

**TEST BANK**

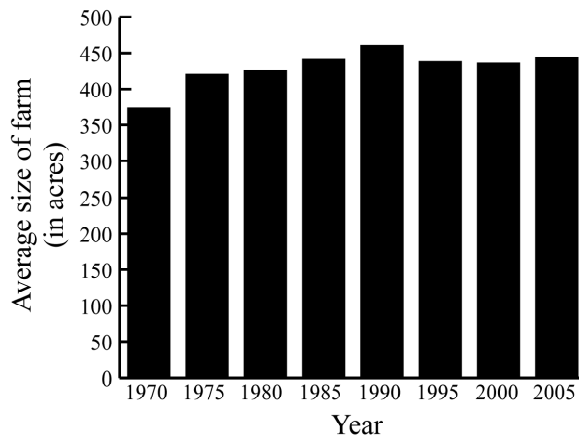


**CALCULUS**  
AND ITS APPLICATIONS

9<sup>th</sup> Edition

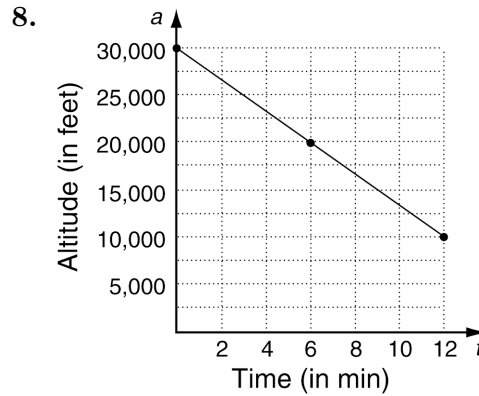
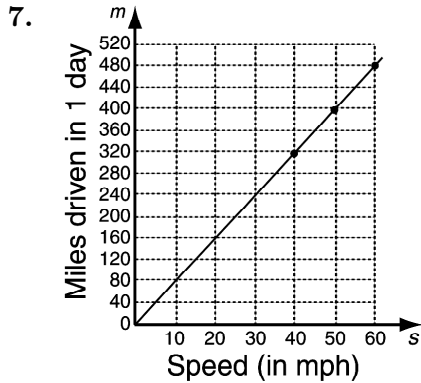
BITTINGER • ELLENBOGEN

1. *Average Farm Size.* The average size of a farm in the United States is shown below.



- (a) What was the approximate average farm size in 2000? 1. (a) \_\_\_\_\_
- (b) In what year was the average farm size approximately 460 acres? (b) \_\_\_\_\_
- (c) Estimate the range of the function that expresses average farm size as a function of the year. (c) \_\_\_\_\_
2. *Business: Compound Interest.* A person makes an investment at 4%, compounded annually. It has grown to \$1406.08 at the end of 1 yr. How much was originally invested? 2. \_\_\_\_\_
3. A function is given by  $f(x) = 3x^2 - x$ . Find (a)  $f(-4)$  and (b)  $f(x + a)$ . 3. (a) \_\_\_\_\_  
(b) \_\_\_\_\_
4. What are the slope and the  $y$ -intercept of  $y = \frac{1}{2}x - 6$ ? 4. \_\_\_\_\_
5. Find an equation of the line with slope  $\frac{2}{5}$ , containing the point  $(5, -2)$ . 5. \_\_\_\_\_
6. Find the slope of the line containing the points  $(-5, 4)$  and  $(3, -6)$ . 6. \_\_\_\_\_

Find the average rate of change.



7. \_\_\_\_\_

8. \_\_\_\_\_

9. *Relative Aperture.* The relative aperture, or f-stop,  $A$ , of a 23.5-mm lens is directly proportional to the focal length  $F$  of the lens. A 150-mm focal length has an f-stop of 6.3. Find an equation of variation expressing  $A$  as a function of  $F$ .

9. \_\_\_\_\_

10. *Business: Profit-and-Loss Analysis.* A cookie company has fixed costs of \$8000 for purchasing equipment for producing a new type of cookie. Variable costs are \$0.76 for producing each cookie with the new equipment. The revenue from each cookie is expected to be \$1.29.

(a) Formulate a function  $C(x)$  for the total cost of producing  $x$  cookies.

10. (a) \_\_\_\_\_

(b) Formulate a function  $R(x)$  for the total revenue from the sale of  $x$  cookies.

(b) \_\_\_\_\_

(c) Formulate a function  $P(x)$  for the total profit from the production and sale of  $x$  cookies.

(c) \_\_\_\_\_

(d) How many cookies must the company sell in order to break even?

(d) \_\_\_\_\_

11. *Economics: Equilibrium Point.* Find the equilibrium point for the demand and supply functions:

Demand:  $q = (x - 7)^2, 0 \leq x \leq 7,$

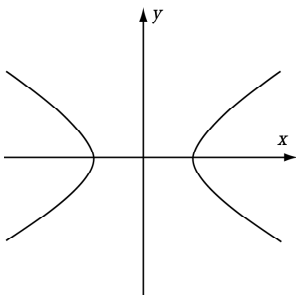
Supply:  $q = \frac{1}{9}x^2,$

given that  $x$  is the unit price, in dollars, and  $q$  is the quantity demanded or supplied, in thousands.

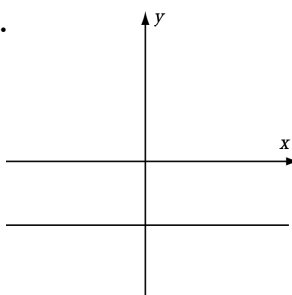
11. \_\_\_\_\_

Use the vertical-line test to determine whether each of the following is the graph of a function.

12.



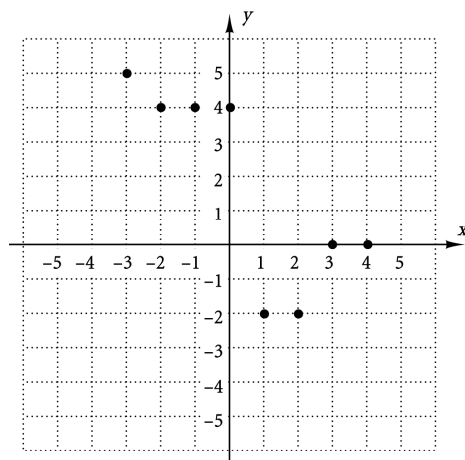
13.



12. \_\_\_\_\_

13. \_\_\_\_\_

14. For the following graph of function  $f$ , determine  
 (a)  $f(-2)$ ; (b) the domain; (c) all  $x$ -values such that  $f(x) = 4$ ; and (d) the range.



14. (a) \_\_\_\_\_

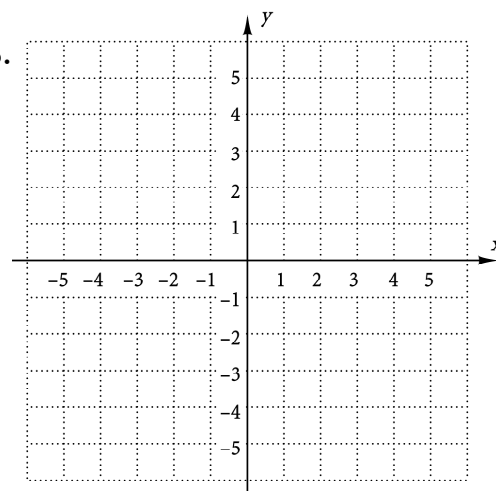
(b) \_\_\_\_\_

(c) \_\_\_\_\_

(d) \_\_\_\_\_

15. Graph:  $f(x) = \frac{-3}{x-4}$ .

15.



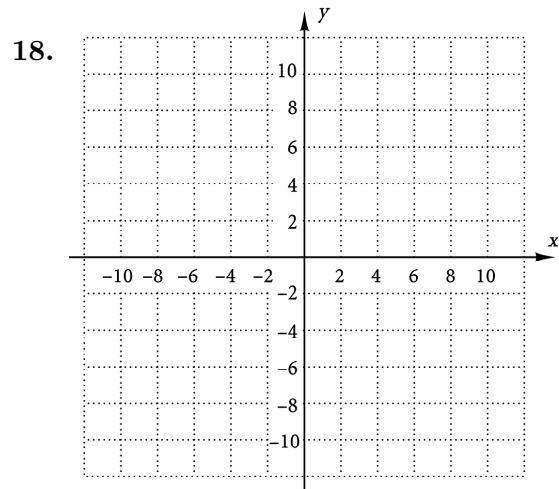
16. Convert to rational exponents:  $\frac{3}{\sqrt[4]{n}}$ .

16. \_\_\_\_\_

17. Convert to radical notation:  $y^{-2/3}$ .

17. \_\_\_\_\_

18. Graph:  $f(x) = \frac{x^2 - 3x - 10}{x + 2}$ .



Determine the domain of the function.

