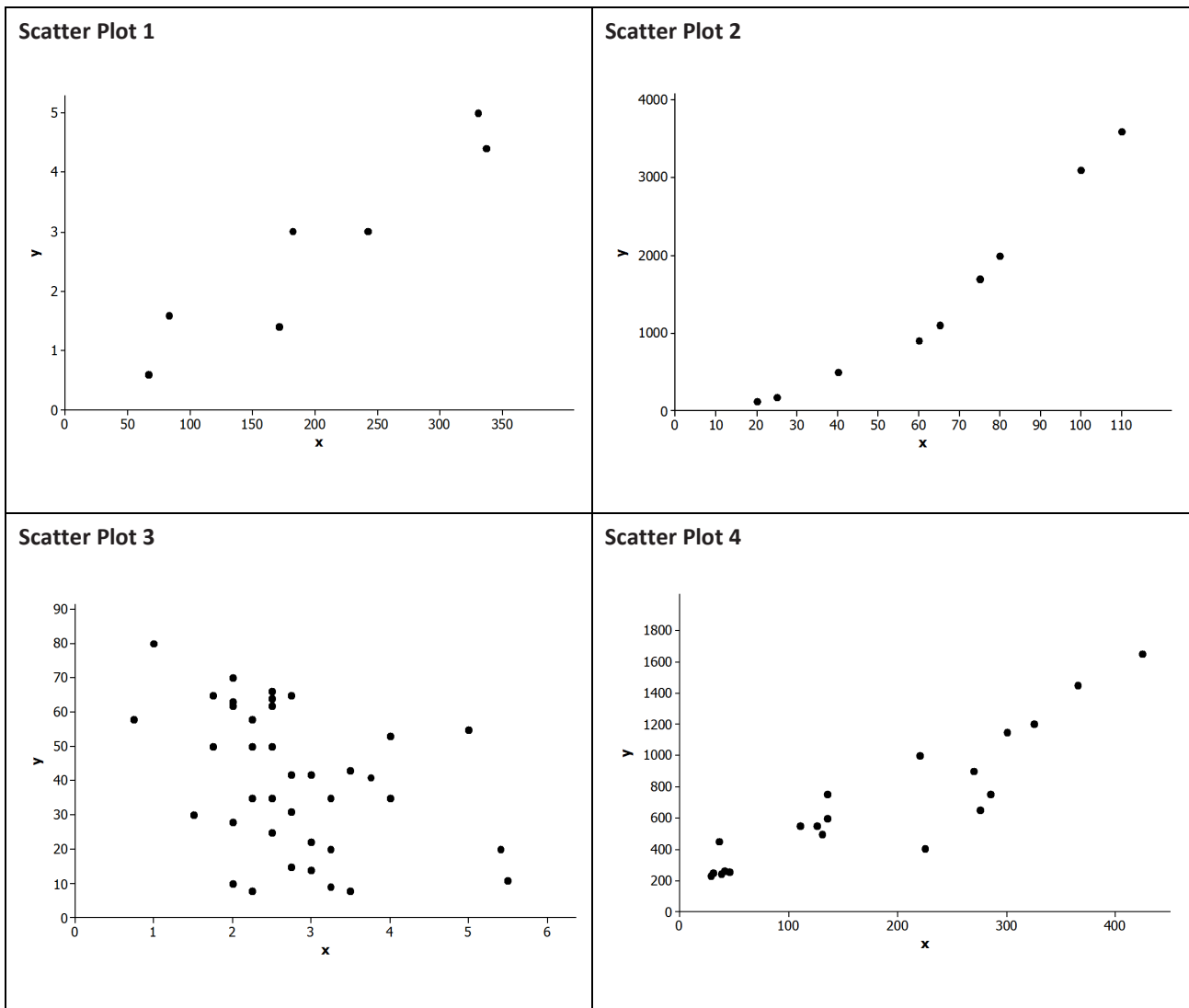
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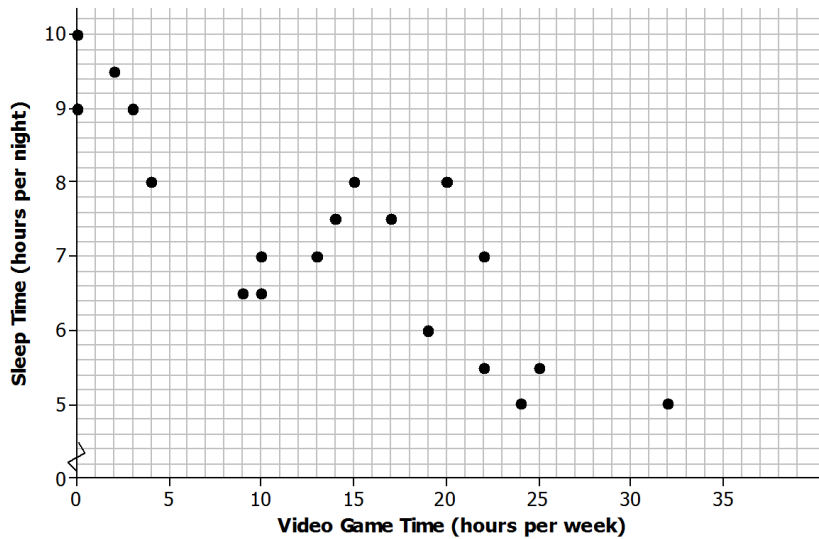
## Lesson 7: Patterns in Scatter Plots

