

## 2.1 Rational Numbers

**Essential Question** How can you use a number line to order rational numbers?

### The Meaning of a Word ● Rational

The word **rational** comes from the word *ratio*.

If you sleep for 8 hours in a day, then the *ratio* of your sleeping time to the total hours in a day can be written as

$$\frac{8 \text{ h}}{24 \text{ h}}$$



A **rational number** is a number that can be written as the ratio of two integers.

$$2 = \frac{2}{1}$$

$$-3 = \frac{-3}{1}$$

$$-\frac{1}{2} = \frac{-1}{2}$$

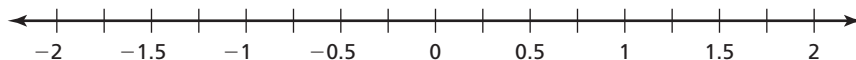
$$0.25 = \frac{1}{4}$$

### 1 ACTIVITY: Ordering Rational Numbers

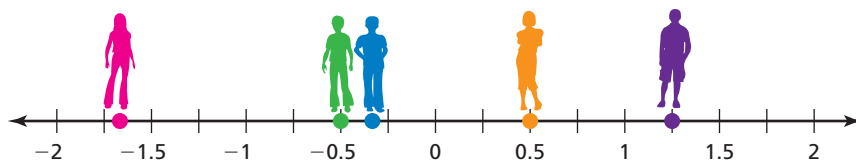
Work in groups of five. Order the numbers from least to greatest.

a. **Sample:**  $-0.5, 1.25, -\frac{1}{3}, 0.5, -\frac{5}{3}$

- Make a number line on the floor using masking tape and a marker.



- Write the numbers on pieces of paper. Then each person should choose one.
- Stand on the location of your number on the number line.



- Use your positions to order the numbers from least to greatest.

∴ So, the numbers from least to greatest are  $-\frac{5}{3}, -0.5, -\frac{1}{3}, 0.5,$  and  $1.25$ .

b.  $-\frac{7}{4}, 1.1, \frac{1}{2}, -\frac{1}{10}, -1.3$

c.  $-\frac{1}{4}, 2.5, \frac{3}{4}, -1.7, -0.3$

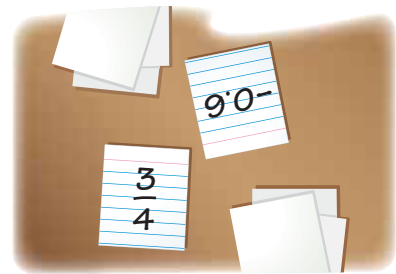
d.  $-1.4, -\frac{3}{5}, \frac{9}{2}, \frac{1}{4}, 0.9$

e.  $\frac{9}{4}, 0.75, -\frac{5}{4}, -0.8, -1.1$

## 2 ACTIVITY: The Game of Math Card War

### Preparation:

- Cut index cards to make 40 playing cards.
- Write each number in the table on a card.



### To Play:

- Play with a partner.
- Deal 20 cards to each player face-down.
- Each player turns one card face-up. The player with the greater number wins. The winner collects both cards and places them at the bottom of his or her cards.
- Suppose there is a tie. Each player lays three cards face-down, then a new card face-up. The player with the greater of these new cards wins. The winner collects all ten cards and places them at the bottom of his or her cards.
- Continue playing until one player has all the cards. This player wins the game.

$-\frac{3}{2}$	$\frac{3}{10}$	$-\frac{3}{4}$	$-0.6$	$1.25$	$-0.15$	$\frac{5}{4}$	$\frac{3}{5}$	$-1.6$	$-0.3$
$\frac{3}{20}$	$\frac{8}{5}$	$-1.2$	$\frac{19}{10}$	$0.75$	$-1.5$	$-\frac{6}{5}$	$-\frac{3}{5}$	$1.2$	$0.3$
$1.5$	$1.9$	$-0.75$	$-0.4$	$\frac{3}{4}$	$-\frac{5}{4}$	$-1.9$	$\frac{2}{5}$	$-\frac{3}{20}$	$-\frac{19}{10}$
$\frac{6}{5}$	$-\frac{3}{10}$	$1.6$	$-\frac{2}{5}$	$0.6$	$0.15$	$\frac{3}{2}$	$-1.25$	$0.4$	$-\frac{8}{5}$

## What Is Your Answer?

3. **IN YOUR OWN WORDS** How can you use a number line to order rational numbers? Give an example.

The numbers are in order from least to greatest. Fill in the blank spaces with rational numbers.

