

**LESSON  
MASTER****2-1****Questions on SPUR Objectives**

See pages 152–157 for objectives.

**Vocabulary**

1. *True or false.* Justify your answer. The following set of ordered pairs is a function:  $\{(1, 1), (1, 2), (1, 3), (1, 4)\}$ .
- \_\_\_\_\_
- \_\_\_\_\_

**Skills** Objective A

In 2 and 3, let  $h(x) = \frac{1}{2}x^2 + 1$ .

2. Evaluate.

a.  $h(4)$  \_\_\_\_\_      b.  $h(-4)$  \_\_\_\_\_      c.  $h\left(\frac{1}{4}\right)$  \_\_\_\_\_

3. *True or false.* Justify your answer.

a.  $0 \cdot h(4) = h(0 \cdot 4)$  \_\_\_\_\_

b. For all  $a$ ,  $h(-a) = h(a)$ . \_\_\_\_\_

c. If  $a > b$ , then  $h(a) > h(b)$ . \_\_\_\_\_

4. Let  $g(x) = \frac{12}{x^2}$ . Evaluate.

a.  $g(2) + g(1)$  \_\_\_\_\_      b.  $g(2 + 1)$  \_\_\_\_\_

c.  $g(2) \cdot g(3)$  \_\_\_\_\_      d.  $g(2 \cdot 3)$  \_\_\_\_\_

**Properties** Objective B

In 5–7, an equation for a function is given.

- a. State the function's domain.      b. State the function's range.

5.  $y = 7x - 1$

a. \_\_\_\_\_      b. \_\_\_\_\_

6.  $y = |7x - 1|$

a. \_\_\_\_\_      b. \_\_\_\_\_

7.  $f(x) = \frac{1}{x^2 - 1}$

a. \_\_\_\_\_      b. \_\_\_\_\_

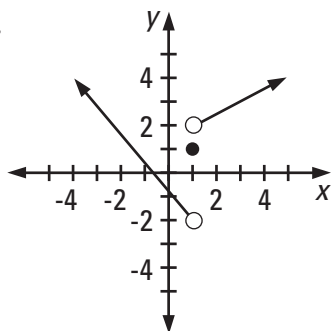
► **LESSON MASTER 2-1** page 2

**Representations** Objective J

In 8–11, a relation is graphed.

- a. State the relation's domain.      b. State the relation's range.  
c. Is the relation a function?

8.

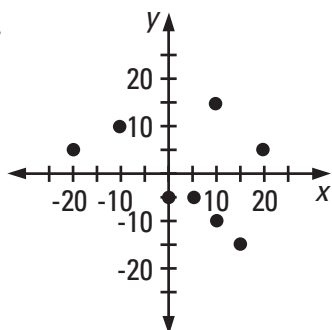


a. \_\_\_\_\_

b. \_\_\_\_\_

c. \_\_\_\_\_

9.

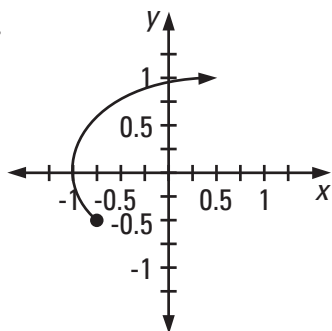


a. \_\_\_\_\_

b. \_\_\_\_\_

c. \_\_\_\_\_

10.

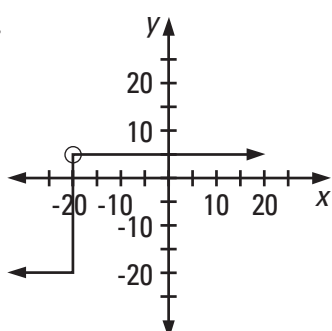


a. \_\_\_\_\_

b. \_\_\_\_\_

c. \_\_\_\_\_

11.



