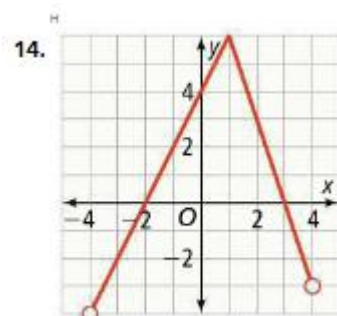


## 1-1 Exercises Key

4.  $(-4, 4]$
5.  $[-1, 3]$
6.  $x = -3, x = -1, x = 4$
7.  $y = 1$
8.  $(-4, -3)$  and  $(-1, 4)$
9.  $(-4, -2)$  and  $(2, 4)$
10.  $(-2, 2)$
11. 0

12. There is a zero at  $x = 4$  because the function is changing from negative to positive at  $x = 4$ .
13. The zeros, or values along the  $x$ -axis, are neither positive nor negative. These values should not be included in the interval over which the function is positive. The function is positive on the interval  $(-1, 3)$  and negative on the intervals  $(-\infty, -1)$  and  $(3, \infty)$ .



15. No; linear functions can also be constant, which means neither increasing nor decreasing.
16. A relative maximum occurs when a function changes from increasing to decreasing. A relative minimum occurs when a function changes from decreasing to increasing.
17. **Model With Mathematics** For a graph of speed in miles per hour as a function of time in hours, what does it mean when the function is increasing? Decreasing?  
When the graph is increasing, the speed is increasing. When the graph is decreasing, the speed is decreasing.

18. Identify the domain and range of the function. SEE EXAMPLE 1  
domain:  $(-\infty, \infty)$ ; range:  $[-9, \infty)$
19. Identify the  $x$ - and  $y$ -intercepts of the function. SEE EXAMPLE 2  
 $x$ -intercepts:  $-4, 2$ ;  $y$ -intercept:  $-8$
20. On what intervals is the function positive? On what intervals is it negative? SEE EXAMPLE 3  
negative:  $(-4, 2)$ ; positive:  $(-\infty, -4)$  and  $(2, \infty)$
21. On what intervals is the function increasing? On what intervals is it decreasing? SEE EXAMPLE 4  
decreasing:  $(-\infty, -1)$ ; increasing:  $(-1, \infty)$
22. What is the average rate of change over the interval  $(-3, 2)$ ? SEE EXAMPLE 5  $1$
23. Identify the domain and range of the function. SEE EXAMPLE 1 domain:  $[-5, 5]$ ; range:  $[-1, 2]$
24. Identify the  $x$ - and  $y$ -intercepts of the function. SEE EXAMPLE 2  
 $x$ -intercepts:  $-5, 3$ ;  $y$ -intercept:  $1.5$
25. Determine over what interval the function is positive or negative. SEE EXAMPLE 3  
positive:  $(-5, 3)$ ; negative:  $(3, 5)$
26. Determine over what interval the function is increasing or decreasing. SEE EXAMPLE 4  
increasing:  $(-5, -1)$ ; decreasing:  $(-1, 5)$
27. What is the average rate of change over the interval  $(-1, 5)$ ? SEE EXAMPLE 5  $-\frac{1}{2}$
28. domain:  $[0, 80]$ ; range:  $[0, 100]$ ;  
increasing:  $[0, 80]$ ; decreasing: none;  
 $x$ -intercept: 0;  $y$ -intercept: 0; positive:  $(0, 80]$ ; negative: none

29. a. The  $x$ -intercepts are approximately 0.05, 0.7, 0.8, 1.45, 1.55, and 2.2.  
The  $x$ -intercepts represent the moment the jumper is at the height of the frame of the trampoline. The  $y$ -intercept is  $-0.5$  and represents the sag of the trampoline when the jumper pushes down at the start of the first jump.
- b.  $(0.05, 0.7)$ ,  $(0.8, 1.45)$ , and  $(1.55, 2.2)$ ;  
The positive intervals represent the times when the jumper is above the frame of the trampoline.
- c.  $(0, 0.05)$ ,  $(0.7, 0.8)$ ,  $(1.45, 1.55)$ , and  $(2.2, 2.25)$ ; The negative intervals represent the times when the jumper is below the frame of the trampoline.
- d. 6 feet per second; The average rate of change over the interval  $[0.75, 1.125]$  represents the average speed of the jumper on the upward part of a jump.

30. a.  $f(x) = 100 - 0.5x$

b. domain:  $[0, 200]$ ; range:  $[0, 100]$

c. 3 hours 20 minutes

33. **Part A** -2,000 gallons per hour; Over the interval  $[0, 4]$ , the water in the cistern is being used at a rate of 2,000 gallons per hour. 1,500 gallons per hour; Over the interval  $[6, 10]$ , the cistern is being filled with water at a rate of 1,500 gallons per hour.

**Part B** The water in the cistern is not being used, and the cistern is not being filled with water. Therefore, the amount of water in the cistern is constant.

**Part C** -200 gallons per hour; From 0 hours to 10 hours, the water in the cistern is being used at a rate of 200 gallons per hour. No, this rate of change shows the change in the starting amount of water at 0 hours and the ending amount of water at 10 hours, but it does not indicate that the amount of water decreased from 0 hours to 4 hours, remained the same from 4 hours to 6 hours, and increased from 6 hours to 10 hours.