4.  $-\frac{1}{2}$ , ,  $\frac{1}{3}$ , ,  $\frac{7}{5}$ ,

5.  $-\frac{5}{2}$ , ,  $-1.9$ , ,  $-\frac{2}{3}$ ,

6.  $-\frac{1}{3}$ , ,  $-0.1$ , ,  $\frac{4}{5}$ ,

7.  $-3.4$ , ,  $-1.5$ , ,  $2.2$ ,

### Practice

Use what you learned about ordering rational numbers to complete Exercises 28–30 on page 54.

# 2.1 Lesson

## Key Vocabulary

terminating decimal,  
p. 52  
repeating decimal,  
p. 52  
rational number,  
p. 52

A **terminating decimal** is a decimal that ends.

$$1.5, -0.25, 10.625$$

A **repeating decimal** is a decimal that has a pattern that repeats.

$$-1.333 \dots = -1.\bar{3}$$

$$0.151515 \dots = 0.1\bar{5}$$

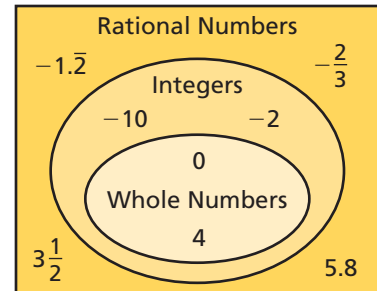
Use bar notation to show which of the digits repeat.

Terminating and repeating decimals are examples of *rational numbers*.

## Key Idea

### Rational Numbers

A **rational number** is a number that can be written as  $\frac{a}{b}$  where  $a$  and  $b$  are integers and  $b \neq 0$ .



## EXAMPLE 1 Writing Rational Numbers as Decimals

a. Write  $-2\frac{1}{4}$  as a decimal.

Notice that  $-2\frac{1}{4} = -\frac{9}{4}$ .

Divide 9 by 4.

$$\begin{array}{r} 2.25 \\ 4 \overline{)9.00} \\ \underline{-8} \phantom{00} \\ 10 \phantom{0} \\ \underline{-8} \phantom{0} \\ 20 \\ \underline{-20} \\ 0 \end{array}$$

The remainder is 0. So, it is a terminating decimal.

∴ So,  $-2\frac{1}{4} = -2.25$ .

b. Write  $\frac{5}{11}$  as a decimal.

Divide 5 by 11.

$$\begin{array}{r} 0.4545 \\ 11 \overline{)5.0000} \\ \underline{-44} \phantom{00} \\ 60 \phantom{0} \\ \underline{-55} \phantom{0} \\ 50 \\ \underline{-44} \\ 60 \\ \underline{-55} \\ 5 \end{array}$$

The remainder repeats. So, it is a repeating decimal.

∴ So,  $\frac{5}{11} = 0.\overline{45}$ .

## On Your Own

Write the rational number as a decimal.

1.  $-\frac{6}{5}$

2.  $-7\frac{3}{8}$

3.  $-\frac{3}{11}$

4.  $1\frac{5}{27}$

Now You're Ready  
Exercises 11–18

## EXAMPLE 2 Writing a Decimal as a Fraction

Write  $-0.26$  as a fraction in simplest form.

$$\begin{aligned} -0.26 &= -\frac{26}{100} \\ &= -\frac{13}{50} \end{aligned}$$

Write the digits after the decimal point in the numerator.

The last digit is in the hundredths place. So, use 100 in the denominator.

Simplify.

### On Your Own

Now You're Ready  
Exercises 20–27

Write the decimal as a fraction or mixed number in simplest form.

5.  $-0.7$

6.  $0.125$

7.  $-3.1$

8.  $-10.25$

## EXAMPLE 3 Ordering Rational Numbers

Creature	Elevations (km)
Anglerfish	$-\frac{13}{10}$
Squid	$-2\frac{1}{5}$
Shark	$-\frac{2}{11}$
Whale	$-0.8$

The table shows the elevations of four sea creatures relative to sea level. Which of the sea creatures are deeper than the whale? Explain.

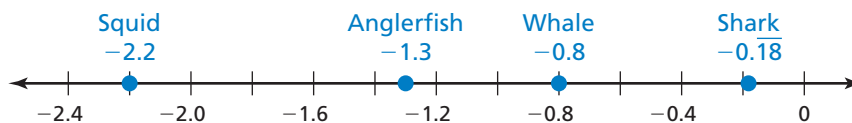
Write each rational number as a decimal.

$$-\frac{13}{10} = -1.3$$

$$-2\frac{1}{5} = -2.2$$

$$-\frac{2}{11} = -0.\overline{18}$$

Then graph each decimal on a number line.



Both  $-2.2$  and  $-1.3$  are less than  $-0.8$ . So, the squid and the anglerfish are deeper than the whale.