a. \_\_\_\_\_

b. \_\_\_\_\_

c. \_\_\_\_\_

**LESSON  
MASTER****2-2****Questions on SPUR Objectives**  
See pages 152–157 for objectives.**Properties** Objective C

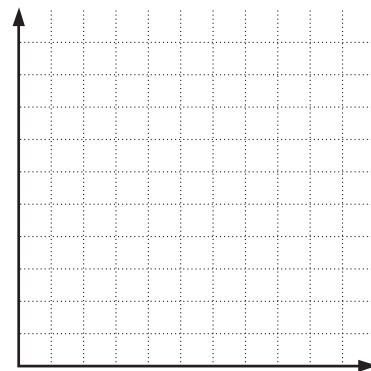
- Suppose  $r$  is a correlation coefficient for a line of best fit. Give each value.
  - the greatest possible value for  $r$  \_\_\_\_\_
  - the least possible value for  $r$  \_\_\_\_\_
  - the greatest possible value for  $r^2$  \_\_\_\_\_
  - the least possible value for  $r^2$  \_\_\_\_\_
- For a set of data, the line of best fit is  $y = -3x - 4$  and  $r^2 \approx 0.22$ . What is the correlation coefficient? \_\_\_\_\_
- Dinah conducted an experiment in which she measured the time it took to boil a certain quantity of water. She noticed that the greater the volume of water, the longer it took to boil. Using her statistics utility, she calculated a regression line for her data and found that  $r^2 \approx 0.87$ . However, she was not sure whether  $r \approx \sqrt{0.87}$  or  $r \approx -\sqrt{0.87}$ . How could Dinah determine which value of  $r$  is correct?  
\_\_\_\_\_  
\_\_\_\_\_

**Uses** Objective E

- The table below contains breaking strength data for new 3-strand polypropylene fiber rope.

Diameter (mm)	5	6	8	10	11	12	14	16	18
Breaking strength (lb)	780	1,125	1,710	2,430	3,150	3,780	4,590	5,580	7,650

- Make a scatterplot of the data with the diameters on the horizontal axis.
- Draw a line that fits the data reasonably well.
- Use two points on the line in part b to write an equation for the line in the form  $y = mx + b$ .  
\_\_\_\_\_
- Use the equation found in part c to estimate the breaking strength of a 25-mm-diameter rope.  
\_\_\_\_\_



► **LESSON MASTER 2-2** page 2

- e. Give a reason why your estimate in part d might not be accurate.

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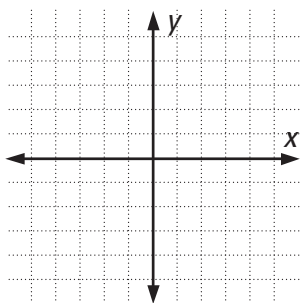


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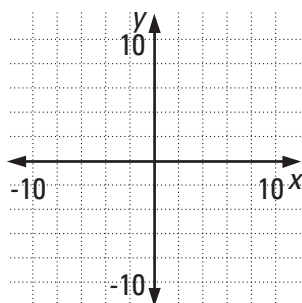
**Representations** Objective I

In 5–7, graph each function over the domain  $\{x: -5 \leq x \leq 5\}$ .

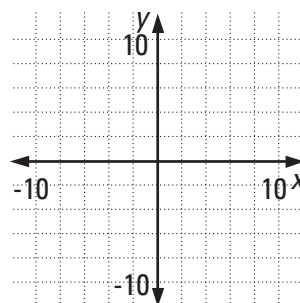
5.  $y = \frac{1}{3}x$



6.  $y = 2x + 1$

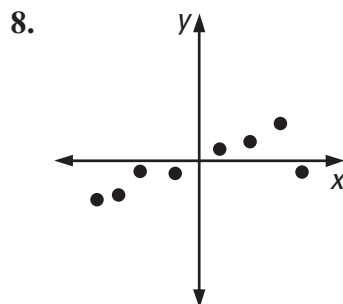


7.  $y = -x + 5$

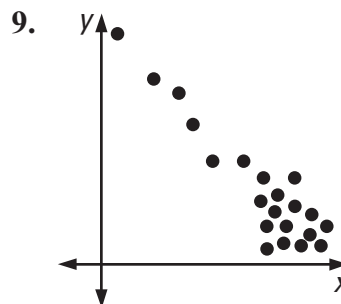


**Representations** Objective K

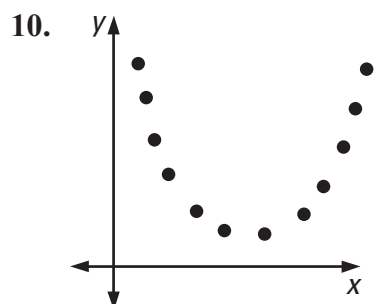
In 8–11, suppose a linear relation is used to model the data in the given scatterplot. State whether the correlation coefficient is likely to be *negative*, *positive*, or *approximately zero*.



