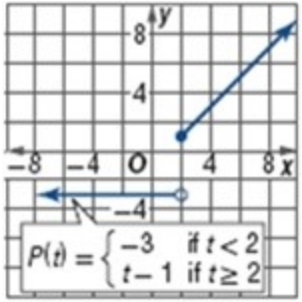
# 1-2 Analyzing Graphs of Functions and Relations

**Use the graph of each function to estimate the indicated function values. Then confirm the estimate algebraically. Round to the nearest hundredth, if necessary.**

4.




**a.** $P(-6)$
**b.** $P(2)$
**c.** $P(9)$

*ANSWER:*

**a.** −3
**b.** 1
**c.** 8

8. **WATER** Bottled water consumption from 1977 to 2006 can be modeled using $f(x) = 9.35x^2 - 12.7x + 541.7$, where $x$ represents the number of years since 1977.

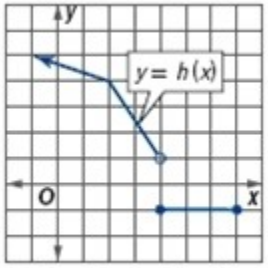

**a.** Use the graph to estimate the amount of bottled water consumed in 1994.
**b**. Find the 1994 consumption numerically. Round to the nearest ten million gallons.
**c.** Use the graph to estimate when water consumption was 6 billion gallons. Confirm numerically.

*ANSWER:*

**a.** 3 billion gallons
**b.** 3.03 billion gallons
**c.** about 2002 or $x = 25; f(24) = 9.35(24)^2 - 12.7(24) + 541.7 \approx 5623; f(26) = 9.35(26)^2 - 12.7(26) + 541.7 \approx 6532$

# 1-2 Analyzing Graphs of Functions and Relations

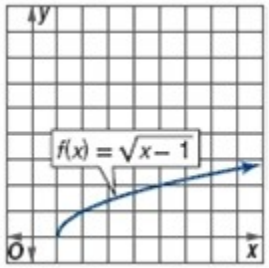
**Use the graph of *h* to find the domain and range of each function.**

12. 


*ANSWER:*

D = $(-\infty, 7]$, R = $[-1] \cup (1, \infty)$

**Use the graph of each function to find its *y*-intercept and zero(s). Then find these values algebraically.**

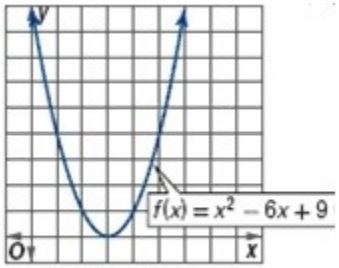
16. 


*ANSWER:*

no *y*-intercept; zero: 1;

$$\sqrt{x-1} = 0$$
$$\left(\sqrt{x-1}\right)^2 = (0)^2$$
$$x - 1 = 0$$
$$x = 1$$

# 1-2 Analyzing Graphs of Functions and Relations

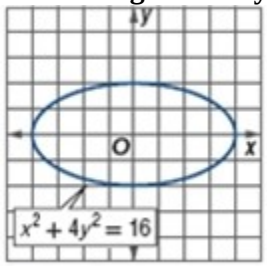
20. 


*ANSWER:*

*y*-intercept: 9; zero: 3;

$$x^2 - 6x + 9 = 0$$
$$(x-3)^2 = 0$$
$$x - 3 = 0$$
$$x = 3$$

**Use the graph of each equation to test for symmetry with respect to the *x*-axis, *y*-axis, and the origin. Support the answer numerically. Then confirm algebraically.**

24. 


*ANSWER:*

*x*-axis, *y*-axis, and origin;

| $x$ | $y$ | $(x, y)$ |
|---|---|---|
| 1 | $\frac{\sqrt{15}}{2}$ | $\left(1, \frac{\sqrt{15}}{2}\right)$ |
| 1 | $-\frac{\sqrt{15}}{2}$ | $\left(1, -\frac{\sqrt{15}}{2}\right)$ |
| 2 | $\sqrt{3}$ | $(2, \sqrt{3})$ |
| 2 | $-\sqrt{3}$ | $(2, -\sqrt{3})$ |
| 3 | $\frac{\sqrt{7}}{2}$ | $\left(3, \frac{\sqrt{7}}{2}\right)$ |
| 3 | $-\frac{\sqrt{7}}{2}$ | $\left(3, -\frac{\sqrt{7}}{2}\right)$ |

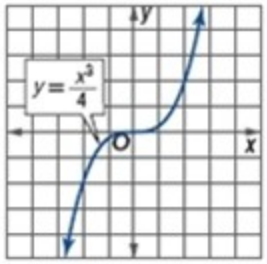
Because $x^2 + 4(-y)^2 = 16$ is equivalent to $x^2 + 4y^2 = 16$, the graph is symmetric with respect to the $x$-axis.

