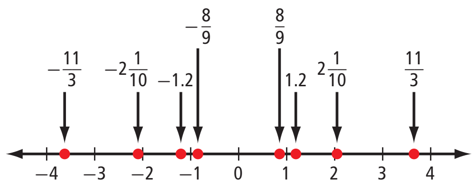
Chapter 2

2.1 Comparing and Ordering Rational Numbers, pages 51–54

4. a) D **b)** C **c)** A **d)** E **e)** B

5. a) W **b)** Y **c)** Z **d)** V **e)** X

6.



7. a) $4.\overline{1}$ **b)** $-\frac{4}{5}$ **c)** $5\frac{3}{4}$ **d)** $-\frac{9}{8}$

8. $-1\frac{2}{3}, -\frac{1}{5}, -0.1, 1\frac{5}{6}, 1.9$

9. $1.\overline{8}, \frac{9}{5}, -\frac{3}{8}, -\frac{1}{2}, -1$

10. Example: **a)** $\frac{-4}{10}$ **b)** $\frac{5}{3}$ **c)** $\frac{-3}{4}$ **d)** $\frac{8}{-6}$

11. Example: **a)** $\frac{-2}{6}$ **b)** $\frac{4}{5}$ **c)** $-\frac{5}{4}$ **d)** $\frac{-7}{2}$

12. a) $\frac{1}{3}$ **b)** $\frac{7}{10}$ **c)** $-\frac{1}{2}$ **d)** $-2\frac{1}{8}$

13. a) $\frac{4}{7}$ **b)** $-\frac{5}{3}$ **c)** $-\frac{7}{10}$ **d)** $-1\frac{4}{5}$

14. Example: **a)** 0.7 **b)** −0.5625 **c)** 0.1 **d)** −0.825

15. Example: **a)** 1.6 **b)** −2.4 **c)** 0.6 **d)** −3.015

16. Example: **a)** $\frac{1}{4}$ **b)** $\frac{-1}{20}$ **c)** $-\frac{3}{4}$ **d)** $\frac{-21}{40}$

17. Example: **a)** $1\frac{4}{5}$ **b)** $1\frac{1}{4}$ **c)** $-3\frac{7}{20}$ **d)** $-2\frac{1}{50}$

18. a) +8.2; Example: An increase suggests a positive value. **b)** +2.9; Example: A growth suggests a positive value. **c)** −3.5; Example: Below sea level suggests a negative value. **d)** +32.5; Example: Earnings suggest a positive value. **e)** −14.2; Example: Below freezing suggests a negative value.
19. a) helium and neon **b)** radon and xenon
c) helium (−272.2), neon (−248.67), argon (−189.2), krypton (−156.6), xenon (−111.9), radon (−71.0)
d) radon (−61.8), xenon (−107.1), krypton (−152.3), argon (−185.7), neon (−245.92), helium (−268.6)
20. a) Example: −2 is to the left of −1 on the number line, so $-2\frac{1}{5}$ is to the left of $-1\frac{9}{10}$ and therefore, it is smaller. **b)** Example: Since both mixed numbers are between −1 and −2 on the number line, Naomi needed to examine the positions of $-\frac{1}{4}$ and $-\frac{2}{7}$. Since $-\frac{2}{7}$ is to the left of $-\frac{1}{4}$, $-1\frac{1}{4}$ is greater.
21. a) 6.1 (Penticton), 5.4 (Edmonton), 3.9 (Regina), 0.6 (Whitehorse), −0.1 (Yellowknife), −5.1 (Churchill), −14.1 (Resolute) **b)** Yellowknife
22. a) = **b)** > **c)** = **d)** < **e)** > **f)** >
23. Yes. Example: Zero can be expressed as the quotient of two integers as long as the dividend is zero, and the divisor is any number except zero.
24. Example: **a)** $\frac{2}{5}$ **b)** $\frac{3}{-4}$ **c)** $\frac{-10}{3}$ **d)** $\frac{5}{-4}$
25. −3, −2, −1, 0, 1, and 2
26. a) 0.44 **b)** $0.\overline{3}$ **c)** −0.7 **d)** −0.66; Example: To determine which pair is greater, write each pair of fractions in an equivalent form with the same positive denominator and compare the numerators.
27. $\frac{-1}{3}$, $\frac{-2}{3}$, $\frac{-3}{3}$, $\frac{-4}{3}$, and $\frac{-5}{3}$
28. None. Example: $\frac{2}{3}$ and $0.\overline{6}$ are equivalent numbers.
29. a) −2; Yes, any integer less than −2 also makes the statement true. **b)** +9; No **c)** −1; No **d)** 0; No
e) 4; Yes, 0, 1, 2, and 3 will also make the statement true.
f) −1; No **g)** −26; No **h)** −1; Yes, −2, −3, −4, −5, −6, −7, −8, −9, −10, and −11 also make the statement true.
30. a) 8 **b)** −2 **c)** −3 **d)** 25

