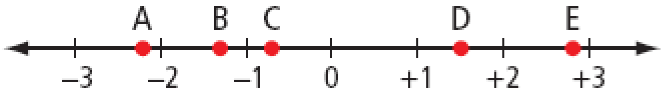
Chapter 2 Rational Numbers

2.1 Comparing and Ordering Rational Numbers

Section 2.1 Page 51 Question 4



a) The fraction $\frac{3}{2}$ is equivalent to 1.5. The location of 1.5 on the number line would be half way between 1 and 2. Therefore, D is the correction location.

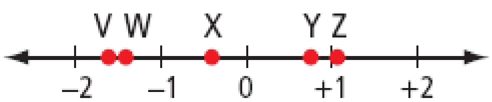
b) The decimal number –0.7 is located between 0 and –1 on the number line, closer to –1. Therefore, C is the correct location.

c) The fraction $-2\frac{1}{5}$ is equivalent to the decimal –2.2. The location of –2.2 on the number line would be between –2 and –3, closer to –2. Therefore, A is the correct location.

d) The fraction $\frac{14}{5}$ is equivalent to 2.8. The location of 2.8 on the number line would be between 2 and 3, closer to 3. Therefore, E is the correct location.

e) The fraction $-1\frac{1}{3}$ is equivalent to $-1.\overline{3}$. The location of $-1.\overline{3}$ on the number line would be between –1 and –2, closer to –1. Therefore, B is the correct location.

Section 2.1 Page 51 Question 5



a) The fraction $-1\frac{2}{5}$ is equivalent to –1.4. The location of –1.4 on the number line would be between –1 and –2, closer to –1. Therefore, W is the correct location.

b) The fraction $\frac{3}{4}$ is equivalent to 0.75. The location of 0.75 on the number line would be between 0 and 1, closer to 1. Therefore, Y is the correct location.

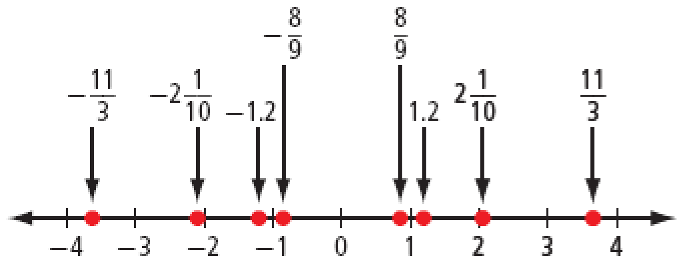
c) The fraction $1\frac{1}{20}$ is equivalent to 1.05. The location of 1.05 on the number line would be between 1 and 2, closer to 1. Therefore, Z is the correct location.

d) The fraction $-1\frac{3}{5}$ is equivalent to –1.6. The location of –1.6 on the number line would be between –1 and –2, closer to –2. Therefore, V is the correct location.

e) The location of $-0.\overline{4}$ on the number line would be between 0 and –1, closer to 0. Therefore, X is the correct location.

Section 2.1 Page 51 Question 6

a) The fraction $\frac{8}{9}$ is just a bit smaller than 1, so it is located to the left of 1 on the number line. Its opposite would be located the same distance from zero, but on the left of zero.



b) –1.2 is between –1 and –2, but closer to –1. It is located just a bit to the left of –1 on the number line. Its opposite would be located the same distance from zero, but on the right of zero.

c) The fraction $2\frac{1}{10}$ is between 2 and 3, but closer to 2. It is located just a bit to the right of 2 on the number line. Its opposite would be located the same distance from zero, but on the left of zero.

d) The fraction $-\frac{11}{3}$ is equivalent to $-3.\overline{6}$ So, it would be located between –3 and –4, but closer to –4. Its opposite would be located the same distance from zero, but on the right of zero.

Section 2.1 Page 51 Question 7

The opposite of a rational number is found by changing its sign.

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

Section 2.1 Page 51 Question 8

You can estimate the order.

$1\frac{5}{6}$ is a little less than 2.

$-1\frac{2}{3}$ is a little greater than –2.

–0.1 is a little less than 0.

1.9 is a little less than 2, but greater than $1\frac{5}{6}$.

$-\frac{1}{5}$ is a little less than 0, but smaller than –0.1.

Therefore, the numbers in ascending order are $-1\frac{2}{3}$, $-\frac{1}{5}$, –0.1, $1\frac{5}{6}$, 1.9.

Section 2.1 Page 51 Question 9

You can estimate the order.

$-\frac{3}{8}$ is close to half way between 0 and –1 on the number line, but closer to 0.

$1.\bar{8}$ is between 1 and 2, but a bit smaller than 2.

$\frac{9}{5}$ is equivalent to 1.8, so it is a bit smaller than $1.\bar{8}$.

$-\frac{1}{2}$ is exactly half way between 0 and –1 on the number line, so it is smaller than $-\frac{3}{8}$.

–1 is the smallest number in the list.

Therefore, the numbers in descending order are $1.\bar{8}$, $\frac{9}{5}$, $-\frac{3}{8}$, $-\frac{1}{2}$, –1.

Section 2.1 Page 52 Question 10

Answers may vary. Example:

a) Multiply the numerator and denominator by 2. An equivalent fraction is $-\frac{4}{10}$.

b) Divide the numerator and denominator by 2. An equivalent fraction is $\frac{5}{3}$.

c) Divide the numerator and denominator by 3. An equivalent fraction is $-\frac{3}{4}$.

d) Multiply the numerator and denominator by 2. An equivalent fraction is $-\frac{8}{6}$.

Section 2.1 Page 52 Question 11

Answers may vary. Example:

a) Multiply the numerator and denominator by 2. An equivalent fraction is $\frac{-2}{6}$.

b) Multiply the numerator and denominator by –1. An equivalent fraction is $\frac{4}{5}$.

c) Multiply the numerator and denominator by –1. An equivalent fraction is $-\frac{5}{4}$.

d) Multiply the numerator and denominator by –1. An equivalent fraction is $\frac{-7}{2}$.

Section 2.1 Page 52 Question 12

When the denominators are the same, compare the numerators.

a) $-\frac{2}{3} = \frac{-2}{3}$, since 1 > –2, $\frac{1}{3} > -\frac{2}{3}$

b) $-\frac{9}{10} = \frac{-9}{10}$, since 7 > –9, $\frac{7}{10} > -\frac{9}{10}$

c) $-\frac{1}{2} = \frac{-5}{10}$ and $-\frac{3}{5} = \frac{-6}{10}$, since –5 > –6, $-\frac{1}{2} > -\frac{3}{5}$

d) $-2\frac{1}{8} = \frac{-17}{8}$ and $-2\frac{1}{4} = \frac{-18}{8}$, since –17 > –18, $-2\frac{1}{8} > -2\frac{1}{4}$

Section 2.1 Page 52 Question 13

When the denominators are the same, compare the numerators.

a) $\frac{4}{7} = \frac{12}{21}$ and $\frac{2}{3} = \frac{14}{21}$, since 12 < 14, $\frac{4}{7} < \frac{2}{3}$

b) $-\frac{4}{3} = \frac{-4}{3}$ and $-\frac{5}{3} = \frac{-5}{3}$, since –5 < –4, $-\frac{5}{3} < -\frac{4}{3}$

c) $-\frac{7}{10} = \frac{-7}{10}$ and $-\frac{3}{5} = \frac{-6}{10}$, since –7 < –6, $-\frac{7}{10} < -\frac{3}{5}$

d) $-1\frac{3}{4} = \frac{-35}{20}$ and $-1\frac{4}{5} = \frac{-36}{20}$, since –36 < –35, $-1\frac{4}{5} < -1\frac{3}{4}$

Section 2.1 Page 52 Question 14

Answers may vary. Convert each fraction to its equivalent decimal form.

a) Example: $\frac{3}{5}$ = 0.6 and $\frac{4}{5}$ = 0.8, so a decimal between is 0.7.

b) Example: $-\frac{1}{2}$ = –0.5 and $-\frac{5}{8}$ = –0.625, so a decimal between is –0.5625.

c) Example: $-\frac{5}{6} = -0.8\bar{3}$ so a decimal between is 0.1.

d) Example: $-\frac{17}{20}$ = –0.85 and $-\frac{4}{5}$ = –0.8, so a decimal between is –0.825.

Section 2.1 Page 52 Question 15

Answers may vary. Convert each fraction to its equivalent decimal form.

a) Example: $1\frac{1}{2}$ = 1.5 and $1\frac{7}{10}$ = 1.7, so a decimal between is 1.6.

b) Example: $-2\frac{2}{3} = -2.\bar{6}$ and $-2\frac{1}{3} = -2.\bar{3}$, so a decimal between is –2.4.

c) Example: $1\frac{3}{5}$ = 1.6 and $-1\frac{7}{10}$ = –1.7, so a decimal between is 0.6.

d) Example: $-3\frac{1}{100}$ = –3.01 and $-3\frac{1}{50}$ = –3.02, so a decimal between is –3.015.

Section 2.1 Page 52 Question 16

Answers may vary. Identify a decimal number between each pair, and convert the decimal to a fraction.

a) Example: One decimal number between 0.2 and 0.3 is 0.25. 0.25 = $\frac{1}{4}$.

b) Example: One decimal number between 0 and –0.1 is –0.05. –0.05 = $-\frac{1}{20}$.

c) Example: One decimal number between –0.74 and –0.76 is –0.75. –0.75 = $\frac{-3}{4}$.

d) Example: One decimal number between –0.52 and –0.53 is –0.525. –0.525 = $-\frac{21}{40}$.

Section 2.1 Page 52 Question 17

Identify a decimal number between each pair, and convert the decimal to a fraction.

a) Example: One decimal number between 1.7 and 1.9 is 1.8. 1.8 = $1\frac{4}{5}$.

b) Example: One decimal number between –0.5 and 1.5 is 1.25. 1.25 = $1\frac{1}{4}$.

c) Example: One decimal number between –3.3 and –3.4 is –3.35. –3.35 = $-3\frac{7}{20}$.

d) Example: One decimal number between –2.01 and –2.03 is –2.02. –2.02 = $-2\frac{1}{50}$.

Section 2.1 Page 52 Question 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" suggests a positive value.

e) –14.2; Example: "Below" freezing suggests a negative value.

Section 2.1 Page 53 Question 19

a) The melting point of argon is –189.2 °C. Helium has a melting point of –272.2 °C and neon has a melting point of –248.67 °C. Since these values are less than –189.2 °C, helium and neon are the two noble gases whose melting points are less than the melting point of argon.

b) The boiling point of krypton is –152.3 °C. Radon has a boiling point of –61.8 °C and xenon has a boiling point of –107.1 °C. Since these values are greater than –152.3 °C, radon and xenon are the two noble gases whose boiling points are greater than the boiling point of krypton.

c) The melting points in ascending order are –272.2 °C (helium), –248.67 °C (neon), –189.2 °C (argon), –156.6 °C (krypton), –111.9 °C (xenon), –71.0 °C (radon).

d) The boiling points in descending order are –61.8 °C (radon), –107.1 °C (xenon), –152.3 °C (krypton), –185.7 °C (argon), –245.92 °C (neon), –268.6 °C (helium).

Section 2.1 Page 53 Question 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.

Section 2.1 Page 53 Question 21

a) The temperatures in descending order are 6.1 °C (Penticton), 5.4 (Edmonton), 3.9 °C (Regina), 0.6 °C (Whitehorse), –0.1 °C (Yellowknife), –5.1 °C (Churchill), –14.1 °C (Resolute).

b) The temperature for Whitehorse is 0.6 °C and the temperature for Churchill is –5.1 °C. The temperature for Yellowknife is –0.1 °C, which is between 0.6 °C and –5.1 °C.

Section 2.1 Page 53 Question 22

To determine the relationship between each pair of numbers, convert each pair to an equivalent form with a common denominator or convert each pair to decimal form.

a) $\frac{-9}{6} = \frac{-3}{2}$ which is the same as $\frac{3}{-2}$, so $\frac{-9}{6} = \frac{3}{-2}$.

b) $\frac{-3}{5} = -0.6$, so $\frac{-3}{5} > -0.\overline{6}$

c) $-1\frac{3}{10} = -1.3$ and $-\left(\frac{-13}{-10}\right) = -1.3$, so the two mixed numbers are equal.

d) $-3\frac{1}{5} = -3.2$, so $-3.25 < -3\frac{1}{5}$

e) $-\frac{8}{12} = -0.\overline{6}$ and $-\frac{11}{15} = -0.7\overline{3}$ so $-\frac{8}{12} > -\frac{11}{15}$

f) $-2\frac{5}{6} = -2.8\overline{3}$ and $-2\frac{7}{8} = -2.875$, so $-2\frac{5}{6} > -2\frac{7}{8}$

Section 2.1 Page 53 Question 23

Yes, zero is a rational number. 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.