19.  $f(x) = \frac{x^2 + 4}{(x - 3)(x + 2)}$

19. \_\_\_\_\_

20.  $f(x) = \sqrt{x + 5}$

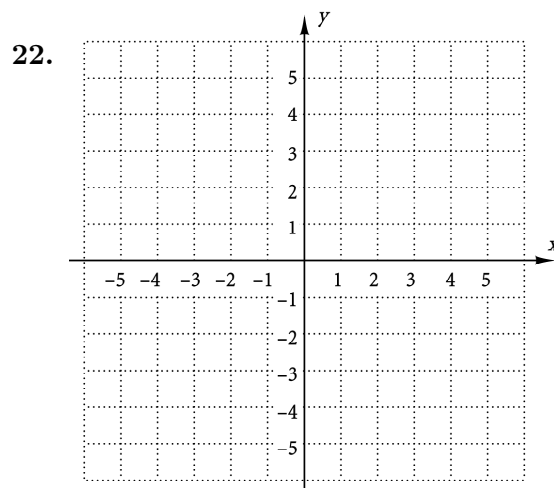
20. \_\_\_\_\_

21. Write interval notation for the following graph.



21. \_\_\_\_\_

22. Graph:  $f(x) = \begin{cases} x^2 - 3, & \text{for } x \geq 0 \\ -2x, & \text{for } x < 0 \end{cases}$



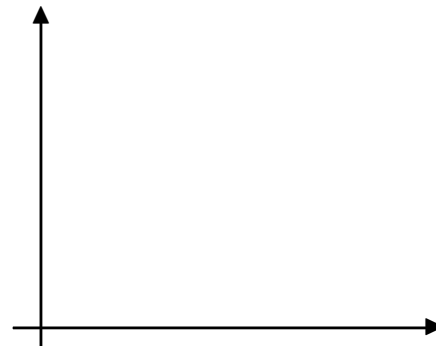
23. *World Wide Web Sites.* The following table shows the growth of world wide web sites from 2002 through 2007.

<i>Year, x (Since 2000)</i>	<i>Number of Active Web Sites, W (in millions)</i>
2	15
3	17
4	22
5	26
6	35
7	51

(Source: Based on graph at Netcraft, www.netcraft.com, 2007)

- (a) Make a scatterplot of the data.
- (b) Decide whether the data seem to fit a quadratic function.
- (c) Using the data points (2, 15), (5, 26), and (7, 51), find a quadratic function that fits the data.
- (d) Use the function from part (c) to estimate the number of active web sites in 2012.

23. (a)



(b) \_\_\_\_\_

(c) \_\_\_\_\_

(d) \_\_\_\_\_

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24. Simplify:  $(625^{1/10})^{-5/2}$ .

24. \_\_\_\_\_

25. Write an equation with exactly three solutions:  
-2, 4, and 6. Answers will vary.

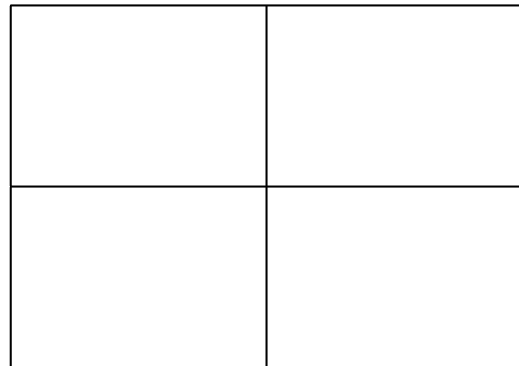
25. \_\_\_\_\_

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26. Graph the function and find the zeros and the domain and range.

$$f(x) = \sqrt[3]{|x^2 - 9|} - 3.$$

26.



27. *Active Web Sites.* Use the data in Question 23.

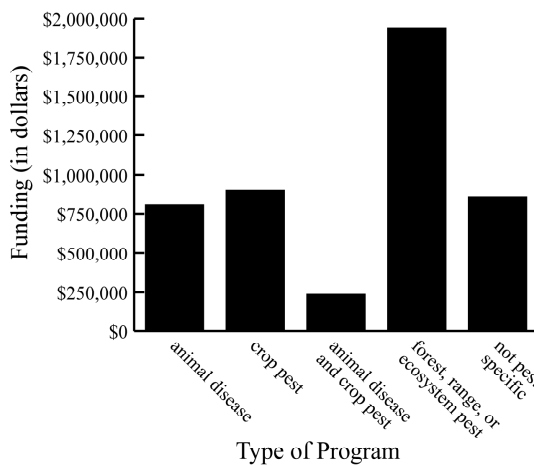
(a) Use the REGRESSION feature to fit a quadratic function to the data.

27. (a) \_\_\_\_\_

(b) Use the function from part (a) to predict the number of active websites in 2012.

(b) \_\_\_\_\_

1. *Invasive Species Management Funding.* The amount of funding provided by ERS (Economic Research Service of the USDA) to programs that addressed invasive species in 2003-2006 is shown below.



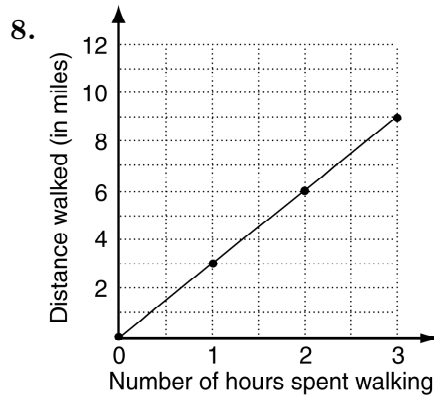
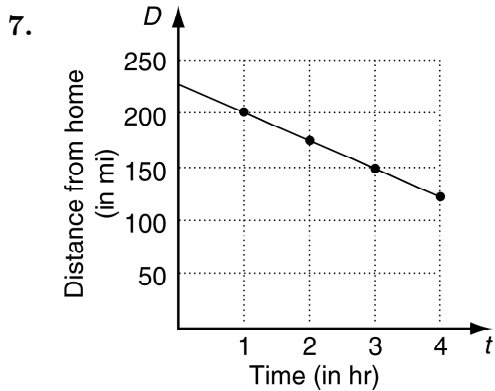
Source: www.ers.usda.com

Use the graph to answer the following.

- (a) What was the approximate level of funding by ERS for programs for only animal disease pests in 2003-2006? 1. (a) \_\_\_\_\_
- (b) Which type of invasive pest program received approximately \$2 million from ERS in 2003-2006? (b) \_\_\_\_\_
- (c) Estimate the range of the function that expresses ERS funding for programs by type of invasive pest in 2003-2006. (c) \_\_\_\_\_
2. *Business: Compound Interest.* A person makes an investment at 9%, compounded annually. It has grown to \$1144.50 at the end of 1 yr. How much was originally invested? 2. \_\_\_\_\_
3. A function is given by  $f(x) = 3x^2 - 5$ . Find (a)  $f(-7)$  and (b)  $f(x + 1)$ . 3. (a) \_\_\_\_\_  
(b) \_\_\_\_\_
4. What are the slope and the  $y$ -intercept of  $y = 3x + 2$ ? 4. \_\_\_\_\_
5. Find an equation of the line with slope  $\frac{5}{8}$ , containing the point  $(6, -2)$ . 5. \_\_\_\_\_
6. Find the slope of the line containing the points  $(6, -5)$  and  $(2, 3)$ . 6. \_\_\_\_\_



Find the average rate of change.



7. \_\_\_\_\_

8. \_\_\_\_\_

9. *Ohm's Law.* The electrical current  $I$ , in amperes, in a circuit is directly proportional to the voltage  $V$ . When 45 volts are applied, the current is 15 amperes. Find an equation of variation expressing  $I$  as a function of  $V$ .

9. \_\_\_\_\_

10. *Business: Profit-and-Loss Analysis.* Aldonna's is planning on producing a ladies' shoe. For the first year, the fixed costs are \$135,000. The variable costs for producing each pair of shoes are \$35. The revenue from the sale of each pair of shoes is expected to be \$70.

- (a) Formulate a function  $C(x)$  for the total cost of producing  $x$  pairs of shoes.
- (b) Formulate a function  $R(x)$  for the total revenue from the sale of  $x$  pairs of shoes.
- (c) Formulate a function  $P(x)$  for the total profit from the production and sale of  $x$  pairs of shoes.
- (d) How many pairs of shoes must Aldonna's sell in order to break even?

10. (a) \_\_\_\_\_

(b) \_\_\_\_\_

(c) \_\_\_\_\_

(d) \_\_\_\_\_

11. *Economics: Equilibrium Point.* Find the equilibrium point for the demand and supply functions:

Demand:  $q = (x - 6)^2$ ,  $0 \leq x \leq 6$ ,  
and

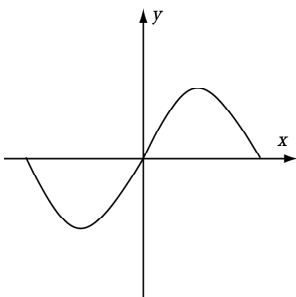
Supply:  $q = x^2 + 5x + 2$ ,

given that  $x$  is the unit price, in dollars, and  $q$  is the quantity demanded or supplied, in thousands.

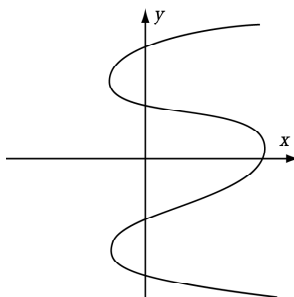
11. \_\_\_\_\_

Use the vertical-line test to determine whether each of the following is the graph of a function.

12.