### Exit Ticket

1. Which of the following scatter plots shows a negative linear relationship? Explain how you know.



2. The scatter plot below was constructed using data from eighth-grade students on time spent in hours playing video games per week ( $x$ ) and number of hours of sleep per night ( $y$ ). Write a few sentences describing the relationship between sleep time and time spent playing video games for these students. Are there any noticeable clusters or outliers?



3. In a scatter plot, if the values of  $y$  tend to increase as the value of  $x$  increases, would you say that there is a positive relationship or a negative relationship between  $x$  and  $y$ ? Explain your answer.

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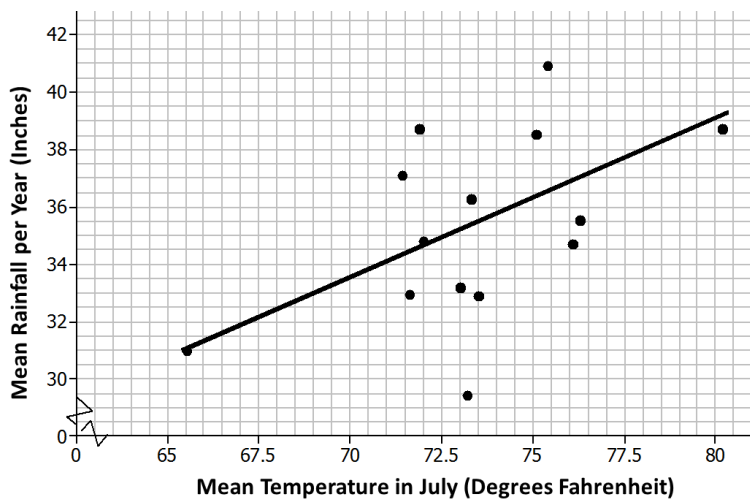
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## Lesson 8: Informally Fitting a Line

### Exit Ticket

The plot below is a scatter plot of mean temperature in July and mean inches of rain per year for a sample of Midwestern cities. A line is drawn to fit the data.