Section 2.1 Page 53 Question 24

Answers may vary.

a) Example: $\frac{2}{5}$ is greater than 0, and denominator is greater than the numerator.

b) Example: $\frac{3}{-4}$ is between 0 and –1 and the denominator is less than the numerator.

c) Example: $\frac{-10}{3} = -3.\overline{3}$, which is less than –2 and the numerator is less than the denominator.

d) Example: $\frac{5}{-4} = -1.25$ and is between –1.2 and –1.3 and the numerator is greater than the denominator.

Section 2.1 Page 54 Question 25

$\frac{11}{5}$ = 2.2 and $\frac{15}{-4}$ = –3.75, so the integers between are –3, –2, –1, 0, 1, and 2.

Section 2.1 Page 54 Question 26

To determine which pair is greater, write each pair of fractions in an equivalent from with the same positive denominator and compare the numerators.

a) 0.4 = $\frac{40}{100}$ and 0.44 = $\frac{44}{100}$. Since 44 is greater than 40, 0.44 is greater.

b) $0.\overline{3} = \frac{100}{300}$ and 0.33 = $\frac{99}{300}$. Since 100 is greater than 99, $0.\overline{3}$ is greater.

c) –0.7 = $\frac{-70}{100}$ and –0.77 = $\frac{-77}{100}$. Since –70 is greater than –77, –0.7 is greater.

d) –0.66 = $\frac{-198}{300}$ and $-0.\overline{6} = \frac{-200}{300}$. Since –198 is greater than –200, –0.66 is greater.

Section 2.1 Page 54 Question 27

0 = $\frac{0}{3}$ and –2 = $\frac{-6}{3}$

The fractions between are $\frac{-1}{3}$, $\frac{-2}{3}$, $\frac{-3}{3}$, $\frac{-4}{3}$, and $\frac{-5}{3}$.

Section 2.1 Page 54 Question 28

$\frac{2}{3} = 0.\overline{6}$ Since the two numbers are equivalent, there are no rational numbers between them.

Section 2.1 Page 54 Question 29

a) The ■ can be replaced with –2, –3, –4 or any integer less than –2 because –2.5 < –1.9, –3.5 < –1.9, –4.5 < –1.9, and so on.

b) $-2\frac{1}{4} = \frac{-9}{4}$. Therefore, there is only one integer that makes the statement true. The integer is +9.

c) $-\frac{-15}{5} = 3$. Therefore, there is only one integer that makes $3 = \frac{-3}{\blacksquare}$ true. The integer is –1.

d) Replacing the ■ with 0 would make the statement true. No other answer is possible.

e) $-\frac{3}{4} = -0.75$, so the ■ must be replaced with any of the integers 0, 1, 2, 3, or 4.
So, –0.75 < –0.74, –0.75 < –0.73, –0.75 < –0.72, –0.75 < –0.71, –0.75 < –0.70.

f) $-5\frac{1}{2} = \frac{11}{-2}$, so the ■ can be replaced with only one integer. The integer is –1.
$\frac{11}{-2} > \frac{11}{-1}$ or $-5\frac{1}{2} > -11$.

g) $-2\frac{3}{5} = \frac{-13}{5}$ and $\frac{-13}{5} = \frac{-26}{10}$. So, the ■ can be replaced with only one integer, the integer is –26.

h) $-\frac{2}{3} = \frac{2}{-3}$, $\frac{2}{-3} = \frac{8}{-12}$. So, the ■ can only be replaced with any negative integer greater than –12. The integers are –1, –2, –3, –4, –5, –6, –7, –8, –9, –10, –11. For example,
$\frac{8}{-1} < \frac{8}{-12}$, $\frac{8}{-2} < \frac{8}{-12}$, $\frac{8}{-3} < \frac{8}{-12}$, and so on.

Section 2.1 Page 54 Question 30

a) $\frac{4}{-5} = \frac{8}{-10}$, so $x = 8$

b) $\frac{6}{-9} = \frac{-6}{9}$ and $\frac{-6}{9} = \frac{-2}{3}$, so $x = -2$

c) $-\frac{20}{12} = \frac{20}{-12}$ and $\frac{20}{-12} = \frac{5}{-3}$, so $x = -3$

d) $\frac{-6}{-5} = \frac{6}{5}$ and $\frac{6}{5} = \frac{30}{25}$, so $x = 25$

2.2 Problem Solving With Rational Numbers in Decimal Form

Section 2.2 Page 60 Question 4

a) Estimate.

$\quad 0.98 + (-2.91)$
$\approx 1 + (-3)$
≈ -2

Calculate.

Adding the opposite of 2.91 is the same as subtracting 2.91.

$0.98 + (-2.91) = 0.98 - 2.91$

Determine the difference between 2.91 and 0.98.

$2.91 - 0.98 = 1.93$

However, $0.98 - 2.91$ must be negative since $2.91 > 0.98$.

So, $0.98 + (-2.91) = -1.93$.

b) Estimate.

$\quad 5.46 - 3.16$
$\approx 5 - 3$
≈ 2

Calculate.

$5.46 - 3.16 = 2.3$

c) Estimate.

$\quad -4.23 + (-5.75)$
$\approx -4 + (-6)$
≈ -10

Calculate.

To add two numbers with like signs, line up the decimals and add, give the sum the common sign. The common sign is negative.

So, $-4.23 + (-5.75) = -9.98$

d) Estimate.

$\quad -1.49 - (-6.83)$
$\approx -1 - (-7)$
$\approx -1 + 7$
≈ -6

Calculate.

Subtracting -6.83 is the same as adding its opposite.

$-1.49 - (-6.83) = -1.49 + 6.83$

$-1.49 + 6.83$ is the same as $6.83 - 1.49$.

$6.83 - 1.49 = 5.34$

So, $-1.49 - (-6.83) = 5.34$.

Section 2.2 Page 60 Question 5

a) Determine the difference between 11.62 and 9.37.
11.62 – 9.37 = 2.25
However, 9.37 – 11.62 must be negative since 11.62 > 9.37.
So, 9.37 – 11.62 = –2.25.

b) –0.512 + 2.385 is the same as 2.385 – 0.512.
2.385 – 0.512 = 1.873. So, –0.512 + 2.385 = 1.873.

c) Subtracting –0.061 is the same as adding it opposite.
0.675 – (–0.061) = 0.675 + 0.061
Add.
0.675 + 0.061 = 0.736
So, 0.675 – (–0.061) = 0.736.

d) To add two numbers with like signs, line up the decimals and add, give the sum the common sign. The common sign is negative.
–10.95 + (–1.99) = –12.94

Section 2.2 Page 60 Question 6

a) Estimate.
  2.7 × (–3.2)
≈ 3 × (–3)
≈ –9
Calculate.
Multiply the decimal numbers.
2.7 × 3.2 = 8.64
The sign of the product is negative because there is one negative factor.
2.7 × (–3.2) = –8.64

b) Estimate.
  –3.25 ÷ 2.5
≈ –3 ÷ 3
≈ –1
Calculate.
Divide the decimal numbers.
3.25 ÷ 2.5 = 1.3
The sign of the quotient is negative because one of the numbers is negative.
–3.25 ÷ 2.5 = –1.3

c) Estimate.
$-5.5 \times (-5.5)$
$\approx -6 \times (-6)$
≈ 36
Calculate.
Multiply the decimal numbers.
$5.5 \times 5.5 = 30.25$
The sign of the product is positive because the two factors are negative.
$-5.5 \times (-5.5) = 30.25$

d) Estimate.
$-4.37 \div (-0.95)$
$\approx -4 \div (-1)$
≈ 4
Divide the decimal numbers.
$4.37 \div 0.95 = 4.6$
The sign of the quotient is positive because both the two numbers are negative.
$-4.37 \div (-0.95) = 4.6$

Section 2.2 Page 60 Question 7

a) Multiply the decimal numbers.
$2.4 \times 1.5 = 3.6$
The sign of the product is positive because the two factors are negative.
$-2.4(-1.5) = 3.6$

b) Divide the decimal numbers.
$8.6 \div 0.9 = 9.\overline{5}$
The sign of the quotient is positive because both of the numbers are positive.
$8.6 \div 0.9 = 9.556$ (rounded to the nearest thousandth)

c) Multiply the decimal numbers.
$5.3 \times 4.2 = 22.26$
The sign of the product is negative because one of the factors is negative.
$-5.3(4.2) = -22.26$

d) Divide the decimal numbers.
$19.5 \div 16.2 = 1.204$ (rounded to the nearest thousandth)
The sign of the quotient is negative because one of the numbers is negative.
$19.5 \div (-16.2) = -1.204$ (rounded to the nearest thousandth)

e) Multiply the decimal numbers.
$1.12 \times 0.68 = 0.762$ (rounded to the nearest thousandth)
The sign of the product is positive because both of the factors are positive.
$1.12\,(0.68) = 0.762$ (rounded to the nearest thousandth)

f) Divide the decimal numbers.
0.55 ÷ 0.66 = 0.833 (rounded to the nearest thousandth)
The sign of the quotient is negative because one of the numbers is positive.
–0.55 ÷ 0.66 = –0.833 (rounded to the nearest thousandth)

Section 2.2 Page 60 Question 8

a) –2.1 × 3.2 + 4.3 × (–1.5)	Multiply from left to right.
= –6.72 + (–6.45)	Add.
= –13.17	

b) –3.5(4.8 – 5.6)	Perform the operation within the parentheses.
= –3.5(–0.8)	Multiply.
= 2.8	

c) –1.1[2.3 – (–0.5)]	Perform the operation within the parentheses.
= –1.1[2.8]	Multiply.
= –3.08	

Section 2.2 Page 60 Question 9

a) (4.51 – 5.32)(5.17 – 6.57)	Perform the operation within the parentheses.
= (–0.81)(–1.4)	Multiply.
= 1.134	

b) 2.4 + 1.8 × 5.7 ÷ (–2.7)	Multiply from left to right.
= 2.4 + 10.26 ÷ (–2.7)	Divide from left to right.
= 2.4 + (–3.8)	Add.
= –1.4	

c) –4.36 + 1.2[2.8 + (–3.5)]	Perform the operation within the parentheses.
= –4.36 + 1.2 [–0.7]	Multiply.
= –4.36 + (–0.84)	Add.
= –5.2	

Section 2.2 Page 60 Question 10

To determine the number of degrees colder that the temperature is in January compared with the temperature in July, subtract the temperature in July from the temperature in January.
  –12.6 – 26.1
= –12.6 + (–26.1)
= –38.7
The temperature in Regina is 38.7 °C colder in January than it is in July.

Section 2.2 Page 60 Question 11

a) To determine the change in temperature, subtract the temperature in the morning from the temperature in the afternoon.

$1.4 - (-6.3)$
$= 1.4 + 6.3$
$= 7.7$

The temperature change was 7.7 °C.

b) To determine the average rate of change in temperature divide the temperature change by the number of hours. From 10:00 a.m. to 3:00 p.m., 5 h have passed.
$7.7 \div 5 = 1.54$. The temperature change was 1.54 °C/h.

Section 2.2 Page 60 Question 12

a) Represent the position of the pelican when it catches the fish as: –2.3, since it is caught under water. The length of the pelican's dive can be represented by subtracting the position underwater from the height above the water: $3.8 - (-2.3)$.

b) $3.8 - (-2.3) = 6.1$. The length of the pelican's dive is 6.1 m.

Section 2.2 Page 60 Question 13

a) Represent a rise by the submarine as a positive value. Since the submarine is rising at the rate of 4.5 m/min, in 15 min, it would rise $15 \times 4.5 = 67.5$ m. Represent the depth of 153 m as –153. Add the total rise of 67.5 to –153: $67.5 + (-153) = -85.5$. The submarine's depth after rising for 15 min is 85.5 m.

b) To determine how much longer the submarine will take to reach the surface, divide the depth of 85.5 by the rate per minute of 4.5: $85.5 \div 4.5 = 19$. It will take the submarine 19 min to reach the surface.