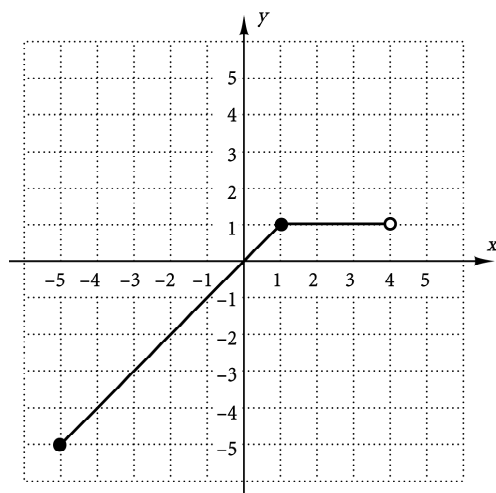
13.



12. \_\_\_\_\_

13. \_\_\_\_\_

14. For the following graph of function  $f$ , determine  
 (a)  $f(-2)$ ; (b) the domain; (c) all  $x$ -values such that  $f(x) = 1$ ; and (d) the range.



14. (a) \_\_\_\_\_

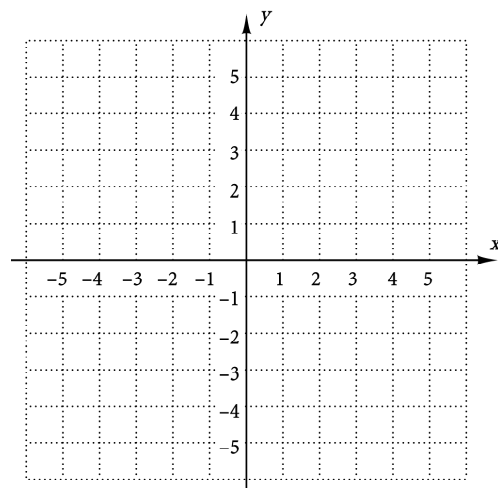
(b) \_\_\_\_\_

(c) \_\_\_\_\_

(d) \_\_\_\_\_

15. Graph:  $f(x) = \frac{2}{x}$ .

15.



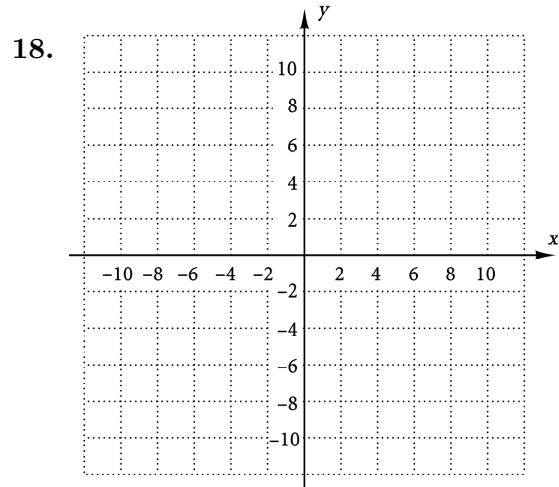
16. Convert to rational exponents:  $\frac{5}{\sqrt[3]{n^2}}$ .

16. \_\_\_\_\_

17. Convert to radical notation:  $y^{3/4}$ .

17. \_\_\_\_\_

18. Graph:  $f(x) = \frac{x^2 - 9}{x + 3}$ .



Determine the domain of the function.

19.  $f(x) = \frac{x^2 - 1}{(x + 3)(x - 4)}$

19. \_\_\_\_\_

20.  $f(x) = \frac{1}{\sqrt{x - 3}}$

20. \_\_\_\_\_

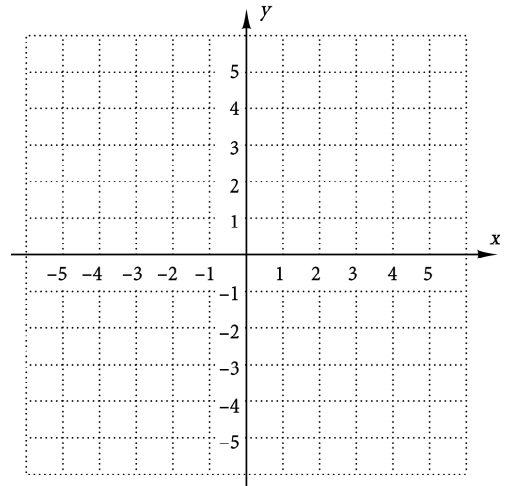
21. Write interval notation for the following graph.



21. \_\_\_\_\_

22. Graph:  $f(x) = \begin{cases} x^2 + 1, & \text{for } x > 0 \\ x - 2, & \text{for } x \leq 0 \end{cases}$

22.



23. *United States Farms.* The following table shows the number of farms, in millions, in the U.S. for various years.

<i>Number of Years since 1900, x</i>	<i>Number of Farms (in millions), f</i>
0	5.7
10	6.4
20	6.5
30	6.5
40	6.3
50	5.6
60	4.0
70	2.9
80	2.4
90	2.1
100	2.2

(Source: www.usda.gov)

23. (a)



- (a) Make a scatterplot of the data.
- (b) Decide whether the data seem to fit a quadratic function.
- (c) Using the data points (40, 6.3), (60, 4.0), and (100, 2.1), find a quadratic function that fits the data.
- (d) Use the function from part (c) to estimate the number of farms in the U.S. in 2020, 120 years after 1900.

(b) \_\_\_\_\_

(c) \_\_\_\_\_

(d) \_\_\_\_\_

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24. Simplify:  $(625^{5/2})^{1/10}$ .

24. \_\_\_\_\_

25. Write an equation with exactly three solutions:  
-8, 1, and 2. Answers will vary.

25. \_\_\_\_\_

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26. Graph the function and find the zeros and the domain and range of the function:

$$f(x) = \left| \sqrt{x^2 - 4} - 5 \right| - 6.$$

26.


27. *United States Farms.* Use the data in Question 23.

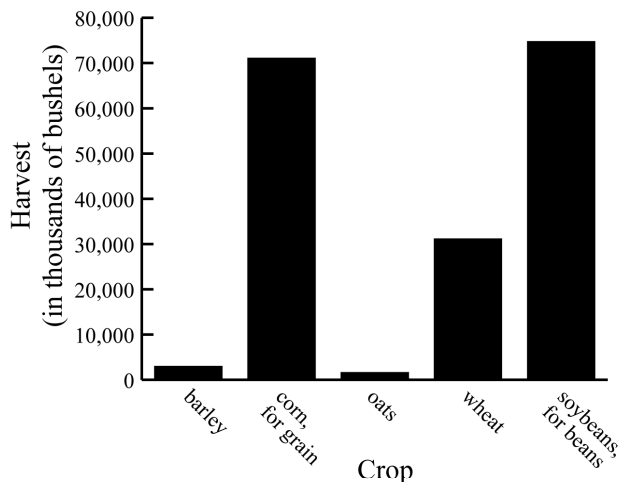
(a) Use the REGRESSION feature to fit a cubic function to the data.

27. (a) \_\_\_\_\_

(b) Use the function from part (a) to estimate the numbers of U.S. farms in 2020.

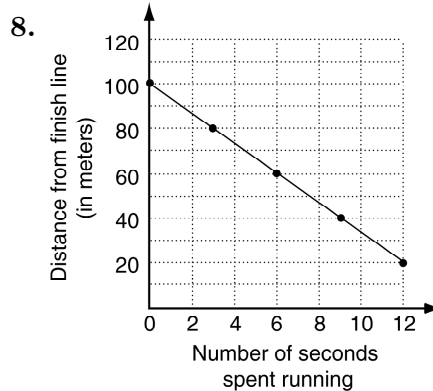
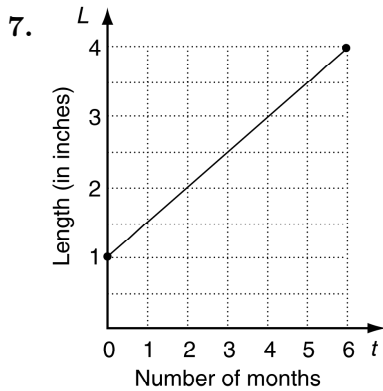
(b) \_\_\_\_\_

1. *Grain Harvest.* The number of bushels of several crops harvested in the U.S. in 2006 is shown below.



- (a) What was the approximate harvest of wheat in 2006? 1. (a) \_\_\_\_\_
- (b) Which crop had a harvest of approximately 3 million bu in 2006? (b) \_\_\_\_\_
- (c) Estimate the range of the function that expresses volume of harvest in 2006 as a function of type of crop for the data provided. (c) \_\_\_\_\_
2. *Business: Compound Interest.* A person makes an investment at 4%, compounded annually. It has grown to \$1310.40 at the end of 1 yr. How much was originally invested? 2. \_\_\_\_\_
3. A function is given by  $f(x) = 4x^2 + x$ . Find (a)  $f(-4)$  and (b)  $f(x - 2)$ . 3. (a) \_\_\_\_\_  
(b) \_\_\_\_\_
4. What are the slope and the  $y$ -intercept of  $y = 0.5x - 8$ ? 4. \_\_\_\_\_
5. Find an equation of the line with slope  $-\frac{2}{3}$ , containing the point  $(5, -3)$ . 5. \_\_\_\_\_
6. Find the slope of the line containing the points  $(-2, -6)$  and  $(5, 4)$ . 6. \_\_\_\_\_

Find the average rate of change.