**July Temperatures and Rainfall in Selected Midwestern Cities**



Data Source: <http://countrystudies.us/united-states/weather/>

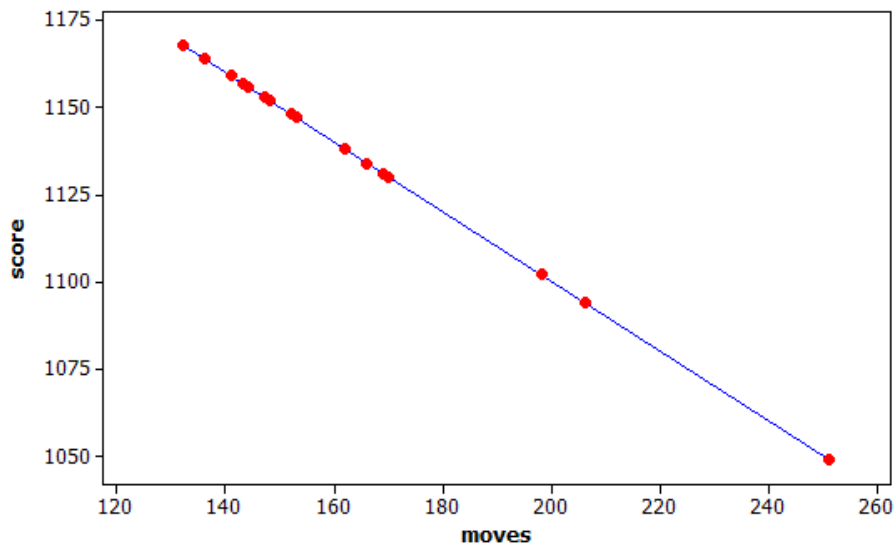
1. Choose a point in the scatter plot and explain what it represents.
2. Use the line provided to predict the mean number of inches of rain per year for a city that has a mean temperature of 70°F in July.
3. Do you think the line provided is a good one for this scatter plot? Explain your answer.



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- Many computers come with a Solitaire card game. The player moves cards in certain ways to complete specific patterns. The goal is to finish the game in the shortest number of moves possible, and a player’s score is determined by the number of moves. A statistics teacher played the game 16 times and recorded the number of moves and the final score after each game. The line represents the linear function that is used to determine the score from the number of moves.



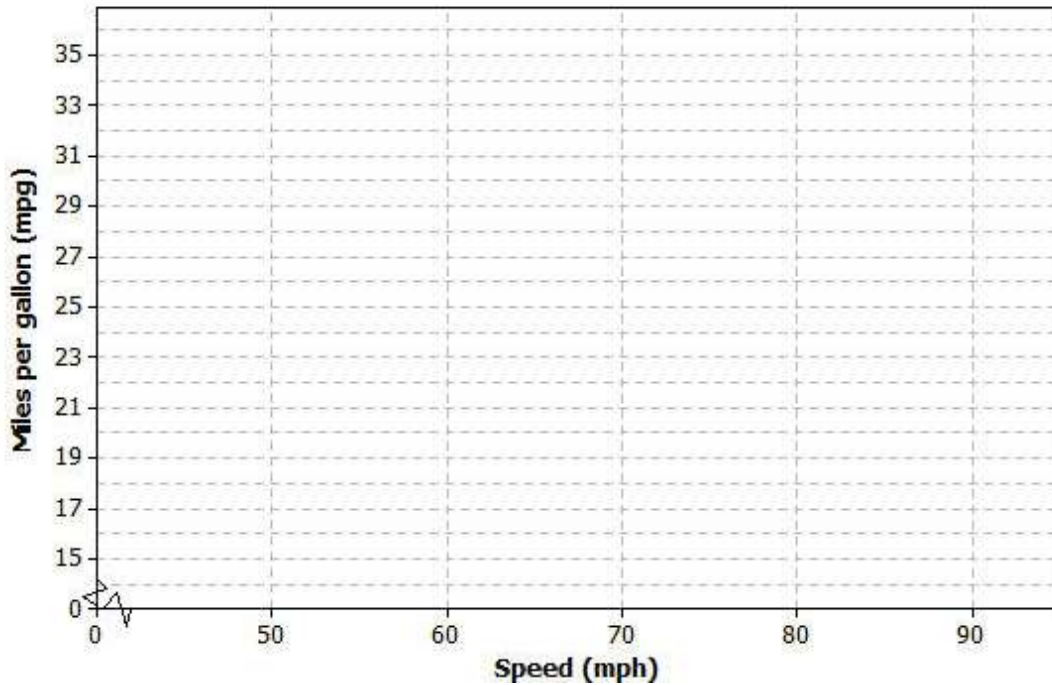
- Was this person’s average score closer to 1130 or 1110? Explain how you decided.
  