Section 2.2 Page 60 Question 14

Represent a drop of \$0.31 as –0.31. Represent a rise of \$0.18 as +0.18. To determine the total change in the value of the shares, add the amount dropped to the amount risen and multiply by the total number of shares:

$125(-0.31 + 0.18)$
$= 125(-0.13)$
$= -16.25$

The total change in the value of Saida's shares was a loss of \$16.25.

Section 2.2 Page 61 Question 15

a) 2.8 km is equivalent to 2800 m. In 2800 m there would be 28 decreases of 0.65°C each. To find the total decrease, multiply –0.65 by 28: $-0.65 \times 28 = -18.2$
Add this total decrease to the temperature of 10 °C.
$10 + (-18.2) = -8.2$
The temperature outside an aircraft at 2.8 km above Red Deer is –8.2 °C.

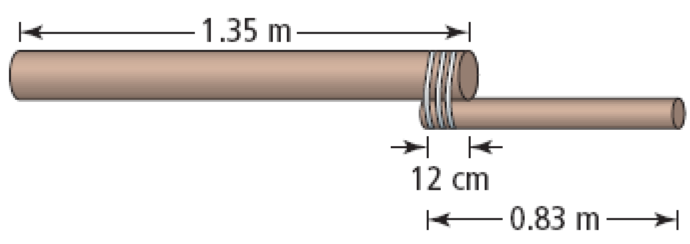
b) In 1600 m there would be 16 increases of 0.65 °C.
To find the total increase, multiply 0.65 by 16: $0.65 \times 16 = 10.4$. To find the temperature in the city, add this amount to the temperature outside the aircraft:
$-8.5 + 10.4 = 1.9$. The temperature in the city is 1.9 °C.

Section 2.2 Page 61 Question 16

a) 6.1 is $\frac{61}{10}$ or 61 tenths.
–3.9 is $\frac{-39}{10}$ or –39 tenths.
61 tenths + (–39) tenths is 22 tenths.
22 tenths is $\frac{22}{10}$ or 2.2.
So, $6.1 + (-3.9) = 2.2$.

b) Example: Use hundredths instead of tenths.
1.25 is $\frac{125}{100}$ or 125 hundredths.
3.46 is $\frac{346}{100}$ or 346 hundredths.
125 hundredths –346 hundredths is –221 hundredths.
–221 hundredths is $\frac{-221}{100}$ or –2.21
So, $1.25 - 3.46 = -2.21$.

Section 2.2 Page 61 Question 17



To determine the length of the new pole, add the lengths of 1.35 m and 0.83 m and subtract the amount of overlap. First, convert the amount of overlap to metres.
12 cm = 0.12 m
$(1.35 + 0.83) - 0.12 = 2.06$
The length of the new pole is 2.06 m.

Section 2.2 Page 61 Question 18

a) The mean is found by adding the numbers and dividing the sum by the number of numbers that were added together. There are 7 numbers to be added.

$[0 + (–4.5) + (–8.2) + 0.4 + (–7.6) + 3.5 + (–0.2)] \div 7$
$= –16.6 \div 7$
$= –2.37$

The mean is –2.37.

b) The mean is found by adding the numbers and dividing the sum by the number of numbers that were added together. There are 6 numbers to be added.

$[6.3 + (–2.2) + 14.9 + (–4.8) + (–5.3) + 1.6] \div 6$
$= 10.5 \div 6$
$= 1.75$

The mean is 1.75.

Section 2.2 Page 61 Question 19

a) To determine the average profit or loss over three years, represent the profits as positive values and the losses as negative values. Calculate the sum of the profits and losses and divide by the number of years, 3.

$[8.6 + (–5.9) + (–6.3)] \div 3$
$= –3.6 \div 3$
$= –1.2$

The average loss over the first three years was $1.2 million per year.

b) If the company broke even over the first four years, that means the net profit or loss was zero. To determine the amount lost or gained in the fourth year, subtract the losses and profits of the first four years from 0.

$0 – [8.6 + (–5.9) + (–6.3)]$
$= 0 – [–3.6]$
$= 3.6$

The profit for the fourth year was $3.6 million.

Section 2.2 Page 61 Question 20

Answers may vary.

Example: Assume the cost of gasoline is $1.30/L.
Calculate the fuel each car uses to drive 300 km.
For the car with fuel consumption of 5.9 L/100 km, multiply the fuel consumption by 3 because 300 ÷ 100 = 3.
5.9(3) = 17.7
The cost of fuel would be 17.7(1.3) = $23.01.
For the car with fuel consumption of 9.4 L/100 km, multiply the fuel consumption by 3.
9.4(3) = 28.2
The cost of fuel would be 28.2(1.3) = $36.66. Find the difference of these two costs:
36.66 – 23.01 = 13.65. It would cost $13.65 less if the first car was used.

Section 2.2 Page 61 Question 21

To find the rate of speed that Andrew drove, divide the distance by the time:
234 ÷ 3 = 78. Andrew drove at a speed of 78 km/h. Brian drove at a speed 5 km/h greater than Andrew's speed. So, Brian's speed was 78 + 5 = 83 km/h. To find the time Brian took, divide the distance by his speed: 234 ÷ 83 = 2.82 h.

Calculate the difference between these two times. 3 – 2.82 = 0.18
Convert 0.18 h to minutes by multiplying by 60. 0.18(60) = 10.8
Brian took about 11 min less than Andrew.

Section 2.2 Page 61 Question 22

To convert the number of minutes to seconds, multiply by 60.
3(60) = 180 s and 2.5(60) = 150 s
To calculate each distance, multiply the time by the rate of descent.
180 × 2.5 = 450
150 × 2.8 = 420
Add the two products: 450 + 420 = 870. The total descent was 870 m. Subtract this amount from the original altitude of 2950 m. 2950 – 870 = 2080
The plane's altitude after the descent is 2080 m.

Section 2.2 Page 62 Question 23

To determine the average temperature, find the sum of the temperatures and divide the sum by the number of temperatures, 7.

$$
\begin{aligned}
&[-4.6 + (-0.5) + 1.2 + 2.3 + (-1.1) + 1.5 + (-3.0)] \div 7 \\
&= -4.2 \div 7 \\
&= -0.6
\end{aligned}
$$

The mean daily high temperature that week was –0.6 °C.

Section 2.2 Page 62 Question 24

a) To calculate the unknown number, subtract 1.8 from –3.5.
$-3.5 - 1.8$
$= -3.5 + (-1.8)$
$= -5.3$

b) To calculate the unknown number, subtract –8.9 from –13.3.
$-13.3 - (-8.9)$
$= -13.3 + 8.9$
$= -4.4$

c) To calculate the unknown number, divide –9.45 by –4.5.
$-9.45 \div (-4.5) = 2.1$

d) To calculate the unknown number, divide –18.5 by 7.4.
$-18.5 \div 7.4 = -2.5$

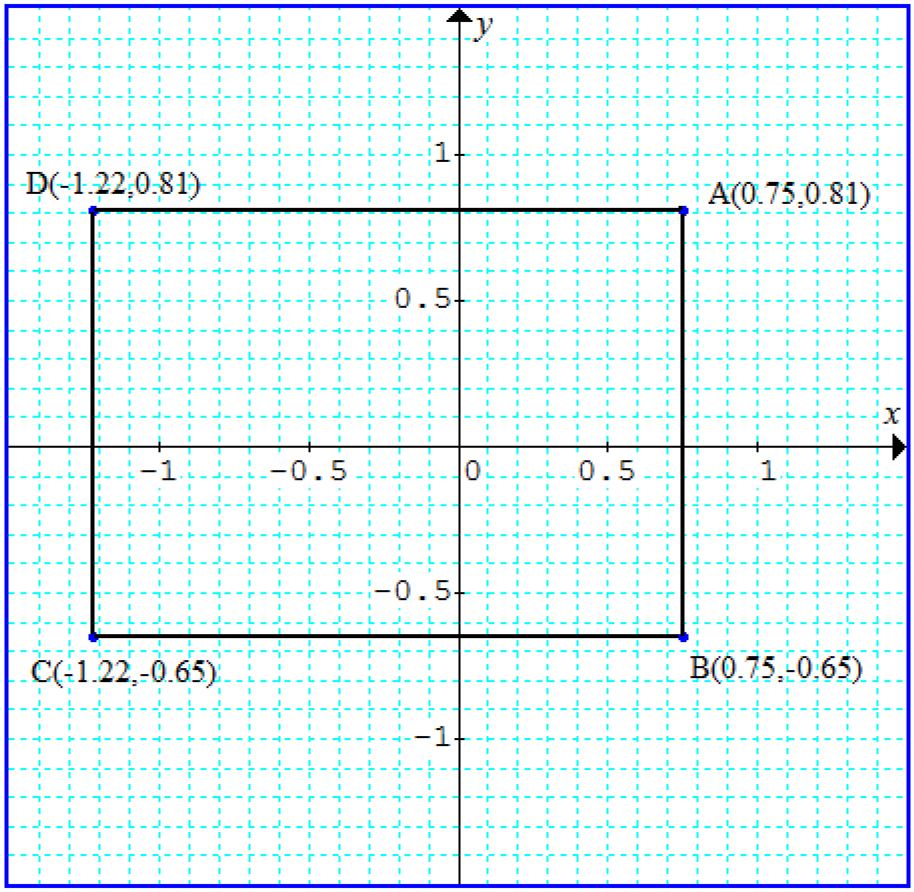
Section 2.2 Page 62 Question 25

Answers may vary.

Example: At 16:00 the temperature in Calling Lake, Alberta, started decreasing at a constant rate of –1.1 °C/h. At 23:00 the temperature was –19.7 °C. What was the temperature at 16:00?
To find the temperature at 16:00, determine how many hours have passed from 16:00 to 23:00 by subtracting: $23 - 16 = 7$.
Multiply 7 by –1.1 to calculate the total temperature change. $7 \times (-1.1) = -7.7$
To calculate the original temperature, subtract –7.7 from –19.7.
$-19.7 - (-7.7) = -12.0$
The temperature at 16:00 was –12 °C.

Section 2.2 Page 62 Question 26

Plot the four points on a coordinate grid.
The quadrilateral formed is a rectangle.
Find the length of side AB by finding the difference of the y–coordinates:
0.81 – (–0.65) = 1.46
Find the length of side BC by finding the difference of the x–coordinates:
0.75 – (–1.22) = 1.97
Find the area by multiplying the lengths of the two sides:
1.46 × 1.97
= 2.88 square units (rounded to the nearest hundredth).



Section 2.2 Page 62 Question 27

a) To find the sum of the rational numbers, multiply the mean by 6: –4.3 × 6 = –25.8.

b) To find the sixth number, subtract the sum of the first five numbers from the total sum of the six numbers. The sum of the 5 numbers is –4.5 × 5 = –22.5.
Subtract –22.5 from –25.8.
–25.8 – (–22.5) = –3.3.
The sixth number is –3.3.

Section 2.2 Page 62 Question 28

a) Replace y with –0.5 in the expression.

$3.6 + 2y$	
$= 3.6 + 2(-0.5)$	Multiply.
$= 3.6 + (-1)$	Add.
$= 2.6$	

b) Replace m with 1.7 in the expression.

$(m - 1.8)(m + 1.8)$	
$= (1.7 - 1.8)(1.7 + 1.8)$	Perform the addition within the parentheses.
$= (-0.1)(3.5)$	Multiply.
$= -0.35$	

c) Replace q with –3.6 in the expression.