7. \_\_\_\_\_

8. \_\_\_\_\_

9. *Weight on the Moon.* The weight  $M$  of an object on the moon is directly proportional to its weight  $E$  on earth. A person who weighs 192 lb on Earth weighs 32 lb on the moon. Find an equation of variation expressing  $E$  as a function of  $M$ .

9. \_\_\_\_\_

10. *Business: Profit-and-Loss Analysis.* Sweet Stuff is planning to introduce lollipops to their line of candies. For the first year, the fixed costs are \$10,000. The variable costs for producing each hundred lollipops are estimated to be \$10. The revenue from each hundred lollipops is expected to be \$30.

- (a) Formulate a function  $C(x)$  for the total cost of producing  $x$  hundred lollipops.
- (b) Formulate a function  $R(x)$  for the total revenue from the sale of  $x$  hundred lollipops.
- (c) Formulate a function  $P(x)$  for the total profit from the production and sale of  $x$  hundred lollipops.
- (d) How many hundred lollipops must Sweet Stuff sell in order to break even?

10. (a) \_\_\_\_\_

(b) \_\_\_\_\_

(c) \_\_\_\_\_

(d) \_\_\_\_\_

11. *Economics: Equilibrium Point.* Find the equilibrium point for the demand and supply functions:

$$\text{Demand: } q = (x - 5)^2, \quad 0 \leq x \leq 5,$$

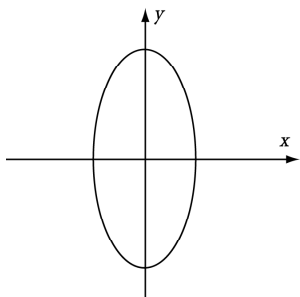
$$\text{Supply: } q = x^2 + 2x + 7,$$

given that  $x$  is the unit price, in dollars, and  $q$  is the quantity demanded or supplied, in thousands.

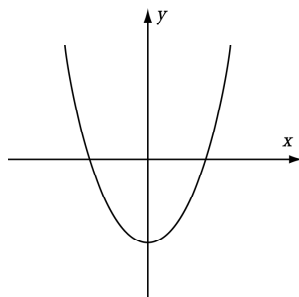
11. \_\_\_\_\_

Use the vertical-line test to determine whether each of the following is the graph of a function.

12.



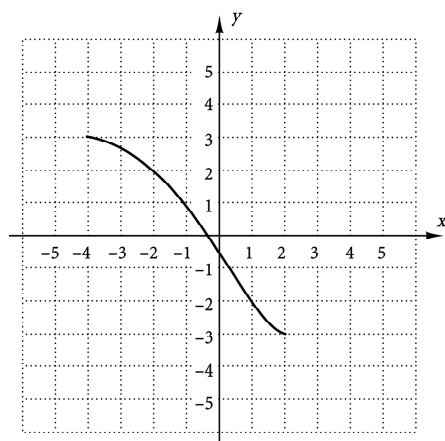
13.



12. \_\_\_\_\_

13. \_\_\_\_\_

14. For the following graph of function  $f$ , determine  
 (a)  $f(1)$ ; (b) the domain; (c) all  $x$ -values such that  $f(x) = 2$ ; and (d) the range.



14. (a) \_\_\_\_\_

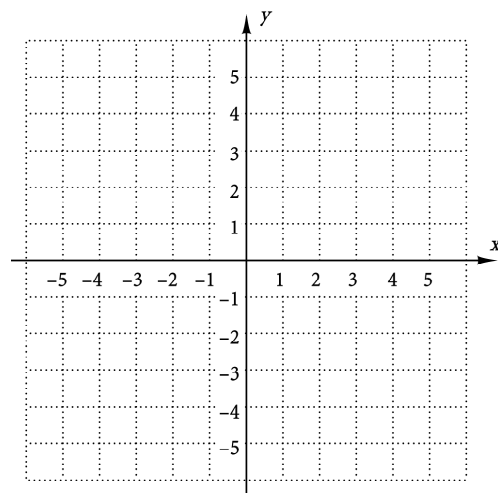
(b) \_\_\_\_\_

(c) \_\_\_\_\_

(d) \_\_\_\_\_

15. Graph:  $f(x) = \frac{3}{x}$ .

15.





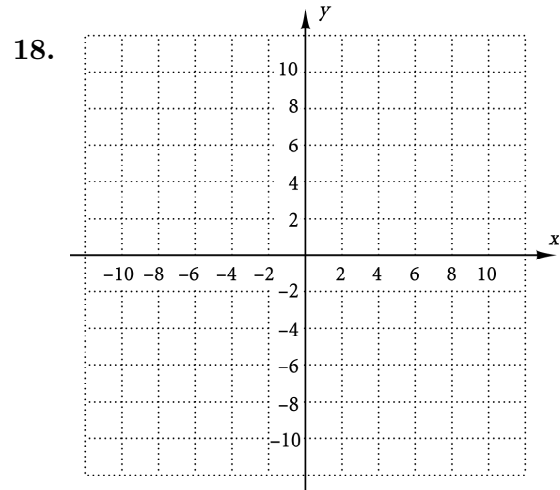
16. Convert to rational exponents:  $\frac{2}{\sqrt[5]{y^2}}$ .

16. \_\_\_\_\_

17. Convert to radical notation:  $x^{9/10}$ .

17. \_\_\_\_\_

18. Graph:  $f(x) = \frac{x^2 + 5x + 6}{x + 2}$ .



Determine the domain of the function.

19.  $f(x) = \frac{x^2 - 3}{(x - 6)(x + 2)}$

19. \_\_\_\_\_

20.  $f(x) = \frac{1}{\sqrt{x + 6}}$

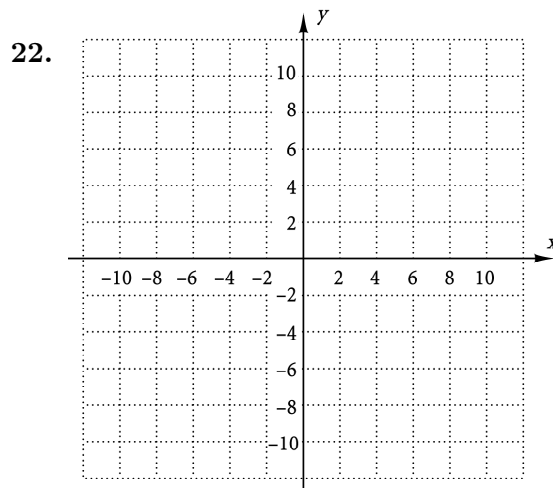
20. \_\_\_\_\_

21. Write interval notation for the following graph.



21. \_\_\_\_\_

22. Graph:  $f(x) = \begin{cases} x^2 + 1, & \text{for } x \geq -1 \\ x - 2, & \text{for } x < -1 \end{cases}$

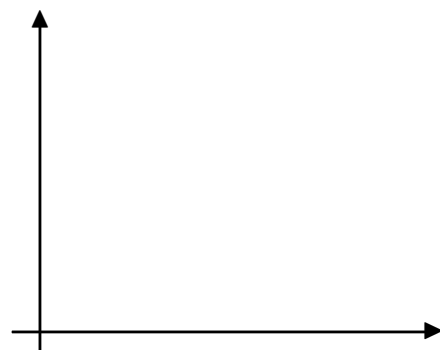


23. *Household Income.* The following table shows the median U.S. household income for people of various ages.

Age, $a$	Median Income, $i$ , in 2005 for the age group containing $a$ .
19.5	28,770
29.5	47,379
39.5	58,084
49.5	62,462
59.5	52,260

(Source: U.S. Bureau of the Census;  
age groups are  $a - 5$  yr to  $a + 5$  yr for each  $a$ .)

23. (a)



- (a) Make a scatterplot of the data.
- (b) Decide whether the data seem to fit a quadratic function.
- (c) Using the data points  $(29.5, 47,379)$ ,  $(49.5, 62,462)$ , and  $(59.5, 52,260)$ , find a quadratic function that fits the data.
- (d) Use the function to estimate the income of a person of age 70.

(b) \_\_\_\_\_

(c) \_\_\_\_\_

(d) \_\_\_\_\_

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24. Simplify:  $(81^{3/2})^{-1/3}$ .

24. \_\_\_\_\_

25. Write an equation with exactly three solutions:  
-2, 0, and 5. Answers will vary.

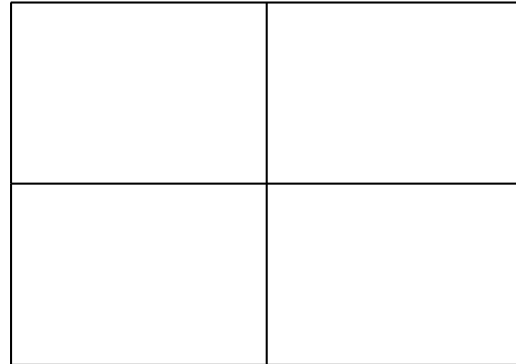
25. \_\_\_\_\_

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26. Graph the function and find the zeros and the domain and range.

$$f(x) = \left| \sqrt{x^2 - 1} - 3 \right| - 5.$$

26.



27. *Household Income.* Use the data in Question 23.

