

Note that in the second part of the definition  $-a$  is positive if  $a$  is negative. For example, if  $a = -5$ , then  $-a = -(-5) = +5$ . Thus,

$$|a| = |-5| = -(-5) = +5.$$

#### Example 5: Absolute Value

Find the absolute value of each of the numbers **a.**  $-10$ , **b.**  $-2.3$ , **c.**  $4.5$ , and **d.**  $0$ .

#### Solution

**a.**  $|-10| = -(-10) = 10$

**b.**  $|-2.3| = -(-2.3) = 2.3$

**c.**  $|4.5| = 4.5$

**d.**  $|0| = 0$

#### Example 6: Absolute Value Equations

Determine what real numbers satisfy each of the following equations.

**a.**  $|x| = 4$

**b.**  $|x| = -1.7$

#### Solution

**a.** Since  $|4| = 4$  and  $|-4| = 4$ ,  $x$  can be either  $4$  or  $-4$ .

**b.** This equation has no solution ( $\emptyset$ ) because the absolute value of any real number is nonnegative.

## 0.1 EXERCISES

### PRACTICE

In Exercises 1–6, list the numbers from the set

$$A = \left\{ -6, -\sqrt{7}, -\sqrt{4}, -\frac{5}{4}, -1.2, 0, \frac{3}{8}, \sqrt{3}, \sqrt{10}, \sqrt{16}, 5.2 \right\}$$

that belong to each of the sets described. Then graph each set of answers on a number line. (**Hint:** Using a calculator to convert numbers in set  $A$  to decimal form may be helpful.)

1.  $\{x \mid x \text{ is a whole number}\}$

2.  $\{x \mid x \text{ is an integer}\}$

3.  $\{x \mid x \text{ is a positive integer}\}$

4.  $\{x \mid x \text{ is a irrational number}\}$

5.  $\{x \mid x \text{ is a rational number}\}$

6.  $\{x \mid x \text{ is a real number}\}$

In Exercises 7–16, graph each of the sets of real numbers; then write each as an interval using the symbol  $-\infty$  or  $\infty$ .

7.  $\{x|x \leq 7\}$

8.  $\{x|x < -9\}$

9.  $\{x|x > -3.4\}$

10.  $\{x|x \geq 4.9\}$

11.  $\{x|x \leq 0\}$

12.  $\{x|x > 0\}$

13.  $\left\{x \mid x < \frac{16}{3}\right\}$

14.  $\left\{x \mid x < -\frac{8}{3}\right\}$

15.  $\left\{x \mid x \geq -\frac{7}{2}\right\}$

16.  $\left\{x \mid x \geq -\frac{11}{4}\right\}$

In Exercises 17–26, find the value of each expression.

17.  $|1.4|$

18.  $|-5.3|$

19.  $\left|-\frac{3}{8}\right|$

20.  $\left|\frac{4}{3}\right|$

21.  $|-\sqrt{2}|$

22.  $|0|$

23.  $|-4| + |8|$

24.  $|2| + |-8.4|$

25.  $|-3.6| - |-4.2|$

26.  $|-9.2| - |6.6|$

In Exercises 27–36, find the real numbers that satisfy the given equation.

27.  $|x| = 8$

28.  $|x| = 10.3$

29.  $|x| = \frac{7}{16}$

30.  $|x| = \frac{9}{5}$

31.  $|x| = -2.5$

32.  $|x| = \sqrt{3}$

33.  $|x| = 3\sqrt{2}$

34.  $|x| = -0.8$

35.  $|x| = x$

36.  $|x| = -x$

### WRITING & THINKING

In Exercises 37–42, choose the word that correctly completes each statement.

37. If  $x$  is a rational number, then  $x$  is (never, sometimes, always) a real number.

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39. If  $x$  is an integer, then  $x$  is (never, sometimes, always) a whole number.

40. If  $x$  is a real number, then  $x$  is (never, sometimes, always) a rational number.

41. If  $x$  is a rational number, then  $x$  is (never, sometimes, always) an integer.

42. If  $x$  is a positive integer, then  $x$  is (never, sometimes, always) a whole number.

43. Let  $x = 0.999\overline{9}$ . Is  $x = 1$  or is  $x < 1$ ? Is  $x$  a rational number?