$\frac{4.5}{q} - \frac{q}{4.5}$	
$= \frac{4.5}{-3.6} - \frac{-3.6}{4.5}$	Divide from left to right.
$= -1.25 - (-0.8)$	Subtract.
$= -0.45$	

Section 2.2 Page 62 Question 29

a) $3.5 \times (4.1 - 3.5) - 2.8 = -0.7$

$3.5 \times (4.1 - 3.5) - 2.8$	Perform the subtraction within the parentheses.
$= 3.5 \times 0.6 - 2.8$	Multiply.
$= 2.1 - 2.8$	Subtract
$= -0.7$	

b) $[2.5 + (-4.1) + (-2.3)] \times (-1.1) = 4.29$

$[2.5 + (-4.1) + (-2.3)] \times (-1.1)$	Add, from left to right within the brackets.
$= -3.9 \times (-1.1)$	Multiply.
$= 4.29$	

c) $-5.5 - (-6.5) \div [2.4 + (-1.1)] = -0.5$

$-5.5 - (-6.5) \div [2.4 + (-1.1)]$	Perform the addition within the parentheses.
$= -5.5 - (-6.5) \div [1.3]$	Divide.
$= -5.5 - (-5)$	Subtract.
$= -0.5$	

2.3 Problem Solving With Rational Numbers in Fraction Form

Section 2.3 Page 68 Question 5

a) Estimate. 0 + 0 = 0
Calculate.

$\frac{3}{10} + \frac{1}{5}$

$= \frac{3}{10} + \frac{2}{10}$ A common denominator of 10 and 5 is 10.

$= \frac{3+2}{10}$ Add the numerators.

$= \frac{5}{10}$ Write the fraction in lowest terms.

$= \frac{1}{2}$

b) Estimate. 2 + (–1) = 1
Calculate.

$2\frac{1}{3} + \left(-1\frac{1}{4}\right)$ Rewrite the mixed numbers as improper fractions.

$= \frac{7}{3} + \frac{-5}{4}$ A common denominator of 3 and 4 is 12.

$= \frac{28}{12} + \frac{-15}{12}$

$= \frac{28+(-15)}{12}$ Add the numerators.

$= \frac{13}{12}$ Rewrite the improper fraction as a mixed number.

$= 1\frac{1}{12}$

c) Estimate. –1 – 0 = –1

Calculate

$-\frac{5}{12} - \frac{5}{12}$

$= \frac{-5}{12} + \frac{-5}{12}$ Subtracting $\frac{5}{12}$ is the same as adding the opposite of $\frac{5}{12}$.

$= \frac{-5 + (-5)}{12}$ Add the numerators.

$= \frac{-10}{12}$ Write the fraction in lowest terms.

$= -\frac{5}{6}$

d) Estimate. –3 – (–3) = 0

Calculate.

$-2\frac{1}{2} - \left(-3\frac{1}{3}\right)$ Subtracting $-3\frac{1}{3}$ is the same as adding the opposite of $-3\frac{1}{3}$.

$= -2\frac{1}{2} + \left(3\frac{1}{3}\right)$ Rewrite the mixed numbers as improper fractions.

$= \frac{-5}{2} + \frac{10}{3}$ A common denominator of 2 and 3 is 6.

$= \frac{-15}{6} + \frac{20}{6}$

$= \frac{-15+20}{6}$ Add the numerators.

$= \frac{5}{6}$

e) Estimate. $-1 + \frac{1}{2} = -\frac{1}{2}$

Calculate.

$-\frac{5}{6} + \frac{1}{3}$ A common denominator of 6 and 3 is 6.

$= \frac{-5}{6} + \frac{2}{6}$

$= \frac{-5+2}{6}$ Add the numerators.

$= \frac{-3}{6}$ Write the fraction in lowest terms.

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

f) Estimate. $\frac{1}{4} - \left(-\frac{1}{4}\right) = \frac{1}{2}$

Calculate.

$\frac{3}{8} - (-\frac{1}{4})$	Subtracting $-\frac{1}{4}$ is the same as adding the opposite of $-\frac{1}{4}$.
$= \frac{3}{8} + \frac{1}{4}$	A common denominator of 8 and 4 is 8.
$= \frac{3}{8} + \frac{2}{8}$	
$= \frac{3+2}{8}$	Add the numerators.
$= \frac{5}{8}$	

Section 2.3 Page 68 Question 6

a) Estimate. 1 – 1 = 0
Calculate

$\frac{2}{3} - \frac{3}{4}$ Subtracting $\frac{3}{4}$ is the same as adding the opposite of $\frac{3}{4}$.

$= \frac{2}{3} + \left(-\frac{3}{4}\right)$ A common denominator of 3 and 4 is 12.

$= \frac{8}{12} + \frac{-9}{12}$

$= \frac{8+(-9)}{12}$ Add the numerators.

$= -\frac{1}{12}$

b) Estimate. $\frac{-1}{3} + \left(\frac{-1}{3}\right) = \frac{-2}{3}$

Calculate.

$-\frac{2}{9} + \left(-\frac{1}{3}\right)$ A common denominator of 9 and 3 is 9.

$= \frac{-2}{9} + \frac{-3}{9}$

$= \frac{-2+(-3)}{9}$ Add the numerators.

$= -\frac{5}{9}$

c) Estimate. $-\frac{1}{2} + \left(-\frac{1}{2}\right) = -1$

Calculate.

$-\frac{1}{4} + \left(-\frac{3}{5}\right)$ A common denominator of 4 and 5 is 20.

$= \frac{-5}{20} + \frac{-12}{20}$

$= \frac{-5+(-12)}{20}$ Add the numerators.

$= -\frac{17}{20}$

d) Estimate. $-1 - \left(-\frac{1}{2}\right) = -\frac{1}{2}$

Calculate.

$-\frac{3}{4} - \left(-\frac{5}{8}\right)$	Subtracting $-\frac{5}{8}$ is the same as adding the opposite of $-\frac{5}{8}$.
$= \frac{-3}{4} + \frac{5}{8}$	A common denominator of 4 and 8 is 8.
$= \frac{-6}{8} + \frac{5}{8}$	
$= \frac{-6+5}{8}$	Add the numerators.
$= -\frac{1}{8}$	

e) Estimate. 1 – 2 = –1
Calculate.

$1\frac{1}{2} - 2\frac{1}{4}$	Subtracting $2\frac{1}{4}$ is the same as adding the opposite of $2\frac{1}{4}$.
$= 1\frac{1}{2} + \left(-2\frac{1}{4}\right)$	Rewrite the mixed numbers as improper fractions.
$= \frac{3}{2} + \frac{-9}{4}$	A common denominator of 2 and 4 is 4.
$= \frac{6}{4} + \frac{-9}{4}$	
$= \frac{6+(-9)}{4}$	Add the numerators.
$= -\frac{3}{4}$	

f) Estimate. $1\frac{1}{2} + (-2) = -\frac{1}{2}$

Calculate.

$1\frac{2}{5} + \left(-1\frac{3}{4}\right)$ Rewrite the mixed numbers as improper fractions.

$= \frac{7}{5} + \frac{-7}{4}$ A common denominator of 5 and 4 is 20.

$= \frac{28}{20} + \frac{-35}{20}$

$= \frac{28 + (-35)}{20}$ Add the numerators.

$= -\frac{7}{20}$

Section 2.3 Page 68 Question 7

a) Estimate. 1 ÷ 1 = 1
Calculate.

$\frac{4}{5} \div \frac{5}{6}$ Multiply by the reciprocal of the divisor.

$= \frac{4}{5} \times \frac{6}{5}$ Multiply the numerators and multiply the denominators.

$= \frac{24}{25}$

b) Estimate. 3 × 2 = 6
Calculate.

$3\frac{1}{3}\left(1\frac{3}{4}\right)$ Rewrite the mixed numbers as improper fractions.

$= \frac{10}{3} \times \frac{7}{4}$ Multiply the numerators and multiply the denominators.

$= \frac{70}{12}$ Write the fraction in lowest terms.

$= \frac{35}{6}$ Rewrite the improper fraction as a mixed number.

$= 5\frac{5}{6}$

c) Estimate. 0 × 0 = 0
Calculate.

$\frac{1}{8} \times \left(-\frac{2}{5}\right)$ Multiply the numerators and multiply the denominators.

$= \frac{-2}{40}$ Write the fraction in lowest terms.

$= -\frac{1}{20}$

d) Estimate. –1 ÷ (–1) = 1
Calculate.

$\frac{-9}{10} \div \left(-\frac{4}{5}\right)$	Multiply by the reciprocal of the divisor.
$= \frac{-9}{10} \times \left(\frac{-5}{4}\right)$	Multiply the numerators and multiply the denominators.
$= \frac{45}{40}$	Write the fraction in lowest terms.
$= \frac{9}{8}$	Rewrite the improper fraction as a mixed number.
$= 1\frac{1}{8}$	

e) Estimate. $-\frac{1}{2} \times 5 = -2\frac{1}{2}$
Calculate.

$-\frac{3}{8} \times 5\frac{1}{3}$	Rewrite the mixed number as an improper fraction.
$= -\frac{3}{8} \times \frac{16}{3}$	Multiply the numerators and multiply the denominators.
$= \frac{-48}{24}$	Write the fraction in lowest terms.
$= -2$	

f) Estimate. $0 \div -\frac{1}{2} = 0$
Calculate.

$\frac{1}{10} \div \left(-\frac{3}{8}\right)$	Multiply by the reciprocal of the divisor.
$= \frac{1}{10} \times \left(\frac{-8}{3}\right)$	Multiply the numerators and multiply the denominators.
$= \frac{-8}{30}$	Write the fraction in lowest terms.
$= -\frac{4}{15}$	

Section 2.3 Page 68 Question 8

a) Estimate. –1 × 0 = 0
Calculate.

$$-\frac{3}{4} \times \left(-\frac{1}{9}\right)$$ Multiply the numerators and multiply the denominators.

$$= \frac{3}{36}$$ Write the fraction in lowest terms.

$$= \frac{1}{12}$$

b) Estimate. 1 ÷ 1 = 1
Calculate.

$$1\frac{1}{3} \div 1\frac{1}{4}$$ Rewrite the mixed numbers as improper fractions.

$$= \frac{4}{3} \div \frac{5}{4}$$ Multiply by the reciprocal of the divisor.

$$= \frac{4}{3} \times \frac{4}{5}$$ Multiply the numerators and multiply the denominators.

$$= \frac{16}{15}$$ Rewrite the improper fraction as a mixed number.

$$= 1\frac{1}{15}$$

c) Estimate. $-\frac{1}{2} \div 1 = -\frac{1}{2}$
Calculate.

$$-\frac{3}{8} \div \frac{7}{10}$$ Multiply by the reciprocal of the divisor.

$$= \frac{-3}{8} \times \frac{10}{7}$$ Multiply the numerators and multiply the denominators.

$$= \frac{-30}{56}$$ Write the fraction in lowest terms.

$$= -\frac{15}{28}$$

d) Estimate. –2 ÷ 1 = –2
Calculate.

$-2\frac{1}{8} \div 1\frac{1}{4}$	Rewrite the mixed numbers as improper fractions.
$= \frac{-17}{8} \div \frac{5}{4}$	Multiply by the reciprocal of the divisor.
$= \frac{-17}{8} \times \frac{4}{5}$	Multiply the numerators and multiply the denominators.
$= \frac{-68}{40}$	Write the fraction in lowest terms.
$= \frac{-17}{10}$	Rewrite the improper fraction as a mixed number.
$= -1\frac{7}{10}$	

e) Estimate. $1 \times \left(-\frac{1}{2}\right) = -\frac{1}{2}$
Calculate.

$\frac{7}{9} \times \frac{-6}{11}$	Multiply the numerators and multiply the denominators.
$= \frac{-42}{99}$	Write the fraction in lowest terms.
$= -\frac{14}{33}$	

f) Estimate. $-2 \div (-3) = \frac{2}{3}$
Calculate.

$-1\frac{1}{2} \div \left(-2\frac{1}{2}\right)$	Rewrite the mixed numbers as improper fractions.
$= \frac{-3}{2} \div \frac{-5}{2}$	Multiply by the reciprocal of the divisor.
$= \frac{-3}{2} \times \frac{-2}{5}$	Multiply the numerators and multiply the denominators.
$= \frac{6}{10}$	Write the fraction in lowest terms.
$= \frac{3}{5}$	

Section 2.3 Page 68 Question 9

You can represent the $39 Lori owed her mother by 39. To calculate the first part Lori paid back, multiply 39 by $\frac{1}{3}$.

$$39 \times \frac{1}{3}$$
$$= \frac{39}{3}$$
$$= 13$$

She paid back $13 in the first payment.
To calculate the second part that Lori paid back, subtract 13 from 39.

$$39 - 13 = 26$$

Then, multiply 26 by $\frac{1}{4}$.

$$26 \times \frac{1}{4}$$
$$= \frac{26}{4}$$
$$= 6\frac{1}{2}$$
$$= 6.5$$

She paid back $6.50 in the second payment.
Add the two amounts that Lori paid back, and subtract this sum from 39.
$39 - (13 + 6.5) = 19.5$.
Lori still owes her mother $19.50.

