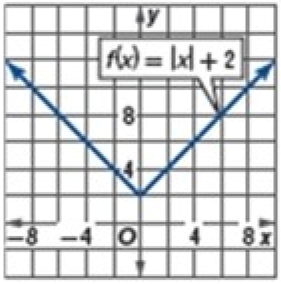
1-2 Analyzing Graphs of Functions and Relations

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

3.



a. $f(-8)$
b. $f(-3)$
c. $f(0)$

SOLUTION:

The function value at $x = -8$ appears to be about 10. To confirm this estimate algebraically, find $f(-8)$.

$$\begin{aligned} f(x) &= |x| + 2 \\ f(-8) &= |-8| + 2 \\ &= 8 + 2 \\ &= 10 \end{aligned}$$

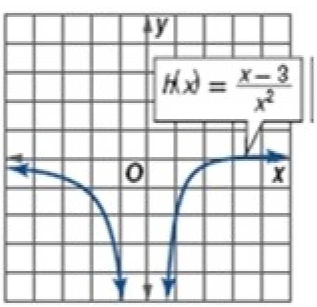
The function value at $x = -3$ appears to be about 5. Find $f(-3)$.

$$\begin{aligned} f(-3) &= |-3| + 2 \\ &= 3 + 2 \\ &= 5 \end{aligned}$$

The function value at $x = 0$ appears to be about 2. Find $f(0)$.

$$\begin{aligned} f(0) &= |0| + 2 \\ &= 2 \end{aligned}$$

6.



a. $h(-1)$
b. $h(1.5)$
c. $h(2)$

SOLUTION:

The function value at $x = -1$ appears to be about –4. To confirm this estimate algebraically, find $h(-1)$.

$$h(x) = \frac{x-3}{x^2}$$
$$h(-1) = \frac{x-3}{x^2}$$
$$= \frac{-1-3}{(-1)^2}$$
$$= \frac{-4}{1}$$
$$= -4$$

The function value at x = 1.5 appears to be about $-\frac{1}{2}$. Find h(1.5).

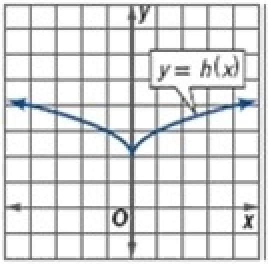
$$h(x) = \frac{x-3}{x^2}$$
$$h(1.5) = \frac{1.5-3}{(1.5)^2}$$
$$= \frac{-1.5}{(1.5)^2}$$
$$= -\frac{1}{1.5}$$
$$= -\frac{2}{3}$$

The function value at x = 2 appears to be about $-\frac{1}{4}$. Find h(2).

$$h(x) = \frac{x-3}{x^2}$$
$$h(2) = \frac{2-3}{(2)^2}$$
$$= -\frac{1}{4}$$

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

9.

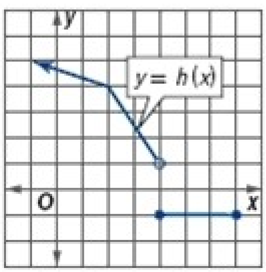


SOLUTION:

The arrows on the left and right sides of the graph indicate that the graph will continue without bound in both directions. Therefore, the domain of h is $(-\infty, \infty)$.

The graph does not extend below $h(0)$ or 2, but $h(x)$ increases without bound for lesser and greater values of x. So, the range of h is $[2, \infty)$.

12.

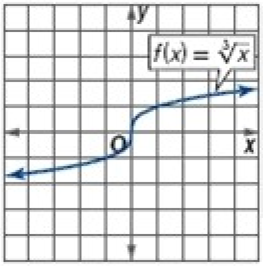


SOLUTION:

The closed dot at (7, –1) indicates that $x = 7$ is in the domain of h. Although there is an open dot at (4, 1), the closed dot at (4, –1) indicates that $x = 4$ is in the domain of h. The arrow to the left indicates that the graph will continue without bound. Therefore, the domain of h is $(-\infty, 7]$.

The closed dots at (4, –1) and (7, –1) indicate that $y = -1$ is in the range of h. The closed dot at (5, 1) indicates that $y = 1$ is not in the range of h. The arrow to the left indicates that the graph will continue without bound. Therefore, the range of h is $[-1] \cup (1, \infty)$.

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

18. 