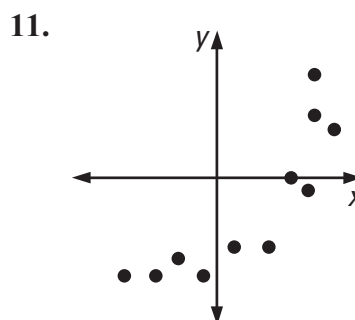

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**LESSON  
MASTER****2-3****Questions on SPUR Objectives**  
See pages 152–157 for objectives.**Vocabulary**

1. Why is the process of finding the line of best fit sometimes called the “method of least squares”?

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2. Use  $\Sigma$ -notation to write an expression for the center of gravity of the data set  $\{(x_1, y_1), (x_2, y_2), \dots, (x_n, y_n)\}$ .

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**Properties** Objective C

In 3 and 4, suppose a data set is modeled by two lines  $m_1$  and  $m_2$ . Line  $m_1$  represents the linear regression model and line  $m_2$  represents some other linear model. Complete the sentence.

3. The sum of the squares of the deviations for  $m_1$  is \_\_\_\_?\_\_\_\_ (greater than, less than, equal to) the sum of the squares of the deviations for  $m_2$ .
4. If all the points in the data set lie on  $m_1$ , then the sum of the squares of the deviations for this model is \_\_\_\_?\_\_\_\_ (greater than 0, less than 0, equal to 0).

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**Uses** Objective E

5. The table below contains breaking-strength data for polypropylene rope.

Diameter (mm)	5	6	8	10	11	12	14	16	18
Breaking strength (lb)	780	1,125	1,710	2,430	3,150	3,780	4,590	5,580	7,650

- a. Use a statistics utility to find an equation for the line of best fit to model this data.
- b. Find the error in the values predicted by the linear regression model for the breaking strength of ropes with diameters of 12 mm and 18 mm.

12 mm \_\_\_\_\_ 18 mm \_\_\_\_\_

- c. Use the equation in part a to estimate the breaking strength of ropes with diameters of 13 mm and 25 mm.

13 mm \_\_\_\_\_ 25 mm \_\_\_\_\_

- d. Which estimate in part c do you think is more accurate? Why?

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► **LESSON MASTER 2-3** page 2**Representations** Objective K

In 6 and 7, a student fit a line  $\ell$  to the data points  $(2, 6)$ ,  $(4, 6)$ ,  $(5, 5)$ , and  $(8, 1)$ , as shown below.

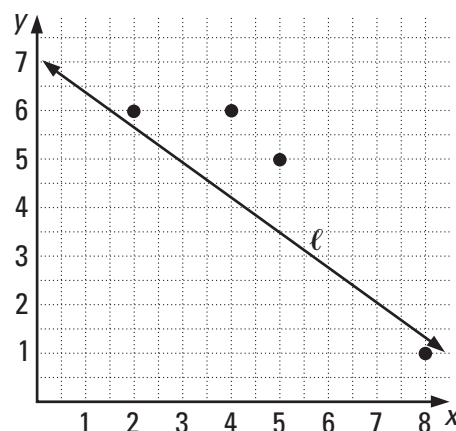
6. a. What is the observed value of  $y$  at  $x = 4$ ?

\_\_\_\_\_

- b. What is the predicted value of  $y$  at  $x = 3$ ?

\_\_\_\_\_

- c. Estimate the error of each of the four points from line  $\ell$ .



- d. Find the sum of the squares of the deviations of the four points from line  $\ell$ .