2.2 Problem Solving With Rational Numbers in Decimal Form, pages 60–62

4. a) −2, −1.93 **b)** 2, 2.3 **c)** −10, −9.98 **d)** 6, 5.34
5. a) −2.25 **b)** 1.873 **c)** 0.736 **d)** −12.94
6. a) −9, −8.64 **b)** −1, −1.3 **c)** 36, 30.25 **d)** 4, 4.6
7. a) 3.6 **b)** 9.556 **c)** −22.26 **d)** −1.204 **e)** 0.762
f) −0.833
8. a) −13.17 **b)** 2.8 **c)** −3.08
9. a) 1.134 **b)** −1.4 **c)** −5.2
10. 38.7 °C
11. a) +7.7 °C **b)** +1.54 °C/h
12. a) 3.8 − (−2.3) **b)** 6.1 m
13. a) 85.5 m **b)** 19 min
14. a loss of $16.25
15. a) −8.2 °C **b)** 1.9 °C
16. a) 2.2 **b)** Example: Use hundredths instead of tenths.
17. 2.06 m
18. a) −2.37 **b)** 1.75
19. a) loss of $1.2 million per year
b) profit of $3.6 million
20. Example: If the cost of gasoline is $1.30/L, then the difference would be $13.65.
21. 11 min
22. 2080 m
23. −0.6 °C
24. a) −5.3 **b)** −4.4 **c)** 2.1 **d)** −2.5
25. Example: At 16:00 the temperature in Calling Lake, Alberta, started decreasing at the constant rate of −1.1 °C/h. At 23:00 the temperature was −19.7 °C. What was the temperature at 16:00? The answer is −12 °C.
26. 2.88
27. a) −25.8 **b)** −3.3
28. a) 2.6 **b)** −0.35 **c)** −0.45
29. a) 3.5 × (4.1 − 3.5) − 2.8 = −0.7
b) [2.5 + (−4.1) + (−2.3)] × (−1.1) = 4.29
c) −5.5 − (−6.5) ÷ [2.4 + (−1.1)] = −0.5

2.3 Problem Solving With Rational Numbers in Fraction Form, pages 68–71

5. a) 0, $\frac{1}{2}$ **b)** 1, $1\frac{1}{12}$ **c)** −1, $\frac{-5}{6}$ **d)** 0, $\frac{5}{6}$
e) $-\frac{1}{2}$, $-\frac{1}{2}$ **f)** $\frac{1}{2}$, $\frac{5}{8}$
6. a) 0, $\frac{-1}{12}$ **b)** $\frac{-2}{3}$, $\frac{-5}{9}$ **c)** −1, $\frac{-17}{20}$ **d)** $-\frac{1}{2}$, $\frac{-1}{8}$
e) −1, $\frac{-3}{4}$ **f)** $\frac{-1}{2}$, $\frac{-7}{20}$
7. a) 1, $\frac{24}{25}$ **b)** 6, $5\frac{5}{6}$ **c)** 0, $\frac{-1}{20}$ **d)** 1, $1\frac{1}{8}$
e) $-2\frac{1}{2}$, −2 **f)** 0, $\frac{-4}{15}$
8. a) 0, $\frac{1}{12}$ **b)** 1, $1\frac{1}{15}$ **c)** $-\frac{1}{2}$, $-\frac{15}{28}$ **d)** −2, $-1\frac{7}{10}$
e) $\frac{-1}{2}$, $\frac{-14}{33}$ **f)** $\frac{2}{3}$, $\frac{3}{5}$
9. $19.50
10. He is short 6.4 m.
11. 120 jiffies
12. a) $2\frac{1}{2}$ h **b)** $13\frac{1}{2}$ h
c) Tokyo is $3\frac{1}{4}$ h ahead of Kathmandu.
d) Chatham Islands are $16\frac{1}{4}$ h ahead of St. John's.
e) Kathmandu, Nepal
13. a) $\frac{1}{50}$ **b)** 2400 km
14. a) Ray **b)** $\frac{1}{24}$ of a pizza **c)** $1\frac{1}{8}$ of a pizza