| $x$ | $y$ | $(x, y)$ |
|---|---|---|
| $-3$ | $\frac{\sqrt{7}}{2}$ | $\left(-3, \frac{\sqrt{7}}{2}\right)$ |
| $-2$ | $\sqrt{3}$ | $(-2, \sqrt{3})$ |
| $-1$ | $\frac{\sqrt{15}}{2}$ | $\left(-1, \frac{\sqrt{15}}{2}\right)$ |
| 1 | $\frac{\sqrt{15}}{2}$ | $\left(1, \frac{\sqrt{15}}{2}\right)$ |
| 2 | $\sqrt{3}$ | $(2, \sqrt{3})$ |
| 3 | $\frac{\sqrt{7}}{2}$ | $\left(3, \frac{\sqrt{7}}{2}\right)$ |

Because $(-x)^2 + 4y^2 = 16$ is equivalent to $x^2 + 4y^2 = 16$, the graph is symmetric with respect to the $y$-axis.

| $x$ | $y$ | $(x, y)$ |
|---|---|---|
| 0 | $-2$ | $(0, -2)$ |
| $-3$ | $-\frac{\sqrt{7}}{2}$ | $\left(-3, -\frac{\sqrt{7}}{2}\right)$ |
| $-2$ | $-\sqrt{3}$ | $(-2, -\sqrt{3})$ |
| 2 | $\sqrt{3}$ | $(2, \sqrt{3})$ |
| 3 | $\frac{\sqrt{7}}{2}$ | $\left(3, \frac{\sqrt{7}}{2}\right)$ |
| 0 | 2 | $(-0, 2)$ |

Because $(-x)^2 + 4(-y)^2 = 16$ is equivalent to $x^2 + 4y^2 = 16$, the graph is symmetric with respect to the origin.

28. 

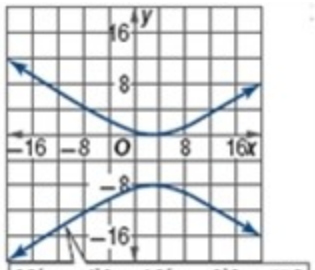

*ANSWER:*

origin;

| x | y | (x, y) |
|---|---|---|
| −4 | −16 | (−4, −16) |
| −2 | −2 | (−2, −2) |
| −1 | $-\frac{1}{4}$ | $\left(-1, -\frac{1}{4}\right)$ |
| 1 | $\frac{1}{4}$ | $\left(1, \frac{1}{4}\right)$ |
| 2 | 2 | (2, 2) |
| 4 | 16 | (4, 16) |

Because $-y = \frac{(-x)^3}{4}$ is equivalent to $y = \frac{x^3}{4}$, the graph is symmetric with respect to the origin.

# 1-2 Analyzing Graphs of Functions and Relations

32. 

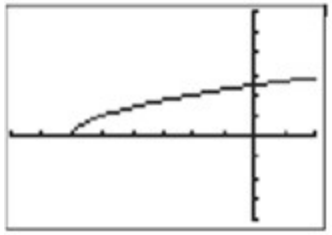

*ANSWER:*

none

**GRAPHING CALCULATOR Graph each function. Analyze the graph to determine whether each function is *even*, *odd*, or *neither*. Confirm algebraically. If odd or even, describe the symmetry of the graph of the function.**

36. $g(x) = \sqrt{x+6}$

*ANSWER:*



[−8, 2] scl: 1 by [−4, 6] scl: 1

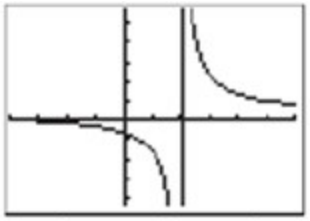
neither;

$g(-x) = \sqrt{-x+6}$

$-g(x) = -\sqrt{x+6}$

40. $f(x) = \dfrac{x+4}{x-2}$

*ANSWER:*



[−4, 6] scl: 1 by [−13, 17] scl: 3

neither;

$$f(-x) = \frac{-x+4}{-x-2}$$

$$-f(x) = -\left(\frac{x+4}{x-2}\right)$$

$$-f(x) = \frac{-x-4}{-x+2}$$

44. **FOOTBALL** A running back's rushing yards for each game in a season are shown.


**a.** State the domain and range of the relation.
**b.** In what game did the player rush for no yards?

*ANSWER:*

**a.** D = {1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12}
R = {16, −3, 13, 19, 25, 32, 0, 23, −4, 15 ,17}
**b.** Game 8