Section 2.3 Page 68 Question 10

To determine the amount of baseboard installed in the first room, multiply 64 by $\frac{1}{2}$.

$$
\begin{aligned}
& 64 \times \frac{1}{2} \\
&= \frac{64}{2} \\
&= 32
\end{aligned}
$$

To determine the amount of baseboard installed in the second room, multiply 64 by $\frac{3}{5}$.

$$
\begin{aligned}
& 64 \times \frac{3}{5} \\
&= \frac{192}{5} \\
&= 38\frac{2}{5} \\
&= 38.4
\end{aligned}
$$

To find out how much baseboard he has left, subtract the sum of the amounts that he installed in the two rooms from 64.

$64 – (32 + 38.4) = –6.4$

He was short 6.4 m of baseboard.

Section 2.3 Page 68 Question 11

Determine how many jiffies are in a minute by dividing 60 by $\frac{1}{100}$.

$$
\begin{aligned}
& 60 \div \frac{1}{100} \\
&= 60 \times 100 \\
&= 6000
\end{aligned}
$$

There are 6000 jiffies in 1 min. To determine how many jiffies it takes Naima to type one word, divide 6000 by 50.

$6000 \div 50 = 120$

It takes Naima 120 jiffies to type one word.

Section 2.3 Page 69 Question 12

a)

Location	Time Zone
Alice Springs, Australia	$+9\frac{1}{2}$
Brandon, Manitoba	-6
Chatham Islands, New Zealand	$+12\frac{3}{4}$
Istanbul, Turkey	$+2$
Kathmandu, Nepal	$+5\frac{3}{4}$
London, England	0
Mumbai, India	$+5\frac{1}{2}$
St. John's, Newfoundland and Labrador	$-3\frac{1}{2}$
Tokyo, Japan	$+9$
Victoria, British Columbia	-8

To determine the number of hours, subtract the time zone for Brandon, from the time zone for St. John's.

$-3\frac{1}{2} - (-6)$ Subtracting –6 is the same as adding the opposite of –6.

$= -3\frac{1}{2} + 6$ A common denominator of 2 and 1 is 2.

$= \frac{-7}{2} + \frac{12}{2}$

$= \frac{-7+12}{2}$ Add the numerators.

$= \frac{5}{2}$ Rewrite as a mixed number.

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

St. John's is $2\frac{1}{2}$ h ahead of the time in Brandon.

b) To determine the number of hours, subtract the time zone for Mumbai, from the time zone for Victoria.

$-8 - 5\frac{1}{2}$	Subtracting $5\frac{1}{2}$ is the same as adding the opposite of $5\frac{1}{2}$.
$= -8 + \left(-5\frac{1}{2}\right)$	A common denominator of 1 and 2 is 2.
$= \frac{-16}{2} + \frac{-11}{2}$	
$= \frac{-16+(-11)}{2}$	Add the numerators.
$= \frac{-27}{2}$	Rewrite as a mixed number.
$= -13\frac{1}{2}$	

Victoria is $13\frac{1}{2}$ h behind of the time in Mumbai.

c) To determine the time difference, subtract the time zone for Kathmandu from the time zone for Tokyo.

$9 - 5\frac{3}{4}$	Subtracting $5\frac{3}{4}$ is the same as adding the opposite of $5\frac{3}{4}$.
$= 9 + \left(-5\frac{3}{4}\right)$	A common denominator of 1 and 4 is 4.
$= \frac{36}{4} + \frac{-23}{4}$	
$= \frac{36+(-23)}{4}$	Add the numerators.
$= \frac{13}{4}$	Rewrite as a mixed number.
$= 3\frac{1}{4}$	

Tokyo is $3\frac{1}{4}$ h ahead of Kathmandu.

d) To determine the time difference, subtract the time zone for St. John's from the time zone for Chatham Islands.

$12\frac{3}{4} - \left(-3\frac{1}{2}\right)$	Subtracting $-3\frac{1}{2}$ is the same as adding the opposite of $-3\frac{1}{2}$.
$= 12\frac{3}{4} + 3\frac{1}{2}$	A common denominator of 4 and 2 is 4.
$= \frac{51}{4} + \frac{14}{4}$	
$= \frac{51+14}{4}$	Add the numerators.
$= \frac{65}{4}$	Rewrite as a mixed number.
$= 16\frac{1}{4}$	

Chatham Islands are $16\frac{1}{4}$ h ahead of St. John's.

e) To determine the location, add the time zone in Istanbul to the time zone in Alice Springs. Divide this sum by 2.

$\left(2+9\frac{1}{2}\right) \div 2$	Perform the operation within the parentheses.
$= 11\frac{1}{2} \div 2$	Multiply by the reciprocal of the divisor.
$= \frac{23}{2} \times \frac{1}{2}$	
$= \frac{23}{4}$	Rewrite as a mixed number.
$= 5\frac{3}{4}$	

The location that has a time zone of $5\frac{3}{4}$ is Kathmandu, Nepal.

Section 2.3 Page 69 Question 13

a) To find the fraction, multiply $\frac{6}{17}$ by $\frac{17}{300}$.

$\frac{6}{17} \times \frac{17}{300}$ Remove the common factor of 17 from the numerator and the denominator.

$= \frac{6}{1} \times \frac{1}{300}$ Multiply the numerators and multiply the denominators.

$= \frac{6}{300}$ Rewrite in lowest terms.

$= \frac{1}{50}$

The diameter of Pluto is $\frac{1}{50}$ the diameter of Saturn.

b) To determine the diameter of Pluto, multiply 120 000 by $\frac{1}{50}$.

$120\,000 \times \frac{1}{50}$ Remove the common factor of 50.

$= 2400$

The diameter of Pluto is 2400 km.

Section 2.3 Page 69 Question 14

a) Represent the amount of pizza that Li ate by $\frac{2}{8} + \frac{1}{6}$. Determine the sum to find the amount of pizza that Li ate.

$\frac{2}{8} + \frac{1}{6}$ A common denominator of 8 and 6 is 24.

$= \frac{6}{24} + \frac{4}{24}$ Add the numerators.

$= \frac{10}{24}$

Represent the amount of pizza that Ray ate by $\frac{1}{8} + \frac{2}{6}$. Determine the sum to find the amount of pizza that Ray ate.

$\frac{1}{8} + \frac{2}{6}$ A common denominator of 8 and 6 is 24.

$= \frac{3}{24} + \frac{8}{24}$ Add the numerators.

$= \frac{11}{24}$

Ray ate more pizza.

b) To determine how much more Ray ate, subtract the amount Li ate from the amount Ray ate.

$\frac{11}{24} - \frac{10}{24}$ Subtract the numerators.

$= \frac{1}{24}$

Ray ate $\frac{1}{24}$ more than Li.

c) To determine how much pizza was left over, subtract the sum of the amounts that Li and Ray ate from 2.

$2 - \left(\frac{10}{24} + \frac{11}{24}\right)$ Perform the operation within the parentheses. Add the numerators.

$= 2 - \frac{21}{24}$ A common denominator for 1 and 24 is 24.

$= \frac{48}{24} - \frac{21}{24}$ Subtract the numerators.

$= \frac{27}{24}$ Rewrite as a mixed number.

$= 1\frac{3}{24}$ Write the mixed number in lowest terms.

$= 1\frac{1}{8}$

There was $1\frac{1}{8}$ pizza left over.

Section 2.3 Page 69 Question 15

a) Rewrite each fraction in the pattern with the common denominator of 8:
$\frac{-12}{8}, \frac{-7}{8}, \frac{-2}{8}, \frac{3}{8}, \frac{8}{8}$

The difference between any two consecutive numbers is $\frac{5}{8}$. To determine the next three numbers, add $\frac{5}{8}$ to $\frac{8}{8}$, then add $\frac{5}{8}$ to that sum, and add $\frac{5}{8}$ to the next sum.

$\frac{8}{8} + \frac{5}{8}$ Add the numerators.
$= \frac{13}{8}$ Rewrite as a mixed number.
$= 1\frac{5}{8}$

So, the next number is $1\frac{5}{8}$.

Add $\frac{5}{8}$ to $\frac{13}{8}$:

$\frac{5}{8} + \frac{13}{8}$ Add the numerators.
$= \frac{18}{8}$ Rewrite as a mixed number.
$= 2\frac{2}{8}$ Write in lowest terms.
$= 2\frac{1}{4}$

So, the next number is $2\frac{1}{4}$.

Add $\frac{5}{8}$ to $\frac{18}{8}$:

$\frac{5}{8} + \frac{18}{8}$ Add the numerators.
$= \frac{23}{8}$ Rewrite as a mixed number.
$= 2\frac{7}{8}$

The third number is $2\frac{7}{8}$.

The next three numbers in the pattern are $1\frac{5}{8}$, $2\frac{1}{4}$, and $2\frac{7}{8}$.

b) Rewrite each fraction in the pattern with the common denominator of 12:

$\frac{16}{12}, \frac{-8}{12}, \frac{4}{12}, \frac{-2}{12}, \frac{1}{12}$

To determine the next consecutive number in the pattern, divide the numerator of the previous fraction by –2.

1 ÷ (–2) = –0.5

So, the next fraction is

$\frac{-0.5}{12}$ Multiply the numerator and the denominator by 2.

$= -\frac{1}{24}$

To determine the next number, divide the numerator of the previous fraction by –2.

–0.5 ÷ (–2) = 0.25

So, the next fraction is

$\frac{0.25}{12}$ Multiply the numerator and the denominator by 4.

$= \frac{1}{48}$

To determine the next number, divide the numerator of the previous fraction by –2.

0.25 ÷ (–2) = –0.125

So, the next fraction is

$\frac{-0.125}{12}$ Multiply the numerator and the denominator by 8.

$= -\frac{1}{96}$

So, the next three numbers in the pattern are $-\frac{1}{24}$, $\frac{1}{48}$, and $-\frac{1}{96}$.

Section 2.3 Page 69 Question 16

a) To determine how much cash Boris has, multiply Anna's amount of $25.60 by $2\frac{1}{2}$.

$25.6 \times 2\frac{1}{2}$	Convert the decimal to a fraction.
$= 25\frac{6}{10} \times 2\frac{1}{2}$	Rewrite the mixed numbers as improper fractions.
$= \frac{256}{10} \times \frac{5}{2}$	Remove the common factors of 5 and 10 from the numerator and denominator.
$= \frac{256}{2} \times \frac{1}{2}$	Multiply the numerators and multiply the denominators.
$= \frac{256}{4}$	Rewrite as a decimal number.
$= 64$	

Boris has $64.

To determine how much cash Charlie has, multiply Anna's amount of $25.60 by $\frac{3}{4}$.

$25.6 \times \frac{3}{4}$	Convert the fraction to a decimal.
$= 25\frac{6}{10} \times \frac{3}{4}$	Rewrite the mixed number as an improper fraction.
$= \frac{256}{10} \times \frac{3}{4}$	Remove the common factor of 4.
$= \frac{64}{10} \times 3$	Multiply the numerators.
$= \frac{192}{10}$	Rewrite as a decimal number.
$= 19.2$	

Charlie has $19.20.
To determine how much all three people have, add the amount that each person has:
$25.6 + 64 + 19.2 = 108.8$
The three people have a total of $108.80.

b) To determine how much more cash Boris has than Charlie, find the difference of the amount that each has.
$64 – 19.2 = 44.8$
Boris has $44.80 more than Charlie.

Section 2.3 Page 69 Question 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 add the numerators.

Section 2.3 Page 70 Question 18

If $\frac{1}{9}$ of the iceberg is above the surface of the water, then $1 - \frac{1}{9}$ is below the water.

$1 - \frac{1}{9}$	A common denominator of 1 and 9 is 9.
$= \frac{9}{9} - \frac{1}{9}$	Subtract the numerators.
$= \frac{8}{9}$	

$\frac{8}{9}$ of the iceberg is below water.

To determine the total height of the iceberg divide 75.8 by $\frac{8}{9}$.