15. a) $1\frac{5}{8}, 2\frac{1}{4}, 2\frac{7}{8}$ **b)** $-\frac{1}{24}, \frac{1}{48}, -\frac{1}{96}$

16. a) \$108.80 **b)** \$44.80

17. a) Example: $-\frac{2}{3}$ is a repeating decimal, so she would need to round before adding. **b)** Example: Find a common denominator, change each fraction to an equivalent form with a common denominator, and then add the numerators.

18. 9.5 m

19. a) $\frac{-5}{4}$ **b)** $1\frac{1}{10}$ **c)** $\frac{8}{13}$ **d)** $-1\frac{1}{2}$

20.

$-\frac{1}{2}$	$-2\frac{1}{6}$	$\frac{1}{6}$
$-\frac{1}{6}$	$-\frac{5}{6}$	$-1\frac{1}{2}$
$-1\frac{5}{6}$	$\frac{1}{2}$	$-1\frac{1}{6}$

21. a) $\frac{4}{15}$ **b)** $\frac{9}{20}$ **c)** $-2\frac{1}{4}$

22. a) 1 large scoop + 1 medium scoop − 1 small scoop or 2 large scoops − 1 medium scoop **b)** 1 large scoop − 2 small scoops or 2 medium scoops − 3 small scoops

23. Example: $-2\frac{1}{6} - ■ = -\frac{4}{3}$. Find the rational number to replace ■. The answer is $\frac{-5}{6}$.

24. Yes. Example: If the two rational numbers are both negative, the sum would be less.
Example: $\frac{-1}{4} + \frac{-5}{6} = \frac{-13}{12}$

25. Example: **a)** $\left[-\frac{1}{2} + \left(-\frac{1}{2}\right)\right] + \left[-\frac{1}{2} - \left(-\frac{1}{2}\right)\right] = -1$

b) $\left[-\frac{1}{2} - \left(-\frac{1}{2}\right)\right] + \left[-\frac{1}{2} - \left(-\frac{1}{2}\right)\right] = 0$

c) $\left[\left(-\frac{1}{2}\right) \times \left(-\frac{1}{2}\right)\right] + \left[-\frac{1}{2} - \left(-\frac{1}{2}\right)\right] = \frac{1}{4}$

d) $\left(-\frac{1}{2}\right) \div \left(-\frac{1}{2}\right) \div \left(-\frac{1}{2}\right) \div \left(-\frac{1}{2}\right) = 4$

e) $\left[-\frac{1}{2} + \left(-\frac{1}{2}\right)\right] + \left[\left(-\frac{1}{2}\right) \times \left(-\frac{1}{2}\right)\right] = -\frac{3}{4}$

f) $\left(-\frac{1}{2}\right) \div \left(-\frac{1}{2}\right) \div \left(-\frac{1}{2}\right) - \left(-\frac{1}{2}\right) = -1\frac{1}{2}$

26. $\frac{-3}{8}$

27. $-\frac{1}{2}$ and 2

History Link, page 71

1. Example: **a)** $\frac{1}{5} + \frac{1}{10}$ **b)** $\frac{1}{2} + \frac{1}{7}$ **c)** $\frac{1}{4} + \frac{1}{5}$ **d)** $\frac{1}{2} + \frac{1}{9}$

2. Example: A strategy is to work with factors of the denominator.

3. Example: **a)** $\frac{1}{28} + \frac{1}{4}$ **b)** $\frac{1}{18} + \frac{1}{6}$ **c)** $\frac{1}{66} + \frac{1}{6}$

4. Example: **a)** $\frac{1}{8} + \frac{1}{4} + \frac{1}{2}$ **b)** $\frac{1}{24} + \frac{1}{12} + \frac{1}{3}$
c) $\frac{1}{12} + \frac{1}{6} + \frac{1}{2}$

2.4 Determining Square Roots of Rational Numbers, pages 78–81

5. Example: 12

6. Example: 0.55

7. a) 9, 9.61 **b)** 144, 156.25 **c)** 0.36, 0.3844 **d)** 0.09, 0.0841

8. a) 16 cm^2, 18.49 cm^2 **b)** 0.0016 km^2, 0.001 225 km^2

9. a) Yes, 1 and 16 are perfect squares. **b)** No, 5 is not a perfect square. **c)** Yes, 36 and 100 are perfect squares. **d)** No, 10 is not a perfect square.