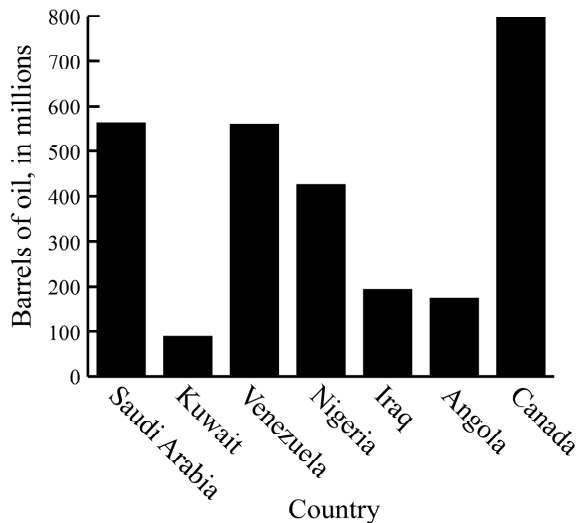
(a) Use the REGRESSION feature to fit a quadratic function to the data.

27. (a) \_\_\_\_\_

(b) Use the function from part (a) to predict the income of a person of age 70.

(b) \_\_\_\_\_

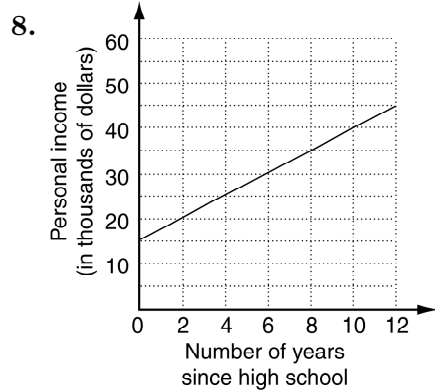
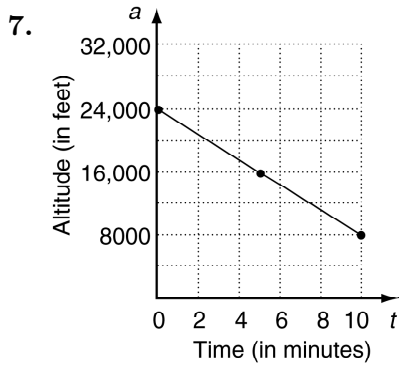
1. *Oil Imports.* The amount of oil imported to the U.S. from several countries in 2005 is shown below.



Source: <http://tonto.eia.doe.gov>

- |   |                                      |
|---|--------------------------------------|
| <p>(a) What is the approximate amount of oil imported from Nigeria in 2005?</p>   | <p>1. (a) _____</p>                  |
| <p>(b) From which country were about 195 million barrels of oil imported in 2005?</p>   | <p>(b) _____</p>                     |
| <p>(c) Estimate the range of the function that expresses the amount of oil imported into the U.S. as a function of country of origin (for the data given).</p>                      | <p>(c) _____</p>                     |
| <p>2. <i>Business: Compound Interest.</i> A person makes an investment at 2%, compounded annually. It has grown to \$1785 at the end of 1 yr. How much was originally invested?</p> | <p>2. _____</p>                      |
| <p>3. A function is given by <math>f(x) = 2x^3 + 4</math>. Find (a) <math>f(-2)</math> and (b) <math>f(x + a)</math>.</p>   | <p>3. (a) _____</p> <p>(b) _____</p> |
| <p>4. What are the slope and the <math>y</math>-intercept of <math>y = -4x + 5</math>?</p>  | <p>4. _____</p>                      |
| <p>5. Find an equation of the line with slope <math>\frac{2}{3}</math>, containing the point <math>(3, -6)</math>.</p>  | <p>5. _____</p>                      |
| <p>6. Find the slope of the line containing the points <math>(10, 7)</math> and <math>(-2, 3)</math>.</p>   | <p>6. _____</p>                      |

Find the average rate of change.



7. \_\_\_\_\_

8. \_\_\_\_\_

9. *Weekly Allowance.* According to Fidelity Investments *Investment Vision Magazine*, the average weekly allowance  $A$  of children is directly proportional to their grade level  $G$ . Recently, the average allowance of a 9th-grade student was \$9.66 per week. Find an equation of variation expressing  $A$  as a function of  $G$ .

9. \_\_\_\_\_

10. *Business: Profit-and-Loss Analysis.* Office Supplier, Inc. is planning on producing erasers. For the first year, the fixed costs are \$5760. The variables costs are estimated to be \$6 per dozen erasers. The revenue from each dozen erasers is expected to be \$10.80.

(a) Formulate a function  $C(x)$  for the total cost of producing  $x$  dozen erasers.

10. (a) \_\_\_\_\_

(b) Formulate a function  $R(x)$  for the total revenue from the sale of  $x$  dozen erasers.

(b) \_\_\_\_\_

(c) Formulate a function  $P(x)$  for the total profit from the production and sale of  $x$  dozen erasers.

(c) \_\_\_\_\_

(d) How many dozen erasers must Office Supplier sell in order to break even?

(d) \_\_\_\_\_

11. *Economics: Equilibrium Point.* Find the equilibrium point for the demand and supply functions:

$$\text{Demand: } q = (x - 4)^2, \quad 0 \leq x \leq 4,$$

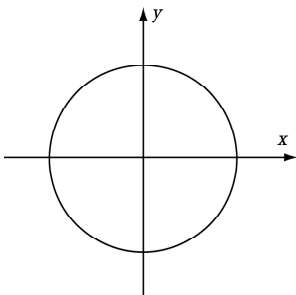
$$\text{Supply: } q = x^2 + 3x + 5,$$

given that  $x$  is the unit price, in dollars, and  $q$  is the quantity demanded or supplied, in thousands.

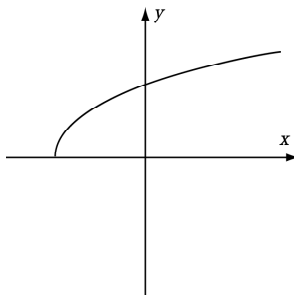
11. \_\_\_\_\_

Use the vertical-line test to determine whether each of the following is the graph of a function.

12.



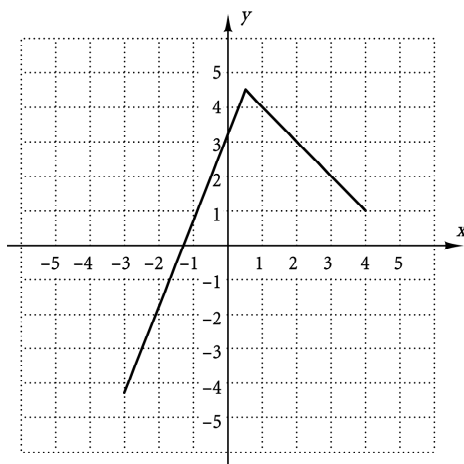
13.



12. \_\_\_\_\_

13. \_\_\_\_\_

14. For the following graph of function  $f$ , determine  
 (a)  $f(3)$ ; (b) the domain; (c) all  $x$ -values such that  $f(x) = 2$ ; and (d) the range.



14. (a) \_\_\_\_\_

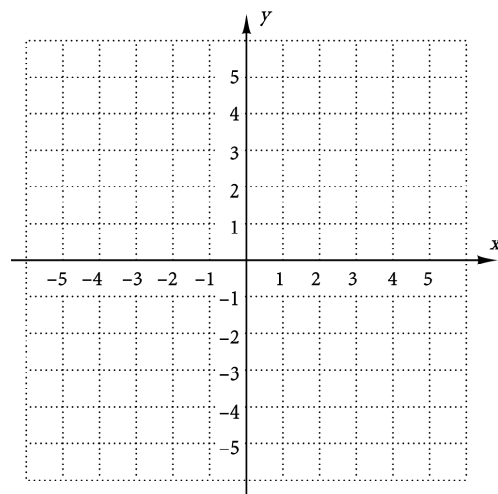
(b) \_\_\_\_\_

(c) \_\_\_\_\_

(d) \_\_\_\_\_

15. Graph:  $f(x) = -\frac{2}{x}$ .

15.



16. Convert to rational exponents:  $\frac{3}{\sqrt{x}}$ .

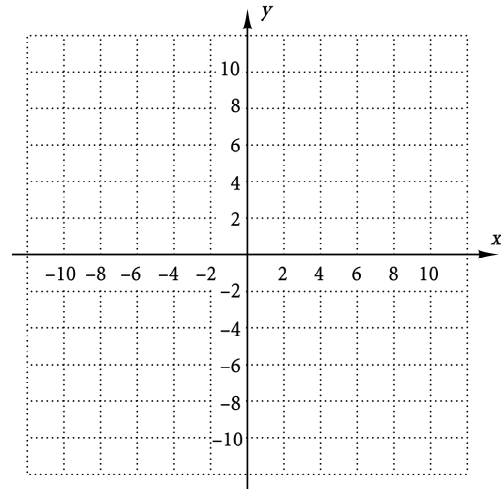
16. \_\_\_\_\_

17. Convert to radical notation:  $y^{-5/9}$ .

17. \_\_\_\_\_

18. Graph:  $f(x) = \frac{x^2 - 16}{x - 4}$ .

18.



Determine the domain of the function.

