EXERCISES

Practice

Write each relation as a table of values and as an equation. Graph the relation.

17. the domain is all positive integers less than 10, the range is 3 times x, where x is a member of the domain

18. the domain is all negative integers greater than -7, the range is x less 5, where x is a member of the domain

19. the domain is all integers greater than -5 and less than or equal to 4, the range is 8 more than x, where x is a member of the domain

State each relation as a set of ordered pairs. Then state the domain and range.

20.

x	y
−5	−5
−3	−3
−1	−1
1	1

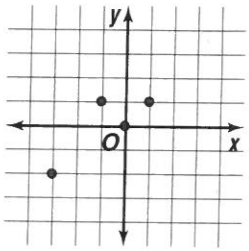
21.

x	y
−10	0
−5	0
0	0
5	0

22.

x	y
4	0
5	1
8	0
13	1

23.



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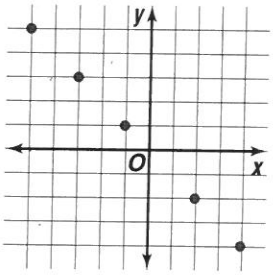

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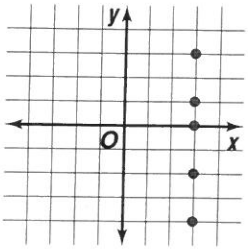


interNET CONNECTION

Graphing Calculator Programs
For a graphing calculator program that plots points in a relation, visit **www.amc.glencoe.com**

Given that x is an integer, state the relation representing each equation by making a table of values. Then graph the ordered pairs of the relation.

26. $y = x - 5$ and $-4 \le x \le 1$

27. $y = -x$ and $1 \le x < 7$

28. $y = |x|$ and $-5 \le x \le 1$

29. $y = 3x - 3$ and $0 < x < 6$

30. $y^2 = x - 2$ and $x = 11$

31. $|2y| = x$ and $x = 4$

State the domain and range of each relation. Then state whether the relation is a function. Write *yes* or *no*. Explain.

32. $\{(4, 4), (5, 4), (6, 4)\}$

33. $\{(1, -2), (1, 4), (1, -6), (1, 0)\}$

34. $\{(4, -2), (4, 2), (1, -1), (1, 1), (0, 0)\}$

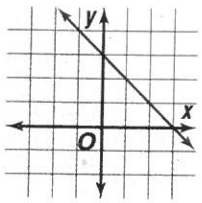
35. $\{(0, 0), (2, 2), (2, -2), (5, 8), (5, -8)\}$

36. $\{(-1.1, -2), (-0.4, -1), (-0.1, -1)\}$

37. $\{(2, -3), (9, 0), (8, -3), (-9, 8)\}$

For each graph, state the domain and range of the relation. Then explain whether the graph represents a function.

38.



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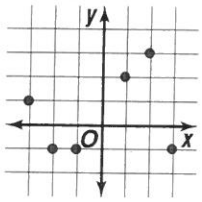

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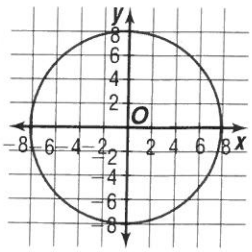


Find $[f \circ g](x)$ and $[g \circ f](x)$ for each $f(x)$ and $g(x)$.

15. $f(x) = x^2 - 9$
$g(x) = x + 4$

16. $f(x) = \frac{1}{2}x - 7$
$g(x) = x + 6$

17. $f(x) = x - 4$
$g(x) = 3x^2$

18. $f(x) = x^2 - 1$
$g(x) = 5x^2$

19. $f(x) = 2x$
$g(x) = x^3 + x^2 + 1$

20. $f(x) = 1 + x$
$g(x) = x^2 + 5x + 6$

21. What are $[f \circ g](x)$ and $[g \circ f](x)$ for $f(x) = x + 1$ and $g(x) = \frac{1}{x-1}$?

State the domain of $[f \circ g](x)$ for each $f(x)$ and $g(x)$.