\_\_\_\_\_

7. Using a statistics utility, the student found that an equation of the line of best fit is  $y = -0.88x + 8.68$ .

- a. Graph the four data points and the line of best fit.

- b. Find the sum of the squares of the deviations.

\_\_\_\_\_

- c. Verify that the center of gravity is on this line.

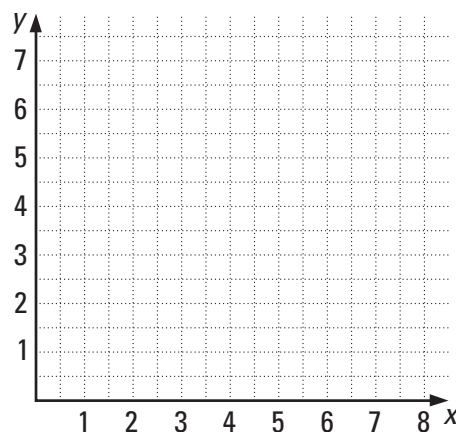
\_\_\_\_\_

\_\_\_\_\_

- d. How do you know that this line is a better fit line than line  $\ell$ ?

\_\_\_\_\_

\_\_\_\_\_



**LESSON  
MASTER****2-4****Questions on SPUR Objectives**  
See pages 152–157 for objectives.**Properties** Objective B**In 1 and 2, an equation for an exponential function is given.**

- a. State the function's domain.      b. State the function's range.**

1.  $f(x) = 0.32(12.6^x)$

2.  $g(x) = 4(0.15^x)$

a. \_\_\_\_\_

a. \_\_\_\_\_

b. \_\_\_\_\_

b. \_\_\_\_\_

**Properties** Objective D**In 3–6, consider an exponential function given by the equation  $f(x) = ab^x$ , where  $a \neq 0$ ,  $b > 0$ , and  $b \neq 1$ . True or false.**

3. If
- $b = \frac{1}{2}$
- , then the graph of the
- 
- function never crosses the
- $x$
- axis. \_\_\_\_\_

4. If
- $b = \frac{1}{2}$
- , then the graph of the function
- 
- never crosses the
- $y$
- axis. \_\_\_\_\_

5. If
- $a = 0.6$
- and
- $b = 3$
- , then
- $f$
- is
- 
- strictly decreasing. \_\_\_\_\_

6. If
- $a = 1.37$
- and
- $b = 0.85$
- , the function
- 
- can model exponential decay. \_\_\_\_\_

**Uses** Objective F

7. In 1994, the population of the Las Vegas metropolitan area
- 
- was about 1,076,000, with an average annual growth rate of
- 
- 6.5%. Assume this growth rate continues into the future.

- a. Estimate the population of Las Vegas in each year.**

\_\_\_\_\_ 1995

\_\_\_\_\_ 1996

\_\_\_\_\_ 1997

- b. Express the population  $P$  as a function  
of  $n$ , the number of years after 1994.**
- \_\_\_\_\_

- c. Estimate the population of Las Vegas in  
the year 2020.**
- \_\_\_\_\_

8. A particular prescription drug has an initial concentration in the
- 
- blood of 50 mg/ml and is absorbed by the body so that each day
- 
- its concentration drops by 68%. What is the drug's concentration
- 
- in the blood after the given amount of time?

\_\_\_\_\_ 1 day

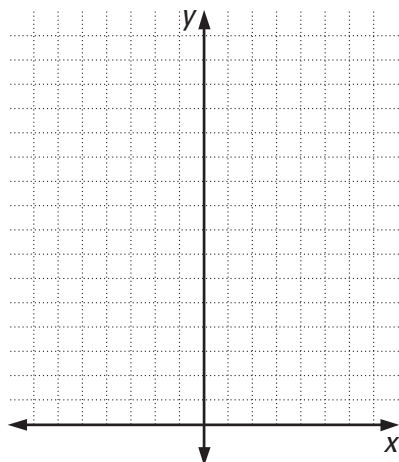
\_\_\_\_\_ 2 days

\_\_\_\_\_  $d$  days

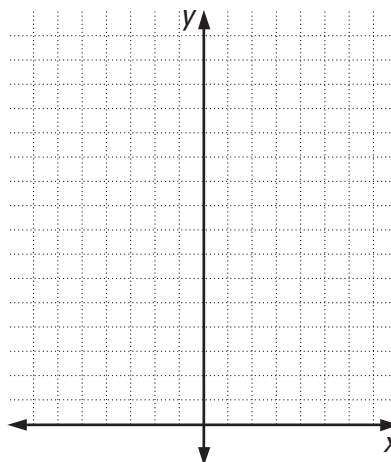
► **LESSON MASTER 2-4** page 2**Representations** Objective I