19.  $f(x) = \frac{x^2 + 4x}{(x - 4)(x + 8)}$

19. \_\_\_\_\_

20.  $f(x) = \sqrt{3x - 2}$

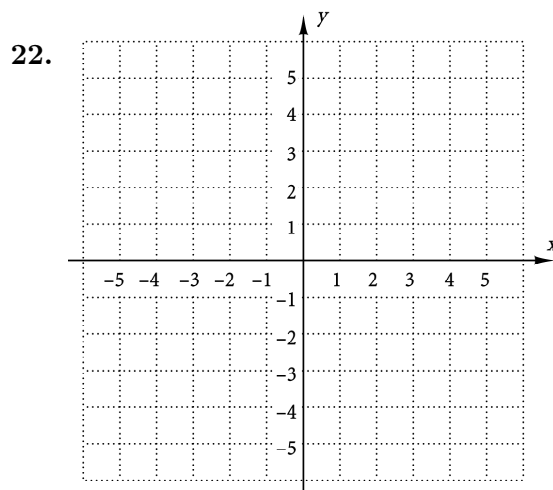
20. \_\_\_\_\_

21. Write interval notation for the following graph.



21. \_\_\_\_\_

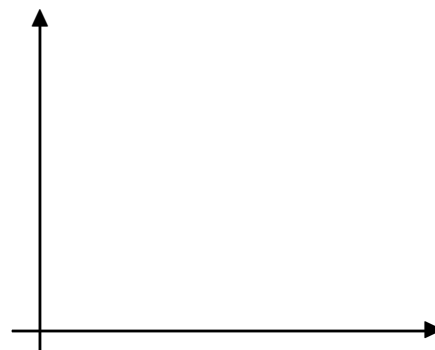
22. Graph:  $f(x) = \begin{cases} x^2 - 4, & \text{for } x \geq 0 \\ x + 1, & \text{for } x < 0 \end{cases}$



23. *Wind Friction.* Wind friction, or air resistance, increases with speed. The table below shows some measurements made in a wind tunnel.

Velocity, $v$ (in kilometers per hour)	Force of Resistance, $f$ (in newtons)
10	3
21	4.2
34	6.2
40	7.1
45	15.1
52	29.0

23. (a)



- (a) Make a scatterplot of the data.
- (b) Decide whether the data seem to fit a quadratic function.
- (c) Using the data points  $(21, 4.2)$ ,  $(40, 7.1)$ , and  $(45, 15.1)$ , find a quadratic function that fits the data.
- (d) Use the function to estimate force of resistance when velocity is 60 km/h.

(b) \_\_\_\_\_

(c) \_\_\_\_\_

(d) \_\_\_\_\_



---

24. Simplify:  $(81^{3/4})^{-1/3}$ .

24. \_\_\_\_\_

25. Write an equation with exactly three solutions:  
-1, 4, and -2. Answers will vary.

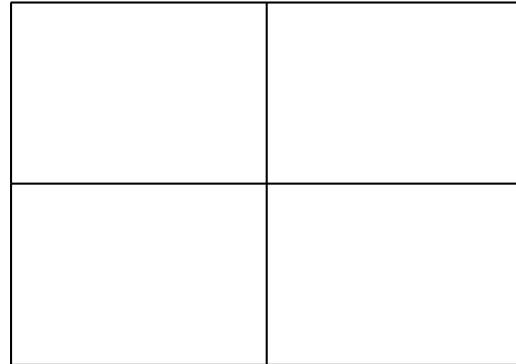
25. \_\_\_\_\_

---

26. Graph the function and find the zeros and the domain and range.

$$f(x) = \left| \sqrt[3]{x^2 + 1} \right| - 4.$$

26.



27. *Wind Friction.* Use the data in Question 23.

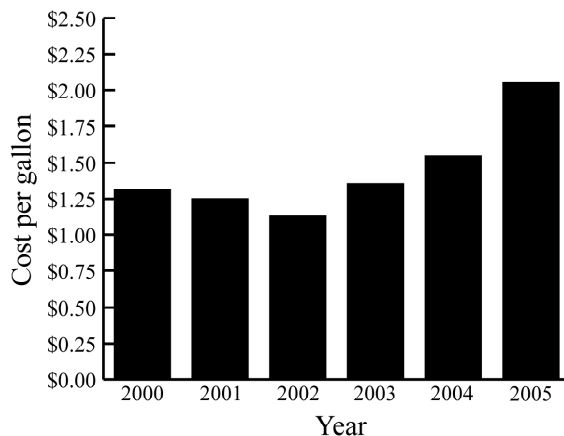
(a) Use the REGRESSION feature to fit a quadratic function to the data.

27. (a) \_\_\_\_\_

(b) Use the function from part (a) to estimate the force of resistance when velocity is 60 km/h.

(b) \_\_\_\_\_

1. *Heating Oil.* The average retail price per gallon of home heating oil in the United States for several years is shown below.



- (a) What was the approximate price per gallon of heating oil in 2003?
- (b) In what year was the average price per gallon for heating oil approximately \$1.25?
- (c) Estimate the range of the function that expresses average price per gallon of heating oil as a function of year (for the years given).

1. (a) \_\_\_\_\_

(b) \_\_\_\_\_

(c) \_\_\_\_\_

2. *Business: Compound Interest.* A person makes an investment at 3%, compounded annually. It has grown to \$824 at the end of 1 yr. How much was originally invested?

2. \_\_\_\_\_

3. A function is given by  $f(x) = 2x^2 + 3$ . Find (a)  $f(-1)$  and (b)  $f(a - 3)$ .

3. (a) \_\_\_\_\_

(b) \_\_\_\_\_

4. What are the slope and the  $y$ -intercept of  $y = 4x - \frac{1}{2}$ ?

4. \_\_\_\_\_

5. Find an equation of the line with slope  $-\frac{5}{8}$ , containing the point  $(4, 0)$ .

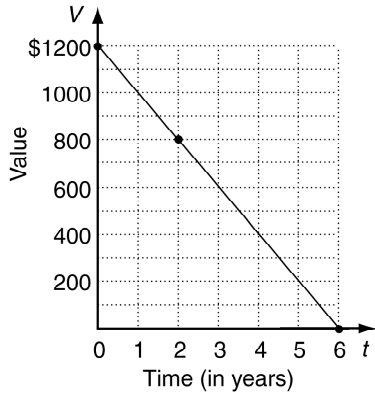
5. \_\_\_\_\_

6. Find the slope of the line containing the points  $(-6, 4)$  and  $(2, -2)$ .

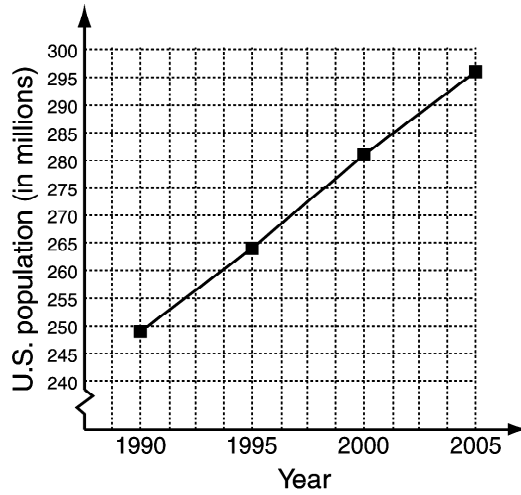
6. \_\_\_\_\_

Find the average rate of change.

7.



8.



7. \_\_\_\_\_

8. \_\_\_\_\_

9. *Use of Aluminum Cans.* The number  $N$  of aluminum cans used each year is directly proportional to the number of people  $P$  using the cans. It is known that 250 people use 60,000 cans in one year. Find an equation of variation expressing  $N$  as a function of  $P$ .

9. \_\_\_\_\_

10. *Business: Profit-and-Loss Analysis.* Workshop of Westfield is planning on producing a new model hammer. For the first year, the fixed costs are \$24,000. The variable costs for producing each hammer are \$12. The revenue from each hammer is expected to be \$18.

- (a) Formulate a function  $C(x)$  for the total cost of producing  $x$  hammers.
- (b) Formulate a function  $R(x)$  for the total revenue from the sale of  $x$  hammers.
- (c) Formulate a function  $P(x)$  for the total profit from the production and sale of  $x$  hammers.
- (d) How many hammers must the company sell in order to break even?

10. (a) \_\_\_\_\_

(b) \_\_\_\_\_

(c) \_\_\_\_\_

(d) \_\_\_\_\_

11. *Economics: Equilibrium Point.* Find the equilibrium point for the demand and supply functions:

$$\text{Demand: } q = (x - 6)^2, \quad 0 \leq x \leq 6,$$

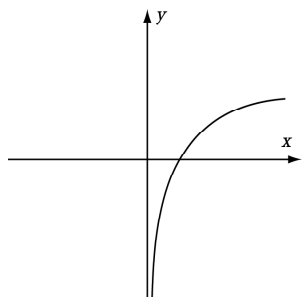
$$\text{Supply: } q = \frac{4}{9}x^2,$$

given that  $x$  is the unit price, in dollars, and  $q$  is the quantity demanded or supplied, in thousands.