SOLUTION:

From the graph, it appears that $f(x)$ intersects the y-axis at approximately (0, 0), so the y-intercept is 0. Find $f(0)$.

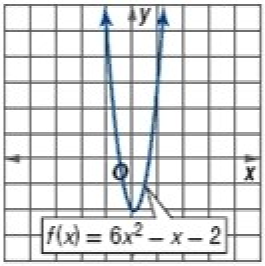
$$f(x) = \sqrt[3]{x}$$
$$f(0) = \sqrt[3]{0}$$
$$f(0) = 0$$

Therefore, the y-intercept is 0.

From the graph, it appears that there is an x-intercept at 0. Let $f(x) = 0$ and solve for x.

$$\sqrt[3]{x} = 0$$
$$(\sqrt[3]{x})^3 = (0)^3$$
$$x = 0$$

Therefore, the zero of f is 0.

21. 

SOLUTION:

From the graph, it appears that $f(x)$ intersects the y-axis at approximately (0, –2), so the y-intercept is –2. Find $f(0)$.

$$f(x) = 6x^2 - x - 2$$
$$f(0) = 6(0)^2 - 0 - 2$$
$$f(0) = -2$$

Therefore, the y-intercept is –2.

From the graph, the x-intercepts appear to be at about $-\frac{1}{2}$ and $\frac{2}{3}$. Let $f(x) = 0$ and solve for x.

$$6x^2 - x - 2 = 0$$
$$(2x+1)(3x-2) = 0$$
$$2x + 1 = 0 \quad \text{or} \quad 3x - 2 = 0$$
$$x = -\frac{1}{2} \qquad x = \frac{2}{3}$$

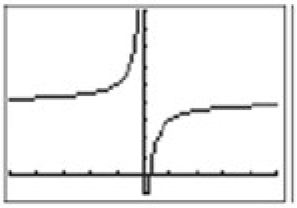
Therefore, the zeros of f are $-\frac{1}{2}$ and $\frac{2}{3}$.

1-2 Analyzing Graphs of Functions and Relations

GRAPHING CALCULATOR Graph each function and locate the zeros. Confirm your answers algebraically.

48. $f(x) = \dfrac{4x-1}{x}$

SOLUTION:



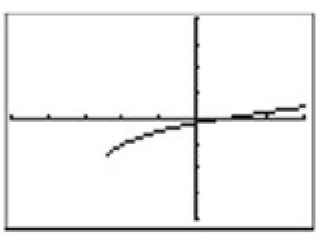
[−5, 5] scl: 1 by [−1, 9] scl: 1

From the graph, there appears to be an x-intercept at about 0.25. Let $f(x) = 0$ and solve for x.

$$\begin{aligned}\frac{4x-1}{x} &= 0\\ \frac{4x}{x} - \frac{1}{x} &= 0\\ 4 - \frac{1}{x} &= 0\\ -\frac{1}{x} &= -4\\ \frac{1}{x} &= 4\\ x &= \frac{1}{4}\end{aligned}$$

51. $h(x) = 2\sqrt{x+12} - 8$

SOLUTION:



[−25, 15] scl: 5 by [−20, 20] scl: 5

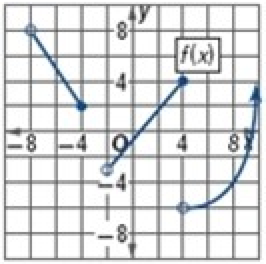
From the graph, there appears to be an x-intercept at about 4. Let $h(x) = 0$ and solve for x. Isolate the radical.

$$\begin{aligned}2\sqrt{x+12} - 8 &= 0\\ 2\sqrt{x+12} &= 8\\ \sqrt{x+12} &= 4\\ x + 12 &= 16\\ x &= 4\end{aligned}$$

1-2 Analyzing Graphs of Functions and Relations

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

55.



SOLUTION:

The open dots at $f(–8) = 8$ and $f(–2) = 3$ indicate that f is not defined at $x = –8$ or $x = –2$, respectively. The closed dots at $f(–4) = 2$ and $f(4) = 4$ indicate that f is defined at $x = –4$ and $x = 4$. Therefore, the domain of the function is $(–8, –4] \cup (–2, \infty)$.

The graph does not extend below $f(4) = –6$, but increases without bound for greater and greater values of x. So, the range of f is $(–6, \infty)$.