$75.8 \div \frac{8}{9}$	Rewrite the decimal as a fraction.
$= 75\frac{8}{10} \div \frac{8}{9}$	Multiply by the reciprocal of the divisor.
$= 75\frac{8}{10} \times \frac{9}{8}$	Rewrite the mixed number as an improper fraction.
$= \frac{758}{10} \times \frac{9}{8}$	Multiply the numerators and multiply the denominators.
$= \frac{6822}{80}$	Rewrite as a decimal number, rounded to the nearest tenth.
$= 85.3$	

The height of the iceberg is 85.3 m. To determine the height of the iceberg above water subtract 75.8 from this amount.

85.3 – 75.8 = 9.5

The iceberg is 9.5 m above the surface.

Section 2.3 Page 70 Question 19

a) To find the missing value, subtract $\frac{1}{2}$ from $-\frac{3}{4}$.

$-\frac{3}{4} - \frac{1}{2}$ Subtracting $\frac{1}{2}$ is the same as adding the opposite of $\frac{1}{2}$.

$= \frac{-3}{4} + \frac{-1}{2}$ A common denominator of 4 and 2 is 4.

$= \frac{-3}{4} + \frac{-2}{4}$ Add the numerators.

$= -\frac{5}{4}$

b) To find the missing number add $1\frac{4}{5}$ and $-\frac{7}{10}$.

$1\frac{4}{5} + \left(-\frac{7}{10}\right)$ Rewrite the mixed number as an improper fraction.

$= \frac{9}{5} + \frac{-7}{10}$ A common denominator of 5 and 10 is 10.

$= \frac{18}{10} + \frac{-7}{10}$ Add the numerators.

$= \frac{11}{10}$ Rewrite the improper fraction as a mixed number.

$= 1\frac{1}{10}$

c) To find the missing value, divide $-1\frac{1}{3}$ by $-2\frac{1}{6}$.

$-1\frac{1}{3} \div \left(-2\frac{1}{6}\right)$ Rewrite the mixed numbers as improper fractions.

$= \frac{-4}{3} \div \frac{-13}{6}$ Dividing by $\frac{-13}{6}$ is the same as multiplying by its reciprocal.

$= \frac{-4}{3} \times \frac{-6}{13}$ Multiply the numerators and multiply the denominators.

$= \frac{24}{39}$ Write the fraction in lowest terms.

$= \frac{8}{13}$

d) To find the missing value, multiply $-\frac{3}{5}$ by $2\frac{1}{2}$.

$$-\frac{3}{5} \times 2\frac{1}{2}$$ Rewrite the mixed number as an improper fraction.

$$= \frac{-3}{5} \times \frac{5}{2}$$ Multiply the numerators and multiply the denominators.

$$= \frac{-15}{10}$$ Write the improper fraction as a mixed number in lowest terms.

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

Section 2.3 Page 70 Question 20

Find the magic sum, by adding $-\frac{1}{2}$, $-\frac{5}{6}$, and $-1\frac{1}{6}$.

$$-\frac{1}{2} + \left(-\frac{5}{6}\right) + \left(-1\frac{1}{6}\right)$$ Rewrite the mixed number as an improper fraction.

$$= \frac{-1}{2} + \frac{-5}{6} + \frac{-7}{6}$$ A common denominator of 2 and 6 is 6.

$$= \frac{-3}{6} + \frac{-5}{6} + \frac{-7}{6}$$ Add the numerators.

$$= -\frac{15}{6}$$

The magic sum is $-\frac{15}{6}$.

To find the lower left missing number, subtract the sum of $\frac{1}{2}$ and $-1\frac{1}{6}$ from $-\frac{15}{6}$.

$-\frac{15}{6} - \left(\frac{1}{2} + \left(-1\frac{1}{6}\right)\right)$	Rewrite the mixed number as an improper fraction.
$= \frac{-15}{6} - \left(\frac{1}{2} + \frac{-7}{6}\right)$	Perform the operation within the parentheses.
$= \frac{-15}{6} - \left(\frac{3}{6} + \frac{-7}{6}\right)$	Add the numerators.
$= \frac{-15}{6} - \left(\frac{-4}{6}\right)$	Subtracting $\frac{-4}{6}$ is the same as adding the opposite of $\frac{-4}{6}$.
$= \frac{-15}{6} + \frac{4}{6}$	Add the numerators.
$= \frac{-11}{6}$	Rewrite as a mixed number.
$= -1\frac{5}{6}$	

To find the left number in the middle row, subtract the sum of $-\frac{11}{6}$ and $-\frac{1}{2}$ from $-\frac{15}{6}$.

$-\frac{15}{6} - \left(-\frac{11}{6} + \left(-\frac{1}{2}\right)\right)$	Perform the operation within the parentheses.
$= \frac{-15}{6} - \left(\frac{-11}{6} + \frac{-3}{6}\right)$	Add the numerators.
$= \frac{-15}{6} - \left(\frac{-14}{6}\right)$	Subtracting $\frac{-14}{6}$ is the same as adding the opposite of $\frac{-14}{6}$.
$= \frac{-15}{6} + \frac{14}{6}$	Add the numerators.
$= -\frac{1}{6}$	

To find the middle number in the top row, subtract from $-\frac{15}{6}$ the sum of $\frac{1}{2}$ and $-\frac{5}{6}$.

$-\frac{15}{6} - \left(\frac{1}{2} + \left(-\frac{5}{6}\right)\right)$	Perform the operation within the parentheses.
$= \frac{-15}{6} - \left(\frac{3}{6} + \frac{-5}{6}\right)$	Add the numerators.
$= \frac{-15}{6} - \left(\frac{-2}{6}\right)$	Subtracting $\frac{-2}{6}$ is the same as adding the opposite of $\frac{-2}{6}$.
$= \frac{-15}{6} + \frac{2}{6}$	Add the numerators.
$= \frac{-13}{6}$	Rewrite as a mixed number.
$= -2\frac{1}{6}$	

To find the right number in the top row, subtract from $-\frac{15}{6}$ the sum of $-\frac{1}{2}$ and $-\frac{13}{6}$.

$-\frac{15}{6} - \left(-\frac{1}{2} + \left(-\frac{13}{6}\right)\right)$	Perform the operation within the parentheses.
$= \frac{-15}{6} - \left(\frac{-3}{6} + \frac{-13}{6}\right)$	Add the numerators.
$= \frac{-15}{6} - \left(\frac{-16}{6}\right)$	Subtracting $\frac{-16}{6}$ is the same as adding the opposite of $\frac{-16}{6}$.
$= \frac{-15}{6} + \frac{16}{6}$	Add the numerators.
$= \frac{1}{6}$	

To find the right number in the middle row, subtract from $-\frac{15}{6}$ the sum of $-\frac{1}{6}$ and $-\frac{5}{6}$.

$-\frac{15}{6}-\left(-\frac{1}{6}+\left(-\frac{5}{6}\right)\right)$	Perform the operation within the parentheses. Add the numerators.
$=\frac{-15}{6}-\left(\frac{-6}{6}\right)$	Subtracting $\frac{-6}{6}$ is the same as adding the opposite of $\frac{-6}{6}$.
$=\frac{-15}{6}+\frac{6}{6}$	Add the numerators.
$=\frac{-9}{6}$	Rewrite as a mixed number in lowest terms.
$=-1\frac{1}{2}$	

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

Section 2.3 Page 70 Question 21

a) $\frac{1}{3}\left(\frac{2}{5}-\frac{1}{2}\right)+\frac{3}{10}$ Perform the operation within the parentheses. A common denominator for 5 and 2 is 10.

$=\frac{1}{3}\left(\frac{4}{10}-\frac{5}{10}\right)+\frac{3}{10}$ Subtract the numerators.

$=\frac{1}{3}\left(\frac{-1}{10}\right)+\frac{3}{10}$ Multiply the numerators and multiply the denominators.

$=\frac{-1}{30}+\frac{3}{10}$ A common denominator for 30 and 10 is 30.

$=\frac{-1}{30}+\frac{9}{30}$ Add the numerators.

$=\frac{8}{30}$ Write the fraction in lowest terms.

$=\frac{4}{15}$

b) $\frac{3}{4}\div\frac{5}{8}-\frac{3}{8}\div\frac{1}{2}$ Dividing by $\frac{5}{8}$ and $\frac{1}{2}$ is the same as multiplying by each reciprocal.

$=\frac{3}{4}\times\frac{8}{5}-\frac{3}{8}\times\frac{2}{1}$ Multiply the numerators and multiply the denominators.

$=\frac{24}{20}-\frac{6}{8}$ A common denominator for 20 and 8 is 40.

$=\frac{48}{40}-\frac{30}{40}$ Subtract the numerators.

$=\frac{18}{40}$ Rewrite the fraction in lowest terms.

$=\frac{9}{20}$

c) $1\frac{1}{2} + 1\frac{1}{2}\left(-2\frac{5}{6} + \frac{1}{3}\right)$ Rewrite the mixed numbers as improper fractions.

$= \frac{3}{2} + \frac{3}{2}\left(\frac{-17}{6} + \frac{1}{3}\right)$ Perform the operation within the parentheses.

$= \frac{3}{2} + \frac{3}{2}\left(\frac{-17}{6} + \frac{2}{6}\right)$ Add the numerators.

$= \frac{3}{2} + \frac{3}{2}\left(\frac{-15}{6}\right)$ Multiply the numerators and multiply the denominators.

$= \frac{3}{2} + \frac{-45}{12}$ A common denominator of 2 and 12 is 12.

$= \frac{18}{12} + \frac{-45}{12}$ Add the numerators.

$= \frac{-27}{12}$ Rewrite as a mixed number in lowest terms.

$= -2\frac{1}{4}$

Section 2.3 Page 70 Question 22

a) One way is to add a large scoop to a medium scoop and subtract a small scoop.

$2\frac{1}{2} + 1\frac{3}{4} - 1$ Rewrite the mixed numbers as improper fractions.

$= \frac{5}{2} + \frac{7}{4} - 1$ A common denominator of 2, 4, and 1 is 4.

$= \frac{10}{4} + \frac{7}{4} - \frac{4}{4}$ Add the numerators.

$= \frac{17}{4} - \frac{4}{4}$ Subtract the numerators.

$= \frac{13}{4}$ Rewrite as a mixed number.

$= 3\frac{1}{4}$

A second way is to add two large scoops and subtract a medium scoop.

$2\frac{1}{2} + 2\frac{1}{2} - 1\frac{3}{4}$	Rewrite the mixed numbers as improper fractions.
$= \frac{5}{2} + \frac{5}{2} - \frac{7}{4}$	A common denominator of 2 and 4 is 4.
$= \frac{10}{4} + \frac{10}{4} - \frac{7}{4}$	Add the numerators.
$= \frac{20}{4} - \frac{7}{4}$	Subtract the numerators.
$= \frac{13}{4}$	Rewrite as a mixed number.
$= 3\frac{1}{4}$	

b) One way is to subtract two small scoops from a large scoop.

$2\frac{1}{2} - 2(1)$

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

$= \frac{1}{2}$

Another way is subtract 3 small scoops from 2 medium scoops.

$1\frac{3}{4} + 1\frac{3}{4} - 3(1)$	Rewrite the mixed numbers as improper fractions.
$= \frac{7}{4} + \frac{7}{4} - \frac{12}{4}$	Add the numerators.
$= \frac{14}{4} - \frac{12}{4}$	Subtract the numerators.
$= \frac{2}{4}$	Rewrite in lowest terms.
$= \frac{1}{2}$	

Section 2.3 Page 70 Question 23

Example:

$$
\begin{aligned}
&-2\frac{1}{6}-\left(-\frac{5}{6}\right)\\
&= \frac{-13}{6} + \frac{5}{6}\\
&= \frac{-8}{6}\\
&= -\frac{4}{3}
\end{aligned}
$$

Section 2.3 Page 70 Question 24

Yes. If the two rational numbers are both negative, the sum would be less than both.

Example:

$$
\begin{aligned}
&-\frac{1}{4} + -\frac{5}{6}\\
&= \frac{-3}{12} + \frac{-10}{12}\\
&= \frac{-13}{12}\\
&= -1\frac{1}{12}
\end{aligned}
$$

$-1\frac{1}{12}$ is less than both $-\frac{1}{4}$ and $-\frac{5}{6}$.