22. $f(x) = 5x$
$g(x) = x^3$

23. $f(x) = \frac{1}{x}$
$g(x) = 7 - x$

24. $f(x) = \sqrt{x - 2}$
$g(x) = \frac{1}{4x}$

Find the first three iterates of each function using the given initial value.

25. $f(x) = 9 - x; x_0 = 2$

26. $f(x) = x^2 + 1; x_0 = 1$

27. $f(x) = x(3 - x); x_0 = 1$

Applications and Problem Solving

Real World Application

28. **Retail** Sara Sung is shopping and finds several items that are on sale at 25% off the original price. The items that she wishes to buy are a sweater originally at \$43.98, a pair of jeans for \$38.59, and a blouse for \$31.99. She has \$100 that her grandmother gave her for her birthday. If the sales tax in San Mateo, California, where she lives is 8.25%, does Sara have enough money for all three items? Explain.

29. **Critical Thinking** Suppose the graphs of functions $f(x)$ and $g(x)$ are lines. Must it be true that the graph of $[f \circ g](x)$ is a line? Justify your answer.

30. **Physics** When a heavy box is being pushed on the floor, there are two different forces acting on the movement of the box. There is the force of the person pushing the box and the force of friction. If W is work in joules, F is force in newtons, and d is displacement of the box in meters, $W_p = F_p d$ describes the work of the person, and $W_f = F_f d$ describes the work created by friction. The increase in kinetic energy necessary to move the box is the difference between the work done by the person W_p and the work done by friction W_f.
   a. Write a function in simplest form for net work.
   b. Determine the net work expended when a person pushes a box 50 meters with a force of 95 newtons and friction exerts a force of 55 newtons.

31. **Finance** A sales representative for a cosmetics supplier is paid an annual salary plus a bonus of 3% of her sales *over* \$275,000. Let $f(x) = x - 275{,}000$ and $h(x) = 0.03x$.
   a. If x is greater than \$275,000, is her bonus represented by $f[h(x)]$ or by $h[f(x)]$? Explain.
   b. Find her bonus if her sales for the year are \$400,000.

32. **Critical Thinking** Find $f\left(\frac{1}{2}\right)$ if $[f \circ g](x) = \frac{x^4 + x^2}{1 + x^2}$ and $g(x) = 1 - x^2$.

EXERCISES

Practice

Graph each equation.

12. $y = 4x - 9$
13. $y = 3$
14. $2x - 3y + 15 = 0$
15. $x - 4 = 0$
16. $y = 6x - 1$
17. $y = 5 - 2x$
18. $y + 8 = 0$
19. $2x + y = 0$
20. $y = \frac{2}{3}x - 4$
21. $y = 25x + 150$
22. $2x + 5y = 8$
23. $3x - y = 7$

Find the zero of each function. If no zero exists, write *none*. Then graph the function.

24. $f(x) = 9x + 5$
25. $f(x) = 4x - 12$
26. $f(x) = 3x + 1$
27. $f(x) = 14x$
28. $f(x) = 12$
29. $f(x) = 5x - 8$

30. Find the zero for the function $f(x) = 5x - 2$.

31. Graph $y = -\frac{3}{2}x + 3$. What is the zero of the function $f(x) = -\frac{3}{2}x + 3$?

32. Write a linear function that has no zero. Then write a linear function that has infinitely many zeros.

Applications and Problem Solving

Real World Application

33. **Electronics** The voltage V in volts produced by a battery is a linear function of the current i in amperes drawn from it. The opposite of the slope of the line represents the battery's effective resistance R in ohms. For a certain battery, $V = 12.0$ when $i = 1.0$ and $V = 8.4$ when $i = 10.0$.
   a. What is the effective resistance of the battery?
   b. Find the voltage that the battery would produce when the current is 25.0 amperes.

34. **Critical Thinking** A line passes through $A(3, 7)$ and $B(-4, 9)$. Find the value of a if $C(a, 1)$ is on the line.