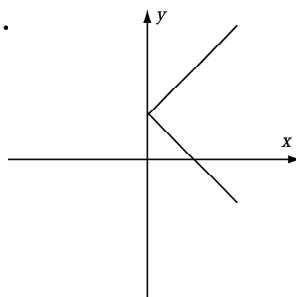
11. \_\_\_\_\_

Use the vertical-line test to determine whether each of the following is the graph of a function.

12.



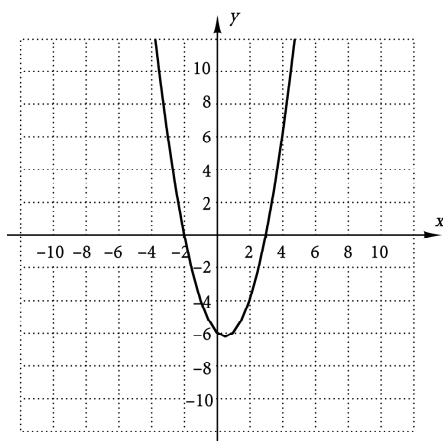
13.



12. \_\_\_\_\_

13. \_\_\_\_\_

14. For the following graph of function  $f$ , determine  
 (a)  $f(-1)$ ; (b) the domain; (c) all  $x$ -values such that  $f(x) = 0$ ; and (d) the range.



14. (a) \_\_\_\_\_

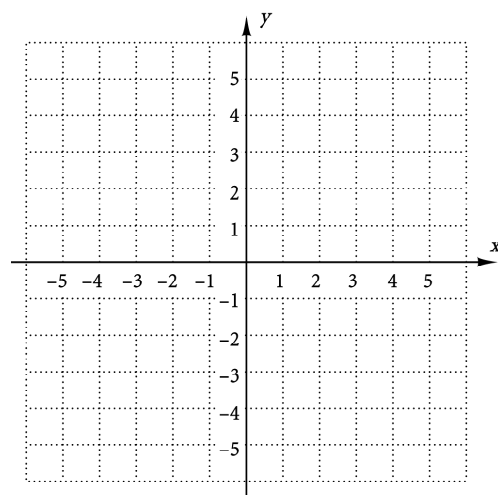
(b) \_\_\_\_\_

(c) \_\_\_\_\_

(d) \_\_\_\_\_

15. Graph:  $f(x) = \frac{6}{x-3}$ .

15.



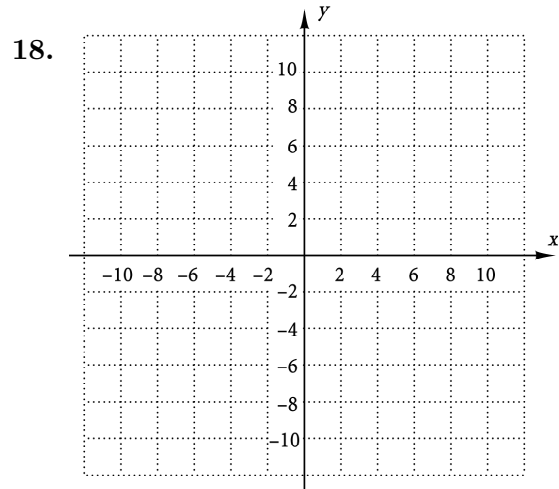
16. Convert to rational exponents:  $\frac{6}{\sqrt[5]{m}}$ .

16. \_\_\_\_\_

17. Convert to radical notation:  $x^{-3/4}$ .

17. \_\_\_\_\_

18. Graph:  $f(x) = \frac{x^2 + 2x - 8}{x + 4}$ .



Determine the domain of the function.

19.  $f(x) = \frac{x^2 + 4x}{(x + 2)(x - 5)}$

19. \_\_\_\_\_

20.  $f(x) = \sqrt{4x - 1}$

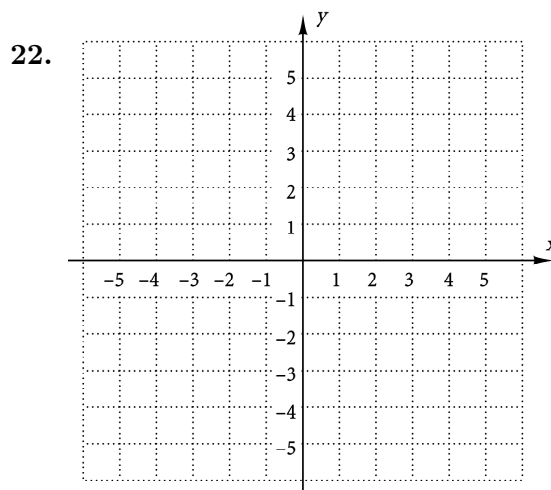
20. \_\_\_\_\_

21. Write interval notation for the following graph.



21. \_\_\_\_\_

22. Graph:  $f(x) = \begin{cases} x^2 - 4, & \text{for } x > 1 \\ x + 3, & \text{for } x \leq 1 \end{cases}$



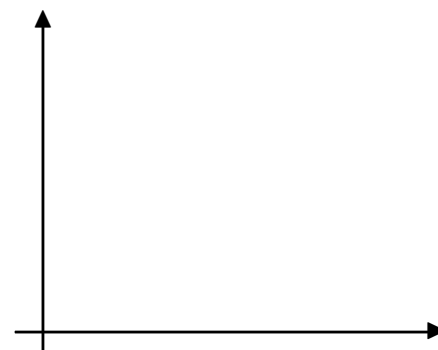
23. *Small Business.* The following table shows the number of new small-business incorporations for various years.

<i>Number of years since 1990, x</i>	<i>Number of New Incorporations, C (in thousands)</i>
1	629
2	667
3	707
4	742
5	770
6	786
7	799

(Source: U.S. Small Business Administration)

- (a) Make a scatterplot of the data.
- (b) Decide whether the data seem to fit a quadratic function.
- (c) Using the data points (1, 629), (3, 707), and (6, 786), find a quadratic function that fits the data.
- (d) Use the function to estimate the number of new small-business incorporations 20 years after 1990.

23. (a)



(b) \_\_\_\_\_

(c) \_\_\_\_\_

(d) \_\_\_\_\_

24. Simplify:  $(256^{-1/2})^{3/4}$ .

24. \_\_\_\_\_

25. Write an equation that has exactly three solutions:  
0, 6, and  $-5$ . Answers will vary.

25. \_\_\_\_\_

26. Graph the function and find the zeros and the domain and range.

$$f(x) = \left| \sqrt[3]{2 - x^2} \right| - 2.$$

26.


27. *Small Business.* Use the data in Question 23.

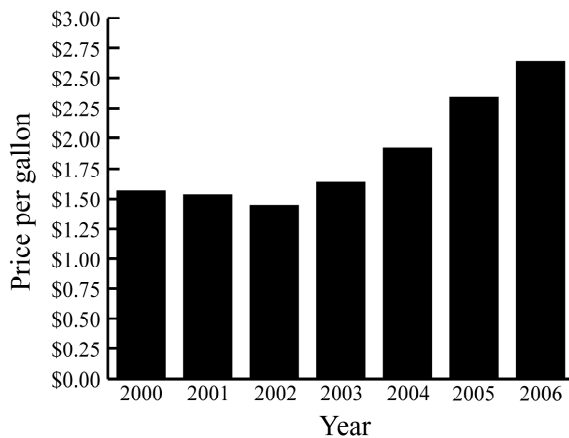
(a) Use the REGRESSION feature to fit a quadratic function to the data.

27. (a) \_\_\_\_\_

(b) Use the function from part (a) to predict the number of new small business incorporations in 2010, 20 years after 1990.

(b) \_\_\_\_\_

1. *Gasoline Prices.* The average retail price per gallon of gasoline in U.S. cities for several years is shown below.

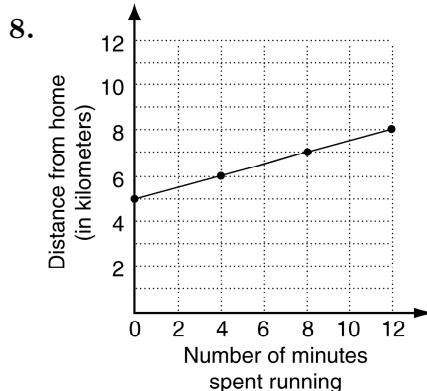
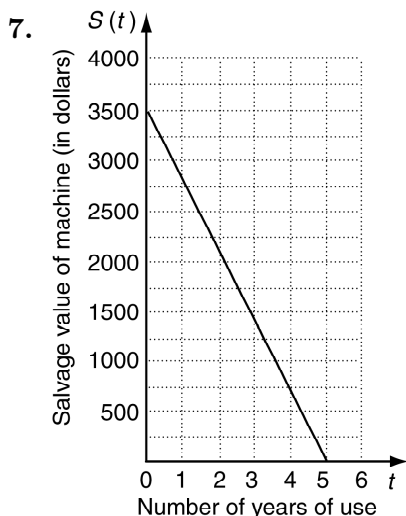


Source: www.eia.doe.gov

- (a) What was the approximate price per gallon for gasoline in 2005? 1. (a) \_\_\_\_\_
- (b) In which year was the average price per gallon \$1.44? (b) \_\_\_\_\_
- (c) Estimate the range of the function that expresses average price per gallon of gasoline in a U.S. city as a function of year. (c) \_\_\_\_\_
2. *Business: Compound Interest.* A person makes an investment at 1.5%, compounded annually. It has grown to \$761.25 at the end of 1 yr. How much was originally invested? 2. \_\_\_\_\_
3. A function is given by  $f(x) = x^3 - 4$ . Find (a)  $f(-2)$  and (b)  $f(x + h)$ . 3. (a) \_\_\_\_\_  
(b) \_\_\_\_\_
4. What are the slope and the  $y$ -intercept of  $y = 1.5x + 6$ ? 4. \_\_\_\_\_
5. Find an equation of the line with slope  $-\frac{1}{4}$ , containing the point  $(2, -8)$ . 5. \_\_\_\_\_
6. Find the slope of the line containing the points  $(-9, 1)$  and  $(-5, -2)$ . 6. \_\_\_\_\_



Find the average rate of change.