- The first two games she played took 169 moves (1131 points) and 153 moves (1147 points). Based on this information, determine the equation of the linear function used by the computer to calculate the score from the number of moves. Explain your work.

- c. Based on the linear function, each time the player makes a move, how many points does he or she lose?
- d. Based on the linear function, how many points does the player start with in this game? Explain your reasoning.
2. To save money, drivers often try to increase their mileage, which is measured in miles per gallon (mpg). One theory is that speed traveled impacts miles per gallon. Suppose the following data are recorded for five different 300-mile tests, with the car traveling at different speeds in miles per hour (mph) for each test.

Speed (mph)	Miles per gallon (mpg)
50	32
60	29
70	24
80	20
90	17

- a. For the data in this table, is the association positive or negative? Explain how you decided.

- b. Construct a scatter plot of these data using the following coordinate grid. The vertical axis represents the miles per gallon (mpg), and the horizontal axis represents the speed in miles per hour (mph).



- c. Draw a line on your scatter plot that you think is a reasonable model for predicting the miles per gallon from the car speed.
- d. Estimate and interpret the slope of the line you found in part (c).



Suppose additional data were measured for three more tests. These results have been added to the previous tests, and the combined data are shown in the table below.

Speed (mph)	Miles per gallon (mpg)
20	25
30	27
40	30
50	32
60	29
70	24
80	20
90	17

- e. Does the association for these data appear to be linear? Why or why not?
- f. If your only concern was miles per gallon and you had no traffic constraints, what speed would you recommend traveling based on these data? Explain your choice.





- c. Fit a line to the data. Show your work.
- d. Based on the context of the problem, interpret in words the intercept and slope of the line you found in part (c).
- e. Use your line to predict life expectancy for babies born in New York City in 2010.

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## Lesson 12: Nonlinear Models in a Data Context

### Exit Ticket

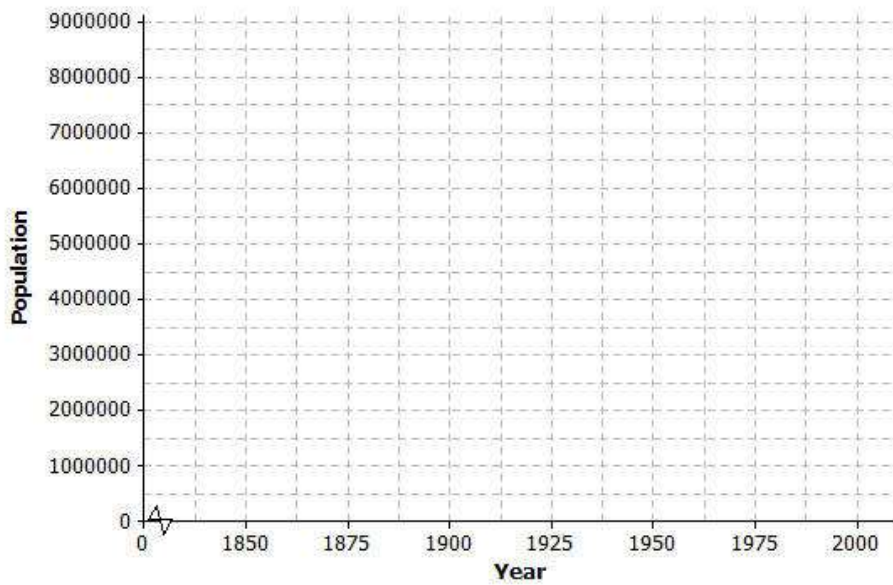
The table shows the population of New York City from 1850–2000 for every 50 years.