In 9 and 10, graph the exponential function over the domain  $\{x: -7 \leq x \leq 7\}$ .

9.  $y = 1.5^x$



10.  $y = 4(0.9^x)$

**Representations** Objective J

11. The equation graphed at the right is of the form  $g(x) = ab^x$ .

- a. *True or false.* The function is strictly decreasing.

\_\_\_\_\_

- b. Give a range of possible values for  $b$ .

\_\_\_\_\_

- c. Find  $a$ .

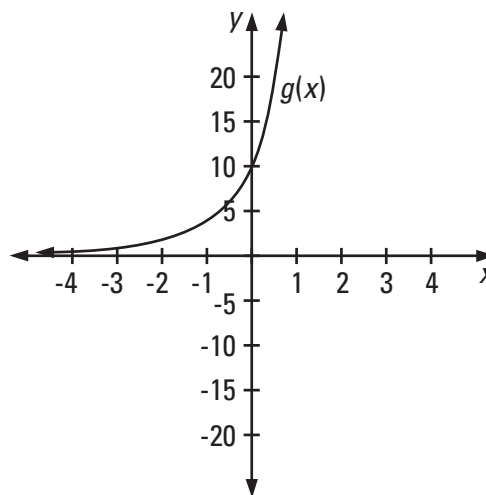
\_\_\_\_\_

- d. Does  $g$  represent exponential growth or exponential decay?

\_\_\_\_\_

- e. Give an equation for an asymptote of the graph of  $g$ .

\_\_\_\_\_





**LESSON  
MASTER****2-5****Questions on SPUR Objectives**

See pages 152–157 for objectives.

**Uses** Objective F

1. The table below contains breaking strength data for new 3-strand polypropylene fiber rope.

Diameter (mm)	5	8	12	14	16	22	30	36	40	48
Breaking strength (lb)	780	1,710	3,780	4,590	5,580	10,350	19,350	27,350	31,950	46,800

- a. Use the data points (12, 3780) and (14, 4590) and a system of equations to determine an exponential model for the data. \_\_\_\_\_
- b. Using the entire data set and a statistics utility, determine an exponential model for the data. \_\_\_\_\_
- c. Which of these models better represents the data? Defend your answer.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

- d. Use the model you chose for part c to estimate the breaking strength of 44-mm-diameter 3-strand polypropylene fiber rope. Is your estimate consistent with the data in the table? Explain your answer.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

2. In 1995, Edith purchased a \$50 U.S. Savings Bond for \$25. Assume the bond has a constant annual yield of 4.75%. (Note: The annual yield on bonds is not always constant. \$50 is the amount the bond is worth when it reaches maturity.)

- a. Express the value of the bond  $A$  as a function of  $n$ , the number of years after 1995. \_\_\_\_\_
- b. Use a calculator and the equation found in part a to estimate the doubling time for the value of the bond. \_\_\_\_\_

► **LESSON MASTER 2-5** page 2

3. The half-life of one isotope of the element lithium ( $^8\text{Li}$ ) is 0.855 second.

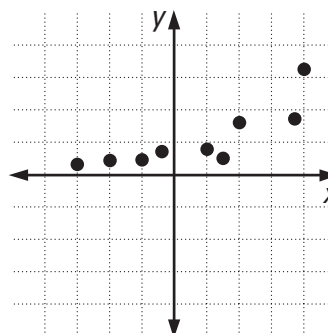
- a. How many seconds are in three half-life periods? \_\_\_\_\_
- b. How much of an 8-gram sample of  $^8\text{Li}$  will be left after three half-life periods? \_\_\_\_\_
- c. Use a statistics utility to find the regression equation which models the decay of an 8-gram sample of  $^8\text{Li}$ . \_\_\_\_\_
- d. Use the equation found in part c to determine how much of an 8-gram sample will be left after 15 seconds. \_\_\_\_\_

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**Representations** Objective K

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4. Is a linear or exponential model more suitable for the data graphed at the right? Justify your answer.