7. \_\_\_\_\_

8. \_\_\_\_\_

9. *Hooke's Law.* The distance  $d$  that a spring is stretched by a hanging object is directly proportional to the mass  $m$  of the object. A 5-kg object stretches a particular spring 28 cm. Find an equation of variation expressing  $d$  as a function of  $m$ .

9. \_\_\_\_\_

10. *Business: Profit-and-Loss Analysis.* A manufacturing company has fixed costs of \$15,000 for producing a specialty soap mold. Thereafter the variable costs are \$0.95 for each bar of soap produced in the mold. The revenue from each specialty soap is expected to be \$3.50.

- (a) Formulate a function  $C(x)$  for the total cost of producing  $x$  specialty soaps.
- (b) Formulate a function  $R(x)$  for the total revenue from the sale of  $x$  specialty soaps.
- (c) Formulate a function  $P(x)$  for the total profit from the production and sale of  $x$  specialty soaps.
- (d) How many specialty soaps must the company sell in order to break even?

10. (a) \_\_\_\_\_

(b) \_\_\_\_\_

(c) \_\_\_\_\_

(d) \_\_\_\_\_

11. *Economics: Equilibrium Point.* Find the equilibrium point for the demand and supply functions:

$$\text{Demand: } q = (x - 8)^2, \quad 0 \leq x \leq 8,$$

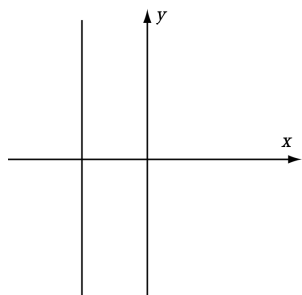
$$\text{Supply: } q = \frac{9}{25}x^2,$$

given that  $x$  is the unit price, in dollars, and  $q$  is the quantity demanded or supplied, in thousands.

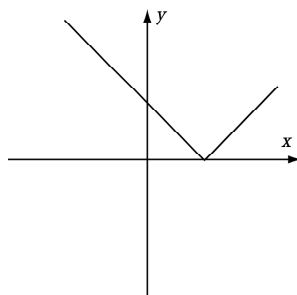
11. \_\_\_\_\_

Use the vertical-line test to determine whether each of the following is the graph of a function.

12.



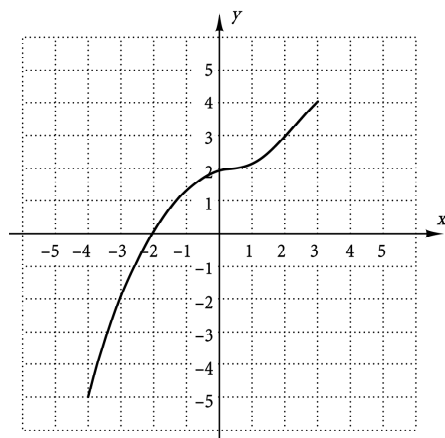
13.



12. \_\_\_\_\_

13. \_\_\_\_\_

14. For the following graph of function  $f$ , determine  
 (a)  $f(1)$ ; (b) the domain; (c) all  $x$ -values such that  $f(x) = 3$ ; and (d) the range.



14. (a) \_\_\_\_\_

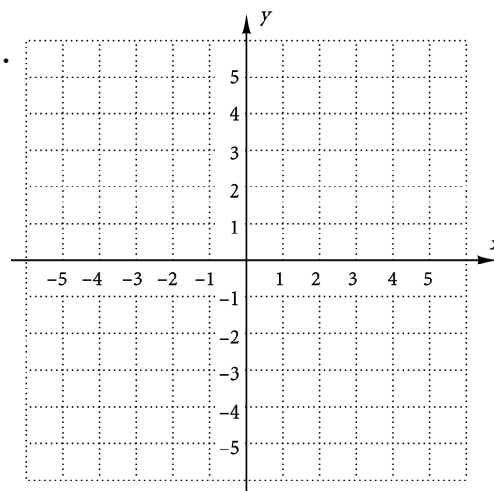
(b) \_\_\_\_\_

(c) \_\_\_\_\_

(d) \_\_\_\_\_

15. Graph:  $f(x) = \frac{4}{x-4}$ .

15.



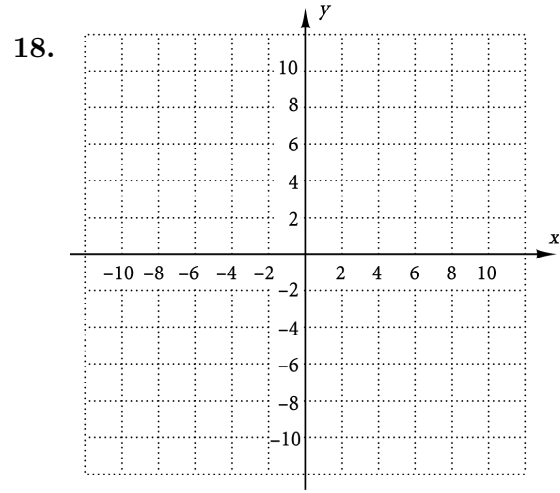
16. Convert to rational exponents:  $\frac{4}{\sqrt[6]{m^5}}$ .

16. \_\_\_\_\_

17. Convert to radical notation:  $y^{-1/3}$ .

17. \_\_\_\_\_

18. Graph:  $f(x) = \frac{x^2 - x - 6}{x + 2}$ .



Determine the domain of the function.

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

19. \_\_\_\_\_

20.  $f(x) = \frac{1}{\sqrt{2 - x}}$

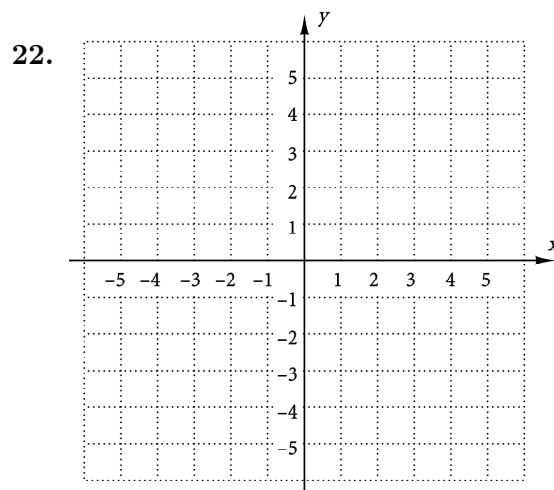
20. \_\_\_\_\_

21. Write interval notation for the following graph.



21. \_\_\_\_\_

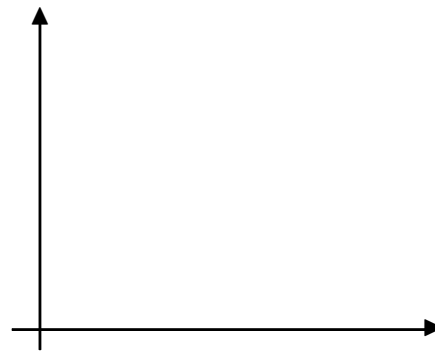
22. Graph:  $f(x) = \begin{cases} -x^2 - 3, & \text{for } x \geq -2 \\ x - 1, & \text{for } x < -2 \end{cases}$



23. *Pizza Prices.* Pizza Unlimited has the following prices, in dollars, for pizzas of the given diameter, in inches.

Diameter, $d$	Price, $p$
6	5.00
8	6.00
12	8.50
16	11.50
24	20.00

23. (a)



- (a) Make a scatterplot of the data.
- (b) Decide whether the data seem to fit a quadratic function.
- (c) Using the data points  $(6, 5)$ ,  $(8, 6)$ , and  $(16, 11.50)$ , find a quadratic function that fits the data.
- (d) Use the function to estimate the price of a pizza with a 20-in. diameter.

(b) \_\_\_\_\_

(c) \_\_\_\_\_

(d) \_\_\_\_\_

---

24. Simplify:  $(8^{2/3})^{-5/2}$ . 24. \_\_\_\_\_

25. Write an equation that has exactly three solutions:  
2, -4, and 6. Answers will vary. 25. \_\_\_\_\_

---

26. Graph the function and find the zeros and the domain and range.

$$f(x) = \sqrt[3]{|10 - x^2|} - 4.$$

26.


27. *Pizza Prices.* Use the data in Question 23.

(a) Use the REGRESSION feature to fit a quadratic function to the data.

27. (a) \_\_\_\_\_

(b) Use the function from part (a) to estimate the price of a pizza with a 20-in. diameter.

(b) \_\_\_\_\_