Section 2.3 Page 70 Question 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) $-\frac{1}{2}\left(-\frac{1}{2}\right) + \left[-\frac{1}{2} - \left(-\frac{1}{2}\right)\right] = \frac{1}{4}$

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

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

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

Section 2.3 Page 70 Question 26

To find the original fraction, perform inverse operations starting with $-3\frac{3}{4}$ in reverse order.

$\left[\left(-3\frac{3}{4} \times \left(-\frac{1}{4}\right)\right) - \frac{3}{4}\right] \div \left(-\frac{1}{2}\right)$ Rewrite the mixed number as an improper fraction.

$= \left[\left(\frac{-15}{4} \times \left(\frac{-1}{4}\right)\right) - \frac{3}{4}\right] \div \left(\frac{-1}{2}\right)$ Perform the operation within the innermost brackets.

$= \left(\frac{15}{16} - \frac{3}{4}\right) \div \left(\frac{-1}{2}\right)$ A common denominator for 16 and 4 is 16.

$= \left(\frac{15}{16} - \frac{12}{16}\right) \div \left(\frac{-1}{2}\right)$ Subtract the numerators.

$= \frac{3}{16} \div \left(\frac{-1}{2}\right)$ Dividing by $\frac{-1}{2}$ is the same as multiplying by its reciprocal.

$= \frac{3}{16} \times \frac{-2}{1}$ Multiply the numerators and multiply the denominators.

$= \frac{-6}{16}$ Write the fraction in lowest terms.

$= -\frac{3}{8}$

The original fraction was $-\frac{3}{8}$.

Section 2.3 Page 70 Question 27

By using guess and test, two values can be found.
One value is $x = 2$.

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

Substitute $x = 2$. $2 - \frac{1}{2} = 1\frac{1}{2}$

Another value of x is $-\frac{1}{2}$.

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

Substitute $x = -\frac{1}{2}$.

$-\frac{1}{2} - \left(1 \div \left(-\frac{1}{2}\right)\right)$ $\frac{1}{x}$ is the same as $1 \div x$. Dividing by $-\frac{1}{2}$ is the same as multiplying by its reciprocal.

$= -\frac{1}{2} - (1 \times -2)$

$= -\frac{1}{2} - (-2)$ Subtracting –2 is the same as adding the opposite of –2.

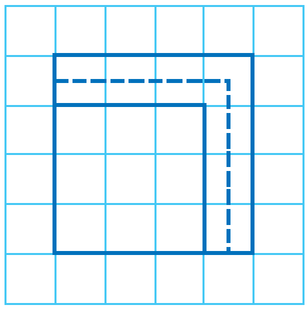
$= -\frac{1}{2} + 2$

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

2.4 Determining Square Roots of Rational Numbers

Section 2.4 Page 78 Question 5

Example: The square with sides of 3 units has an area of 9 square units. The square with sides of 4 units has an area of 16 square units. So, any number between 9 and 16 would have a square root between 3 and 4, such as 12.



Section 2.4 Page 78 Question 6

A square on a hundreds grid with sides of 7 by 7 would have an area of 49 square units. A square on a hundreds grid with sides of 8 by 8 would have an area of 64 square units. Since the squares actually represent 0.49 and 0.64, any value between these two numbers would have a square root between 0.7 and 0.8, such as 0.55.

Section 2.4 Page 78 Question 7

a) Estimate. $3^2 = 9$
Calculate.
$3.1^2 = 9.61$

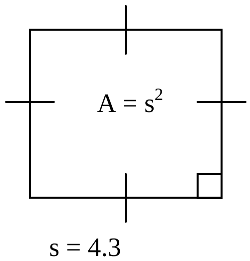
b) Estimate. $12^2 = 144$
Calculate.
$12.5^2 = 156.25$

c) Estimate. $0.6^2 = 0.36$
Calculate.
$0.62^2 = 0.3844$

d) Estimate. $0.3^2 = 0.09$
Calculate.
$0.29^2 = 0.0841$

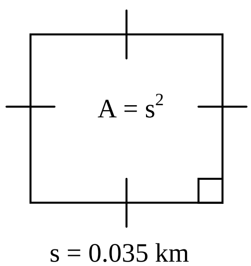
Section 2.4 Page 78 Question 8

a) Draw a diagram.



Estimate. $4^2 = 16$
Calculate.
$4.3^2 = 18.49$
The area of the square is 18.49 cm^2.

b) Draw a diagram.



Estimate. $0.04^2 = 0.0016$
Calculate.
$0.035^2 = 0.001\ 225$
The area of the square is 0.001 225 km^2.

Section 2.4 Page 78 Question 9

a) In $\frac{1}{16}$, both the numerator and denominator are perfect squares. $\frac{1}{16}$ can be expressed as the product of two equal rational factors, $\frac{1}{4} \times \frac{1}{4}$. So, $\frac{1}{16}$ is a perfect square.

b) In $\frac{5}{9}$, the numerator, 5 is not a perfect square. $\frac{5}{9}$ cannot be expressed as the product of two equal rational factors. So, $\frac{5}{9}$ is not a perfect square.

c) 0.36 can be expressed in fraction form as $\frac{36}{100}$. In $\frac{36}{100}$, both the numerator and denominator are perfect squares. $\frac{36}{100}$ can be expressed as the product of two equal rational factors, $\frac{6}{10} \times \frac{6}{10}$. So, 0.36 is a perfect square.

d) 0.9 can be expressed in fraction form as $\frac{9}{10}$. In $\frac{9}{10}$, the numerator, 9, is a perfect square. The denominator, 10, is not a perfect square. $\frac{9}{10}$ cannot be expressed as the product of two equal rational factors. So, 0.9 is not a perfect square.

Section 2.4 Page 78 Question 10

a) In $\frac{7}{12}$, the numerator, 7, is not a perfect square and the denominator,12, is not a perfect square. $\frac{7}{12}$ cannot be expressed as the product of two equal rational factors. So, $\frac{7}{12}$ is not a perfect square.

b) In $\frac{100}{49}$, both the numerator and denominator are perfect squares. $\frac{100}{49}$ can be expressed as the product of two equal rational factors, $\frac{10}{7} \times \frac{10}{7}$. So, $\frac{100}{49}$ is a perfect square.

c) 0.1 can be expressed in fraction form as $\frac{1}{10}$. In $\frac{1}{10}$, the numerator, 1, is a perfect square. The denominator, 10, is not a perfect square. $\frac{1}{10}$ cannot be expressed as the product of two equal rational factors. So, 0.1 is not a perfect square.

d) 0.01 can be expressed in fraction form as $\frac{1}{100}$. In $\frac{1}{100}$, both the numerator and denominator are perfect squares. $\frac{1}{100}$ can be expressed as the product of two equal rational factors, $\frac{1}{10} \times \frac{1}{10}$. So, $\frac{1}{100}$ is a perfect square.

Section 2.4 Page 79 Question 11

a) Determine the positive number that, when multiplied by itself, results in a product of 324. Use guess and check.
$15 \times 15 = 225$ Too low
$20 \times 20 = 400$ Too high
$18 \times 18 = 324$ Correct
So, $\sqrt{324} = 18$

b) Determine the positive number that, when multiplied by itself, results in a product of 2.89. Use fraction form.

$$\begin{aligned} 2.89 &= \frac{289}{100} \\ &= \frac{17}{10} \times \frac{17}{10} \\ &= 1.7 \times 1.7 \end{aligned}$$

So, $\sqrt{2.89} = 1.7$

c) Determine the positive number that, when multiplied by itself, results in a product of 0.0225. Use fraction form.

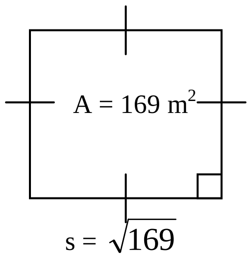
$$\begin{aligned} 0.0225 &= \frac{225}{10000} \\ &= \frac{15}{100} \times \frac{15}{100} \\ &= 0.15 \times 0.15 \end{aligned}$$

So, $\sqrt{0.0225} = 0.15$

d) Determine the positive number that, when multiplied by itself, results in a product of 2025. Use guess and check
$40 \times 40 = 1600$ Too low
$50 \times 50 = 2500$ Too high
$45 \times 45 = 2025$ Correct
So, $\sqrt{2025} = 45$

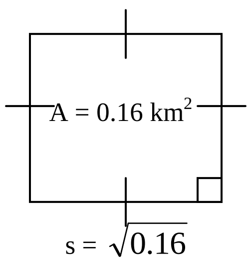
Section 2.4 Page 79 Question 12

a) Draw a diagram.



Determine the positive number that, when multiplied by itself, results in a product of 169. By inspection, $13 \times 13 = 169$. So, the side length of the square is 13 m.

b) Draw a diagram.



Determine the positive number that, when multiplied by itself, results in a product of 0.16. By inspection, $0.4 \times 0.4 = 0.16$. So, the side length of the square is 0.4 km.

Section 2.4 Page 79 Question 13

a) Estimate.
You can use the square root of a perfect square on each side of $\sqrt{39}$. $\sqrt{39}$ is between $\sqrt{36}$ and $\sqrt{49}$, but closer to $\sqrt{36}$. Since the $\sqrt{36}$ = 6 and $\sqrt{49}$ = 7, an estimate for $\sqrt{39}$ might be 6.
Calculate.
Use a calculator, entering the appropriate keystrokes for your calculator.
$\sqrt{39} \approx 6.244\ 997\ 998$
So, $\sqrt{39}$ = 6.2, to the nearest tenth.

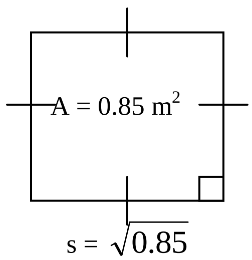
b) Estimate.
You can use the square root of a perfect square on each side of $\sqrt{4.5}$. $\sqrt{4.5}$ is between $\sqrt{4}$ and $\sqrt{9}$, but closer to $\sqrt{4}$. An estimate for $\sqrt{4.5}$ might be 2.
Calculate.
Use a calculator, entering the appropriate keystrokes for your calculator.
$\sqrt{4.5} \approx 2.121\ 320\ 344$
So, $\sqrt{4.5}$ = 2.12, to the nearest hundredth.

c) Estimate.
You can use the square root of a perfect square on each side of $\sqrt{0.87}$. $\sqrt{0.87}$ is between $\sqrt{0.81}$ and $\sqrt{1}$, but closer to $\sqrt{0.81}$. An estimate for $\sqrt{0.87}$ might be 0.9.
Calculate.
Use a calculator, entering the appropriate keystrokes for your calculator.
$\sqrt{0.87} \approx 0.932\ 737\ 905$
So, $\sqrt{0.87}$ = 0.933, to the nearest thousandth.

d) Estimate.
You can use the square root of a perfect square on each side of $\sqrt{0.022}$. $\sqrt{0.022}$ is about halfway between $\sqrt{0.01}$ and $\sqrt{0.04}$. An estimate for $\sqrt{0.022}$ might be 0.15.
Calculate.
Use a calculator, entering the appropriate keystrokes for your calculator.
$\sqrt{0.022} \approx 0.148\ 323\ 969$
So, $\sqrt{0.022}$ = 0.148, to the nearest thousandth.

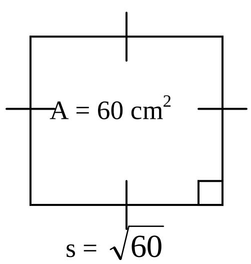
Section 2.4 Page 79 Question 14

a) Draw a diagram.



Determine the positive number that, when multiplied by itself, results in a product of 0.85.
Use a calculator, entering the appropriate keystrokes for your calculator.
$\sqrt{0.85} \approx 0.921\ 954\ 445$
So, the side length of the square, expressed to the nearest hundredth, is 0.92 m.

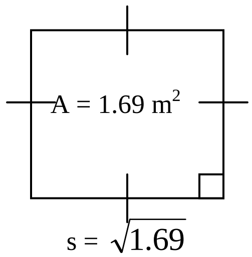
b) Draw a diagram.



Determine the positive number that, when multiplied by itself, results in a product of 60.
Use a calculator, entering the appropriate keystrokes for your calculator.
$\sqrt{60} \approx 7.745\ 966\ 692$
So, the side length of the square, expressed to the nearest hundredth, is 7.75 cm.