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**LESSON  
MASTER****2-6****Questions on SPUR Objectives**  
See pages 152–157 for objectives.**Properties** Objective B**In 1 and 2, a quadratic function is described. Identify each.**

- a. the independent variable      b. the dependent variable  
c. its domain      d. its range

1.  $z = 4x^2 - 8$

a. \_\_\_\_\_

b. \_\_\_\_\_

c. \_\_\_\_\_

d. \_\_\_\_\_

2.  $T = 6.4 - v^2$

a. \_\_\_\_\_

b. \_\_\_\_\_

c. \_\_\_\_\_

d. \_\_\_\_\_

**Properties** Objective D

3. Consider the function
- $f$
- with equation
- 
- $f(x) = 2x^2 + x - 15$
- .

a. Find its  $y$ -intercept. \_\_\_\_\_b. Find its  $x$ -intercepts. \_\_\_\_\_c. Tell whether the graph has a maximum  
or minimum point and find its coordinates. \_\_\_\_\_**Uses** Objective G

4. The inner surface of a round wooden bowl is carved so that the depth measured from the top of the bowl is given by
- $d = 0.5x^2 - 4x + 2$
- , where
- $x$
- (in inches) is the horizontal distance from the outer edge of the bowl.

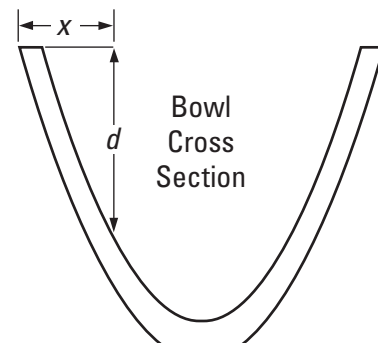
- a. Graph the equation for the inner surface of the bowl on an automatic grapher. What is an appropriate domain for this function?
- 
- \_\_\_\_\_

- b. How deep is the bowl at
- $x = 2$
- ?
- 
- \_\_\_\_\_

- c. How deep is the bowl at its deepest point? \_\_\_\_\_

- d. How wide (thick) is the wood at the top of the bowl? \_\_\_\_\_

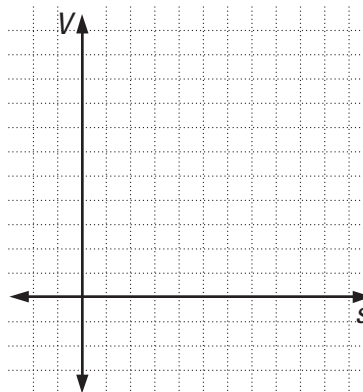
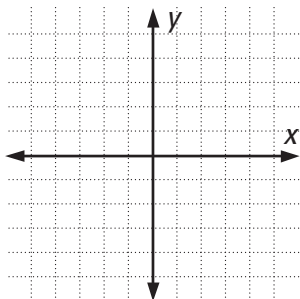
- e. What is the interior diameter at the top of the bowl? \_\_\_\_\_



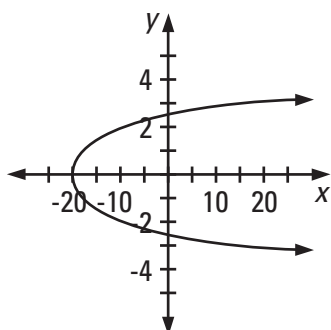
► **LESSON MASTER 2-6** page 2**Representations** Objective I

In 5 and 6, graph the function over the given domain.