Year	Population	Population Growth (Change over 50-year Time Period)
1850	515,547	—
1900	3,437,202	
1950	7,891,957	
2000	8,008,278	

1. Find the growth of the population from 1850–1900. Write your answer in the table in the row for the year 1900.
2. Find the growth of the population from 1900–1950. Write your answer in the table in the row for the year 1950.
3. Find the growth of the population from 1950–2000. Write your answer in the table in the row for the year 2000.
4. Does it appear that a linear model is a good fit for this data? Why or why not?

5. Describe how the population changes as the number of years increases.

6. Construct a scatter plot of time versus population on the grid below. Draw a line or curve that you feel reasonably describes the data.



7. Estimate the population of New York City in 1975. Explain how you found your estimate.



3. A random group of students is polled about how they get to school. The results are summarized in the table below.

		School Transportation Survey			Total
		Walk	Ride Bus	Carpool	
Gender	Male	9	26	9	44
	Female	8	26	24	58
Total		17	52	33	102

- a. Calculate the relative frequencies for the table above. Write them as a percent in each cell of the table. Round to the nearest tenth of a percent.
- b. What is the relative frequency for the Carpool category? Write a sentence interpreting this value in the context of school transportation.
- c. What is the proportion of students that are female and walk to school? Write a sentence interpreting this value in the context of school transportation.
- d. A student is selected at random from this school. What would you predict this student's mode of school transportation to be? Explain.



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## Lesson 14: Association Between Categorical Variables

### Exit Ticket

A random sample of 100 eighth-grade students is asked to record two variables, whether they have a television in their bedroom and if they passed or failed their last math test. The results of the survey are summarized below.

- 55 students have a television in their bedroom.
- 35 students do not have a television in their bedroom and passed their last math test.
- 25 students have a television and failed their last math test.
- 35 students failed their last math test.

1. Complete the two-way table.

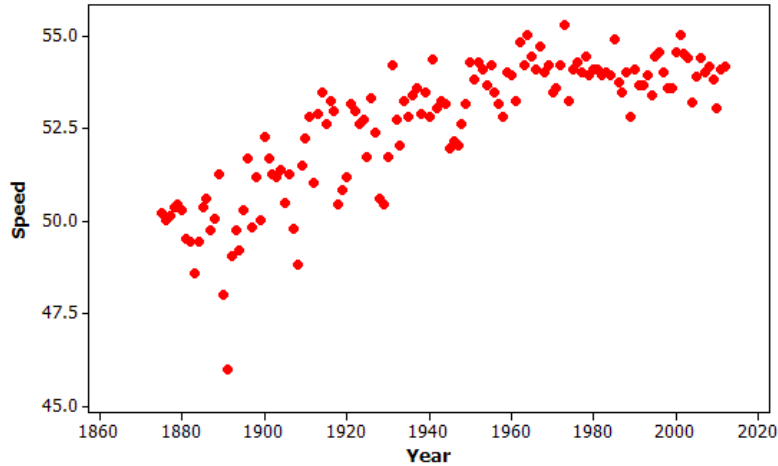
	Pass	Fail	Total
Television in Bedroom			
No Television in Bedroom			
Total			

2. Calculate the row relative frequencies and enter the values in the table above. Round to the nearest thousandth.
3. Is there evidence of association between the variables? If so, does this imply there is a cause-and-effect relationship? Explain.