35. **Chemistry** According to Charles' Law, the pressure P in pascals of a fixed volume of a gas is linearly related to the temperature T in degrees Celsius. In an experiment, it was found that when $T = 40$, $P = 90$ and when $T = 80$, $P = 100$.
   a. What is the slope of the line containing these points?
   b. Explain the meaning of the slope in this context.
   c. Graph the function.

36. **Critical Thinking** The product of the slopes of two non-vertical perpendicular lines is always -1. Is it possible for two perpendicular lines to both have positive slope? Explain.

37. **Accounting** A business's capital costs are expenses for things that last more than one year and lose value or wear out over time. Examples include equipment, buildings, and patents. The value of these items declines, or depreciates over time. One way to calculate depreciation is the straight-line method, using the value and the estimated life of the asset. Suppose $v(t) = 10{,}440 - 290t$ describes the value $v(t)$ of a piece of software after t months.
   a. Find the zero of the function. What does the zero represent?
   b. Find the slope of the function. What does the slope represent?
   c. Graph the function.

EXERCISES

Practice

Write an equation in slope-intercept form for each line described.

11. slope = 5, y-intercept = -2
12. slope = 8, passes through $(-7, 5)$
13. slope = $-\frac{3}{4}$, y-intercept = 0
14. slope = -12, y-intercept = $\frac{1}{2}$
15. passes through $A(4, 5)$, slope = 6
16. no slope and passes through $(12, -9)$
17. passes through $A(1, 5)$ and $B(-8, 9)$
18. x-intercept = -8, y-intercept = 5
19. passes through $A(8, 1)$ and $B(-3, 1)$
20. vertical and passes through $(-4, -2)$
21. the y-axis
22. slope = 0.25, x-intercept = 24
23. Line ℓ passes through $A(-2, -4)$ and has a slope of $-\frac{1}{2}$. What is the standard form of the equation for line ℓ?
24. Line m passes through $C(-2, 0)$ and $D(1, -3)$. Write the equation of line m in standard form.

Applications and Problem Solving

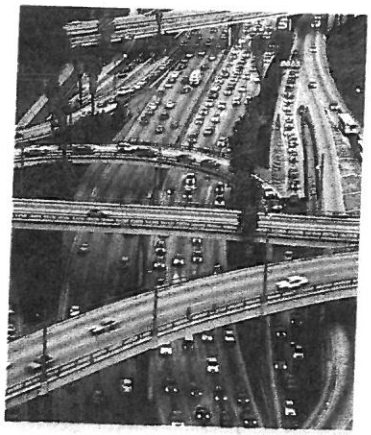
Real World Application

25. **Sports** Skiers, hikers, and climbers often experience altitude sickness as they reach elevations of 8000 feet and more. A good rule of thumb for the amount of time that it takes to become acclimated to high elevations is 2 weeks for the first 7000 feet. After that, it will take 1 week more for each additional 2000 feet of altitude.
    a. Write an equation for the time t to acclimate to an altitude of f feet.
    b. Mt. Whitney in California is the highest peak in the contiguous 48 states. It is located in Eastern Sierra Nevada, on the border between Sequoia National Park and Inyo National Forest. About how many weeks would it take a person to acclimate to Mt. Whitney's elevation of 14,494 feet?

26. **Critical Thinking** Write an expression for the slope of a line whose equation is $Ax + By + C = 0$.

27. **Transportation** The mileage in miles per gallon (mpg) for city and highway driving of several 1999 models are given in the chart.

Model	City (mpg)	Highway (mpg)
A	24	32
B	20	29
C	20	29
D	20	28
E	23	30
F	24	30
G	27	37
H	22	28



    a. Find a linear equation that can be used to find a car's highway mileage based on its city mileage.
    b. Model J's city mileage is 19 mpg. Use your equation to predict its highway mileage.
    c. Highway mileage for Model J is 26 mpg. How well did your equation predict the mileage? Explain.