- 5.
- $g(x) = 0.2x^2 + x - 3$
- ,
- $\{x: -5 \leq x \leq 5\}$
- 6.
- $V = -0.3s^2 + 2s + 4$
- ,
- $\{s: 0 \leq s \leq 10\}$

**Representations** Objective JIn 7 and 8, a quadratic relation is graphed. a. State its domain.  
b. State its range. c. Tell whether the relation is a function.

7.

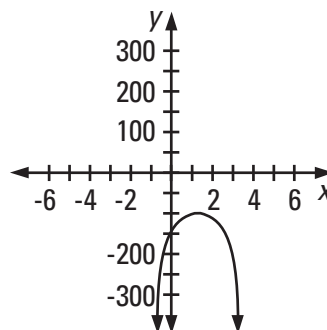


a. \_\_\_\_\_

b. \_\_\_\_\_

c. \_\_\_\_\_

8.



a. \_\_\_\_\_

b. \_\_\_\_\_

c. \_\_\_\_\_

**Representations** Objective K

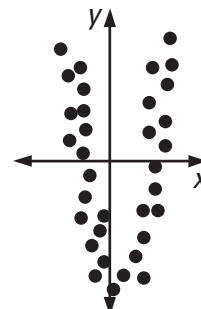
- 9.
- Multiple choice.*
- Which equation best models the data in the scatterplot at the right?

(a)  $y = -x^2 - 5x - 2$

(b)  $y = 3x^2 - 2x - 4$

(c)  $y = 6x^2 + 7$

(d)  $y = x^2 + 5x + 6$



**LESSON  
MASTER****2-7****Questions on SPUR Objectives**

See pages 152–157 for objectives.

**Skills** Objective A1. Let  $f(x) = \lfloor x \rfloor + \lfloor x - 0.5 \rfloor$ . Evaluate.

a.  $f(1)$  \_\_\_\_\_ b.  $f(3)$  \_\_\_\_\_

c.  $f(2.3)$  \_\_\_\_\_ d.  $f(-0.1)$  \_\_\_\_\_

2. Let  $c(x) = \lceil x \rceil + \lfloor x - 1 \rfloor$ . Evaluate.

a.  $c(75)$  \_\_\_\_\_ b.  $c(75.3)$  \_\_\_\_\_

c.  $c\left(\frac{13}{4}\right)$  \_\_\_\_\_ d.  $c\left(-\frac{3}{5}\right)$  \_\_\_\_\_

**Properties** Objective B

In 3 and 4, an equation for a step function is given.

Identify each.

a. its domain      b. its range      c. any points of discontinuity

3.  $m(x) = \lceil x^2 \rceil$

4.  $y = 3\lfloor 2x + 1 \rfloor$

a. \_\_\_\_\_

a. \_\_\_\_\_

b. \_\_\_\_\_

b. \_\_\_\_\_

c. \_\_\_\_\_

c. \_\_\_\_\_

**Uses** Objective HIn 5 and 6, *multiple choice*.5. Which of the following gives the number  $B$  of 40-seat buses that a field trip for  $s$  students will require? \_\_\_\_\_

(a)  $B = \lfloor 40s \rfloor$

(b)  $B = \lceil \frac{s}{40} \rceil$

(c)  $B = \lfloor \frac{s}{40} \rfloor$

(d)  $B = 40\lceil s \rceil$

6. A phone company charges 49 cents per minute for calls made from the U.S. to Manchester, England, and rounds all calls up to the nearest 6 seconds. Which formula gives the cost  $c(t)$  of a phone call to Manchester lasting  $t$  seconds? \_\_\_\_\_

(a)  $(t) = 0.49\lceil \frac{t}{6} \rceil$

(b)  $c(t) = 0.49\lfloor \frac{t}{60} \rfloor$

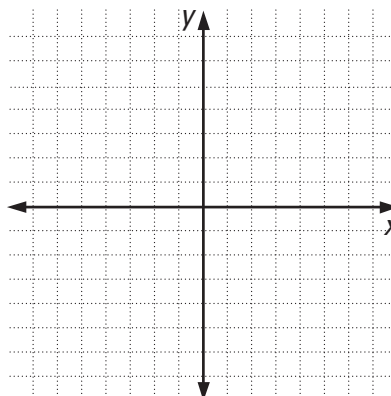
(c)  $c(t) = 0.49\lceil \frac{t}{10} \rceil$