10. a) No **b)** Yes **c)** No **d)** Yes

11. a) 18 **b)** 1.7 **c)** 0.15 **d)** 45

12. a) 13 m **b)** 0.4 mm

13. a) 6, 6.2 **b)** 2, 2.12 **c)** 0.9, 0.933 **d)** 0.15, 0.148

14. a) 0.92 m **b)** 7.75 cm

15. 1.3 m

16. a) 3.16 m **b)** 6.16 m **c)** 4.2 L

17. a) \$3504 **b)** The cost will not be the same. **c)** The cost of fencing two squares each having an area of 60 m^2 is \$4960.

18. No. Example: Each side of the picture is 22.36 cm. This is too large for the frame that is 30 cm by 20 cm.

19. 2.9 cm

20. 3.8 m

21. 27.4 m

22. 14.1 cm

23. 12.5 cm; Assume the 384 square tiles are all the same size.

24. a) 7.2 km **b)** 4.6 km **c)** 252.4 km

25. 35.3 cm

26. 12.2 m

27. 4.1 cm

28. a) 2.53 s **b)** 3.16 s **c)** 1.41 s

29. 30 m/s greater

30. 12.3 s

31. a) 59.8 cm^2 **b)** 34.7 cm^2

32. 36 cm

33. 25.1 cm^2

34. 3.6 m

35. 1.8 cm by 5.4 cm

36. 4

Chapter 2 Review, pages 82–83

1. OPPOSITES

2. RATIONAL NUMBER

3. PERFECT SQUARE

4. NON-PERFECT SQUARE

5. $\frac{3}{24}, \frac{-10}{-6}, \frac{-6}{4}, \frac{82}{-12}$

6. a) = **b)** < **c)** > **d)** = **e)** > **f)** >

7. a) Example: Axel wrote each fraction in an equivalent form so both fractions had a common denominator of 4. He then compared the numerators to find that $-6 < -5$, so $-1\frac{1}{2} < -1\frac{1}{4}$. **b)** Example: Bree wrote $-1\frac{1}{2}$ as -1.5 and $-1\frac{1}{4}$ as -1.25. She compared the decimal portions to find that $-1.5 < -1.25$. **c)** Example: Caitlin compared $-\frac{2}{4}$ and $-\frac{1}{4}$ and found that $-\frac{2}{4} < -\frac{1}{4}$. **d)** Example: Caitlin's method is preferred because it involves fewer computations.

8. Example: $-\frac{5}{6}$ and $\frac{5}{-7}$

9. a) -0.95 **b)** 1.49 **c)** -8.1 **d)** 1.3

10. a) -0.6 **b)** 8.1 **c)** -6.5 **d)** 5.3

11. 1.6 °C/h

12. $1.3 million profit

13. a) $-\frac{2}{15}$ **b)** $-1\frac{1}{8}$ **c)** $-1\frac{9}{10}$ **d)** $4\frac{7}{12}$

14. a) $\frac{4}{9}$ **b)** $-\frac{20}{21}$ **c)** $-12\frac{5}{6}$ **d)** $1\frac{17}{22}$

15. The quotients are the same. Example: The quotient of two rational numbers with the same sign is positive.

16. 420 h

17. $\frac{9}{10}$

18. a) Yes, both 64 and 121 are perfect squares.
b) No, 7 is not a perfect square.
c) Yes, 49 and 100 are perfect squares.
d) No, 10 is not a perfect square.

19. Example: The estimate is 14.8.
220 is between the perfect square numbers 196 and 225. The square roots of 196 and 225 are 14 and 15. Since 220 is closer to 225, the value in the tenths place should be close to 8 or 9.

20. 0.0225

21. a) 3.6 **b)** 0.224

22. a) Example: When the number is greater than 1. The square root of 49 is 7.
b) Example: When the number is smaller than 1. The square root of 0.16 is 0.4.

23. a) 1.5 cm; Example: One method is to find the square root of 225, and divide by 10. A second method is to divide 225 by 100, then find the square root of the quotient. **b)** 21.2 cm

24. a) 2.5 cans **b)** 6.6 m by 6.6 m

25. 15.7 s