### On Your Own

Now You're Ready  
Exercises 28–33

9. **WHAT IF?** The elevation of a dolphin is  $-\frac{1}{10}$  kilometer. Which of the sea creatures in Example 3 are deeper than the dolphin? Explain.

## Vocabulary and Concept Check

- VOCABULARY** How can you tell that a number is rational?
- WRITING** You have to write 0.63 as a fraction. How do you choose the denominator?

Tell whether the number belongs to each of the following number sets:  
*rational numbers, integers, whole numbers.*

3.  $-5$                       4.  $-2.\overline{16}$                       5.  $12$                       6.  $0$

Tell whether the decimal is *terminating* or *repeating*.


7.  $-0.4848\dots$                       8.  $-0.151$                       9.  $72.72$                       10.  $-5.\overline{236}$

## Practice and Problem Solving

Write the rational number as a decimal.

11.  $\frac{7}{8}$                       12.  $\frac{5}{11}$                       13.  $-\frac{7}{9}$                       14.  $-\frac{17}{40}$   
15.  $1\frac{5}{6}$                       16.  $-2\frac{17}{18}$                       17.  $-5\frac{7}{12}$                       18.  $8\frac{15}{22}$

19. **ERROR ANALYSIS** Describe and correct the error in writing the rational number as a decimal.

  $-\frac{7}{11} = -0.6\overline{3}$

Write the decimal as a fraction or mixed number in simplest form.

20.  $-0.9$                       21.  $0.45$                       22.  $-0.258$                       23.  $-0.312$   
24.  $-2.32$                       25.  $-1.64$                       26.  $6.012$                       27.  $-12.405$

Order the numbers from least to greatest.

28.  $-\frac{3}{4}, 0.5, \frac{2}{3}, -\frac{7}{3}, 1.2$                       29.  $\frac{9}{5}, -2.5, -1.1, -\frac{4}{5}, 0.8$                       30.  $-1.4, -\frac{8}{5}, 0.6, -0.9, \frac{1}{4}$   
31.  $2.1, -\frac{6}{10}, -\frac{9}{4}, -0.75, \frac{5}{3}$                       32.  $-\frac{7}{2}, -2.8, -\frac{5}{4}, \frac{4}{3}, 1.3$                       33.  $-\frac{11}{5}, -2.4, 1.6, \frac{15}{10}, -2.25$

34. **COINS** You lose one quarter, two dimes and two nickels.

- Write the amount as a decimal.
- Write the amount as a fraction in simplest form.

35. **HIBERNATION** A box turtle hibernates in sand at  $-1\frac{5}{8}$  feet. A spotted turtle hibernates at  $-1\frac{16}{25}$  feet. Which turtle is deeper?

Copy and complete the statement using  $<$ ,  $>$ , or  $=$ .

36.  $-2.2$    $-2.42$

37.  $-1.82$    $-1.81$

38.  $\frac{15}{8}$    $1\frac{7}{8}$

39.  $-4\frac{6}{10}$    $-4.65$

40.  $-5\frac{3}{11}$    $-5.\bar{2}$

41.  $-2\frac{13}{16}$    $-2\frac{11}{14}$

42. **OPEN-ENDED** Find one terminating decimal and one repeating decimal between  $-\frac{1}{2}$  and  $-\frac{1}{3}$ .

Player	Hits	At Bats
Eva	42	90
Michelle	38	80

43. **SOFTBALL** In softball, a batting average is the number of hits divided by the number of times at bat. Does Eva or Michelle have the higher batting average?

44. **QUIZ** You miss 3 out of 10 questions on a science quiz and 4 out of 15 questions on a math quiz. Which quiz has a higher percent of correct answers?

45. **SKATING** Is the half pipe deeper than the skating pool? Explain.



46. **ENVIRONMENT** The table shows the changes from the average water level of a pond over several weeks. Order the numbers from least to greatest.

Week	1	2	3	4
Change (inches)	$-\frac{7}{5}$	$-1\frac{5}{11}$	$-1.45$	$-1\frac{91}{200}$

47. **Critical Thinking** Given:  $a$  and  $b$  are integers.

a. When is  $-\frac{1}{a}$  positive?

b. When is  $\frac{1}{ab}$  positive?



## Fair Game Review what you learned in previous grades & lessons

Add or subtract. *(Skills Review Handbook)*

48.  $\frac{3}{5} + \frac{2}{7}$

49.  $\frac{9}{10} - \frac{2}{3}$

50.  $8.79 - 4.07$

51.  $11.81 + 9.34$

52. **MULTIPLE CHOICE** In one year, a company has a profit of  $-\$2$  million. In the next year, the company has a profit of  $\$7$  million. How much more money did the company make the second year? *(Section 1.3)*

(A) \$2 million

(B) \$5 million

(C) \$7 million

(D) \$9 million