(d)  $c(t) = 0.49\lfloor \frac{t}{6} \rfloor$

► **LESSON MASTER 2-7** page 2**Representations** Objective I

7. Sketch a graph of the function over the given domain.

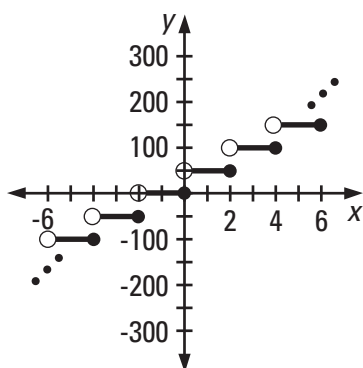
$$y = \lfloor x + 1 \rfloor - 1, \{x: -6 \leq x \leq 6\}$$

**Representations** Objective J

In 8 and 9, a graph of a step function is given.

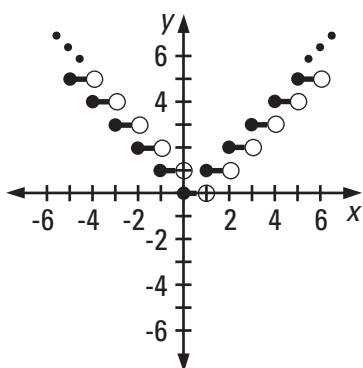
- a. State the domain of the function.      b. State the range of the function.      c. Identify any points of discontinuity.

8.



- a. \_\_\_\_\_  
b. \_\_\_\_\_  
c. \_\_\_\_\_

9.



- a. \_\_\_\_\_  
b. \_\_\_\_\_  
c. \_\_\_\_\_

**LESSON  
MASTER****2-8****Questions on SPUR Objectives**

See pages 152–157 for objectives.

**Representations** Objective K

1. Use the scatterplot at the right showing the relation between diameter and breaking strength of 3-strand polypropylene rope.

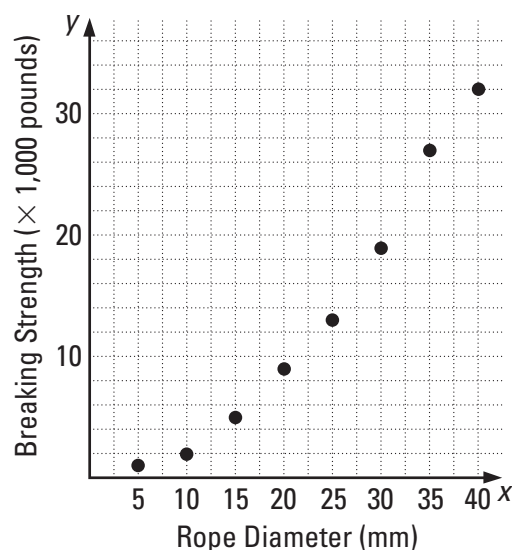
- a. Use a statistics utility to determine the regression equation for each model of the data.

linear model:

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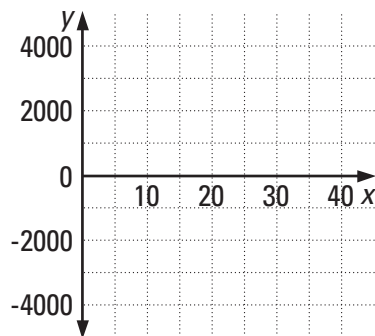
quadratic model:

\_\_\_\_\_

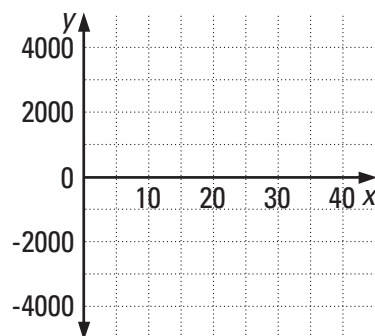


- b. Plot the residuals for each model in part a.

linear model:



quadratic model:



- c. From the residual plots in part b, which do you believe is a more appropriate model for this data? Justify your answer.

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