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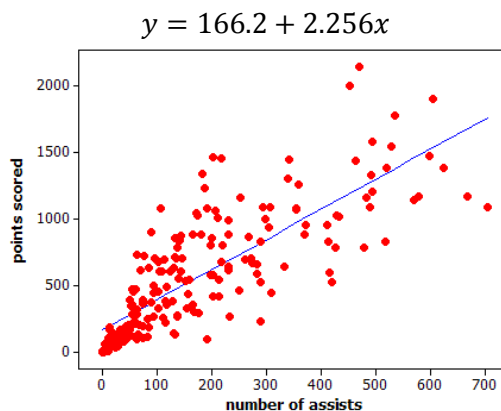
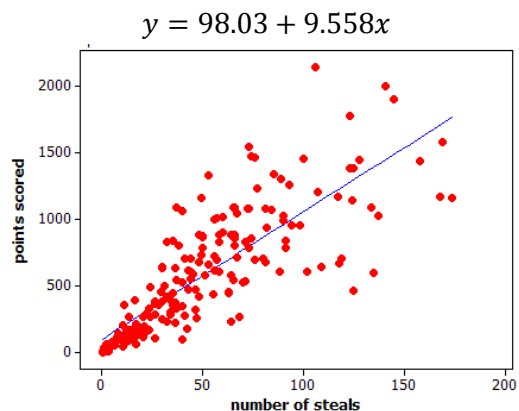
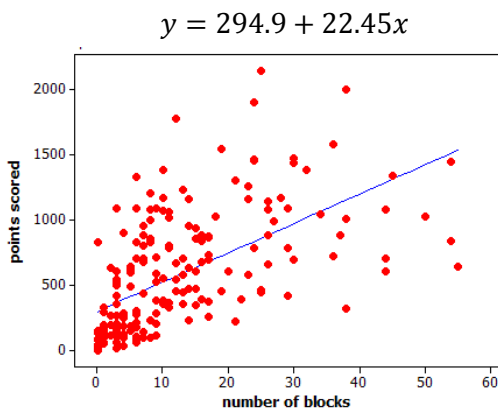
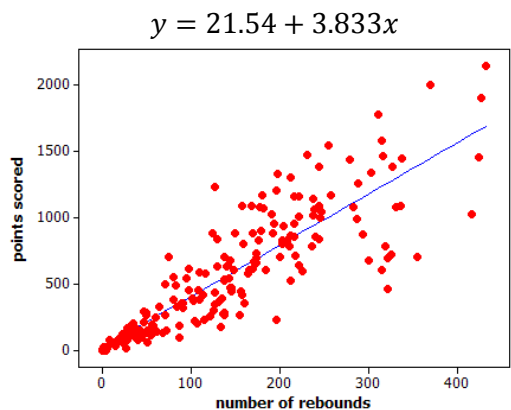
1. The Kentucky Derby is a horse race held each year. The following scatter plot shows the speed of the winning horse at the Kentucky Derby each year between 1875 and 2012.



- a. Is the association between *speed* and *year* positive or negative? Give a possible explanation in the context of this problem for why the association behaves this way considering the variables involved.
- b. Comment on whether the association between *speed* and *year* is approximately linear and then explain in the context of this problem why the form of the association (linear or not) makes sense considering the variables involved.

- c. Circle an outlier in this scatter plot and explain, in context, how and why the observation is unusual.
2. Students were asked to report their gender and how many times a day they typically wash their hands. Of the 738 males, 66 said they wash their hands at most once a day, 583 said two to seven times per day, and 89 said eight or more times per day. Of the 204 females, 2 said they wash their hands at most once a day, 160 said two to seven times per day, and 42 said eight or more times per day.
- a. Summarize these data in a two-way table with rows corresponding to the three different frequency-of-hand-washing categories and columns corresponding to gender.
- b. Do these data suggest an association between *gender* and *frequency of hand washing*? Support your answer with appropriate calculations.

3. Basketball players who score a lot of points also tend to be strong in other areas of the game such as number of rebounds, number of blocks, number of steals, and number of assists. Below are scatter plots and linear models for professional NBA (National Basketball Association) players last season.



- a. The line that models the association between points scored and number of rebounds is  $y = 21.54 + 3.833x$ , where  $y =$  points scored and  $x =$  number of rebounds. Give an interpretation, in context, of the slope of this line.

- b. The equations above all show  $y =$  number of points as a function of the other variables. An increase in which of the variables (rebounds, blocks, steals, and assists) tends to have the largest impact on the predicted points scored by an NBA player?
- c. Which of the four linear models shown in the scatter plots above has the worst fit to the data? Explain how you know using the data above.