Section 2.4 Page 79 Question 15

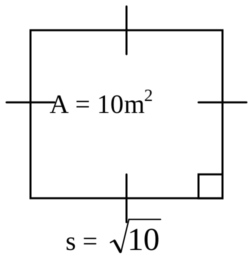
Draw a diagram.



Determine the positive number that, when multiplied by itself, results in a product of 1.69
Use a calculator, entering the appropriate keystrokes for your calculator.
$\sqrt{1.69} = 1.3$
So, the length of laminate Kai needs is 1.3 m.

Section 2.4   Page 79   Question 16

a) Draw a diagram.



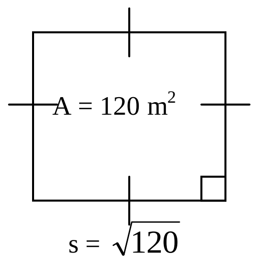
Determine the positive number that, when multiplied by itself, results in a product of 10.
Use a calculator, entering the appropriate keystrokes for your calculator.
$\sqrt{10} \approx 3.162\ 277\ 66$
So, the side length is 3.16 m, to the nearest hundredth of a metre.

b) To determine the area of the square that can be covered by a 3.79 –L can of paint, multiply 3.79 by 10 m^2.
$3.79 \times 10 = 37.9$ m^2
Determine the positive number that, when multiplied by itself, results in a product of 37.9.
Use a calculator, entering the appropriate keystrokes for your calculator.
$\sqrt{37.9} \approx 6.156\ 297\ 589$
So, the side length is 6.16 m to the nearest hundredth of a metre.

c) To determine the amount of paint needed, first determine the area to be painted.
Multiply 4.6 m by 4.6m by 2, since Nadia is applying two coats of paint.
$4.6 \times 4.6 \times 2 = 42.32$ m^2
Divide this area by 10.
$42.32 \div 10 = 4.232$
Nadia will use 4.2 L of paint.

Section 2.4 Page 79 Question 17

a) Draw a diagram.



Determine the positive number that, when multiplied by itself, results in a product of 120.
Use a calculator, entering the appropriate keystrokes for your calculator.
$\sqrt{120} \approx 10.954\ 451\ 15$
So, the side length is 10.95 m, to the nearest hundredth of a metre. The perimeter of the square would be found by multiplying 10.95 by 4.
$4 \times 10.95 \approx 43.8$
43.8 m of fencing would be needed. Multiply this amount by $80.
$43.8 \times 80 \approx 3504$
The cost of the fencing would be $3504.

b) Example: The cost will not be the same.

c) Find the side length of one square with an area of 60 m^2.
$s = \sqrt{60}$
$s \approx 7.745\ 966\ 692$
So, the side length is 7.75 m, to the nearest hundredth of a metre. The perimeter of the square would be found by multiplying 7.75 by 4 and then by 2 since there are two squares.
$7.75 \times 4 \times 2 \approx 62$
62 m of fencing would be needed to enclose the two squares. Multiply this amount by $80.
$62 \times 80 \approx 4960$
The cost of enclosing the two squares would be $4960.

Section 2.4 Page 79 Question 18

No. Example:
Find the side length of a square with an area of 500 cm^2.
$s = \sqrt{500}$
$s \approx 22.36$
A square with an area of 500 cm^2 would have a side length of 22.36 cm. This is too large for the frame that measures 30 cm by 20 cm.

Section 2.4 Page 79 Question 19

Find the side length of the square picture.
$s = \sqrt{100}$
$s = 10$
The side length of the square picture is 10 cm.

To find the area of the matting, multiply the area of the picture by 2.5.
$100 \times 2.5 = 250$

The area of the matting is 250 cm^2.

Find the side length of the outside edge of the matting.
$m = \sqrt{250}$
$m \approx 15.8$

To find the width of the matting, subtract 10 from 15.8 and divide by 2.
$(15.8 - 10) \div 2 = 2.9$
The width of the matting is 2.9 cm.

Section 2.4 Page 79 Question 20

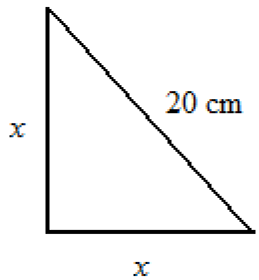
Find the area of the living room by multiplying 8.2 m by 4.5 m.
$8.2 \times 4.5 = 36.9$ m^2
The area of the living room is 36.9 m^2.
Multiply 36.9 by $\frac{2}{5}$.
Change $\frac{2}{5}$ to its decimal equivalent of 0.4.
$0.4 \times 36.9 = 14.76$
The area of the rug is 14.76 m^2.
Find the side length of the rug by finding the square root of 14.76.
$\sqrt{14.76} \approx 3.8$
The side length of the rug is 3.8 m.

Section 2.4 Page 80 Question 21

To find the distance from first base to second base, find the square root of 750.
$\sqrt{750} \approx 27.4$
The distance from first base to second base is 27.4 m.

Section 2.4 Page 80 Question 22

Draw a diagram.



Use the Pythagorean relationship.

$x^2 + x^2 = 20^2$ Combine like terms and evaluate the exponent.

$2x^2 = 400$ Divide both sides by 2.

$x^2 = 200$

$x = \sqrt{200}$

$x \approx 14.1$

The length of each leg is 14.1 cm.

Section 2.4 Page 80 Question 23

Convert 3 m and 2 m to centimetres.
3 m = 300 cm and 2 m = 200 cm
Find the area of the rectangular floor in square centimetres.
$300 \times 200 = 60\ 000$
The area of the rectangular floor is 60 000 cm^2.
Divide the area of the floor by the number of tiles, 384, to determine the area of each square tile. The assumption is that each tile is the same size.
$60\ 000 \div 384 = 156.25$
Each square tile has an area of 156.25 cm^2.
To find the side length of each square tile, find the square root of the area.
$\sqrt{156.25} = 12.5$
Each square tile has a side length of 12.5 cm.

Section 2.4 Page 80 Question 24

a) In the formula, $d = \sqrt{12.74 \times h}$, replace h with 4.1.

$d = \sqrt{12.74 \times h}$

$d = \sqrt{12.74 \times 4.1}$ Multiply.

$d = \sqrt{52.234}$ Find the square root.

$d \approx 7.2$

Adele can see 7.2 km across the ocean to the horizon.

b) Convert 165 cm to metres. 165 cm = 1.65 m

In the formula, $d = \sqrt{12.74 \times h}$, replace h with 1.65.

$d = \sqrt{12.74 \times h}$

$d = \sqrt{12.74 \times 1.65}$ Multiply.

$d = \sqrt{24.321}$ Find the square root.

$d \approx 4.6$

Brian can see 4.6 km across the ocean to the horizon.

c) Convert 5 km to metres. 5 km = 5000 m

In the formula, $d = \sqrt{12.74 \times h}$, replace h with 5000.

$d = \sqrt{12.74 \times h}$

$d = \sqrt{12.74 \times 5000}$ Multiply.

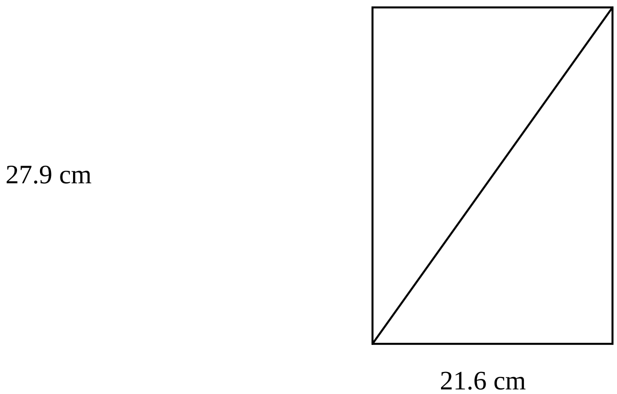
$d = \sqrt{63\ 700}$ Find the square root.

$d \approx 252.4$

Yvonne can see 252.4 km across the ocean to the horizon.

Section 2.4 Page 80 Question 25

Draw a diagram.



The longest line segment would be the diagonal. The diagonal forms the hypotenuse of a right triangle with legs of 21.6 cm and 27.9 cm.
Use the Pythagorean relationship, where *c* represents the length of the hypotenuse.

$$
\begin{aligned}
21.6^2 + 27.9^2 &= c^2 \\
466.56 + 778.41 &= c^2 \\
1244.97 &= c^2 \\
\sqrt{1244.97} &= c \\
35.3 &\approx c
\end{aligned}
$$

The length of the segment is 35.3 cm, to the nearest tenth of a centimetre.

Section 2.4 Page 80 Question 26

Multiply 200 by $\frac{3}{4}$ to determine the area of the square that will be covered.

$$
\begin{aligned}
&200 \times \frac{3}{4} \\
&= \frac{600}{4} \\
&= 150
\end{aligned}
$$

The area of the square that can be covered by $\frac{3}{4}$ of a bag of fertilizer is 150 m^2. To find the side measurements of the square, find the square root of 150.

$\sqrt{150} \approx 12.2$

The side length of the square is 12.2 m.

Section 2.4 Page 80 Question 27

The total surface of a cube is made up of six identical squares. So, divide the total surface area of the cube, 100 cm^2, by 6.
$100 \div 6 \approx 16.7$
The area of one face of the cube is 16.7 cm^2.
Find the square root of 16.7 to find the edge length of the cube.
$\sqrt{16.7} \approx 4.1$
The side length of the cube is 4.1 cm.

Section 2.4 Page 80 Question 28

a)

$t = \sqrt{4l}$	Replace *l* with 1.6 m.
$t = \sqrt{4(1.6)}$	Multiply 4 by 1.6.
$t = \sqrt{6.4}$	Find the square root of 6.4.
$t \approx 2.53$	

The period of the pendulum is 2.53 s.

b)

$t = \sqrt{4l}$	Replace *l* with 2.5 m.
$t = \sqrt{4(2.5)}$	Multiply 4 by 2.5.
$t = \sqrt{10}$	Find the square root of 10.
$t \approx 3.16$	

The period of the pendulum is 3.16 s.

c) Rewrite 50 cm as metres. 50 cm = 0.5 m

$t = \sqrt{4l}$	Replace *l* with 0.5 m.
$t = \sqrt{4(0.5)}$	Multiply 4 by 0.5.
$t = \sqrt{2}$	Find the square root of 2.
$t \approx 1.41$	

The period of the pendulum is 1.41 s.

Section 2.4 Page 80 Question 29

Determine the speed of sound on a day when the temperature is 30 °C.

$s = \sqrt{401(273 + t)}$ Replace t with 30.

$s = \sqrt{401(273 + 30)}$ Follow the order of operations.

$s = \sqrt{401(303)}$

$s = \sqrt{121\,503}$

$s \approx 349$

The speed of sound when the temperature is 30 °C is 349 m/s.

Determine the speed of sound on a day when the temperature is –20 °C.

$s = \sqrt{401(273 + t)}$ Replace t with –20.

$s = \sqrt{401(273 + (-20))}$ Follow the order of operations.

$s = \sqrt{401(253)}$

$s = \sqrt{101\,453}$

$s \approx 319$

The speed of sound when the temperature is –20 °C is 319 m/s.

Subtract the two speeds.

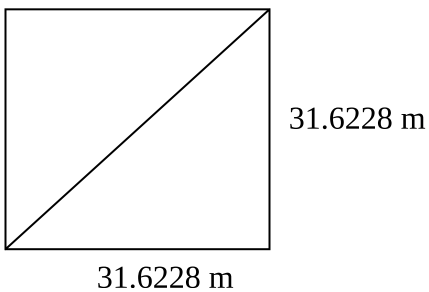
349 – 319 = 30

The difference in the speed of sound is 30 m/s.

Section 2.4 Page 80 Question 30

Determine the side length of the square field by finding the square root of 1000.
$\sqrt{1000} \approx 31.6228$
The side length of the square field is 31.6228 m.
The total distance Laura would walk if she walked along two sides would be found by multiplying 31.6228 m by 2.
$31.6228 \times 2 \approx 63.2456$
The total distance Laura would walk along two sides of the square field is 63.2456 m.

To find the amount of time this would take her, divide 63.2456 m by 1.5 m/s.
$63.2456 \div 1.5 \approx 42.1637$
It would take Laura 42.1637 s to walk along two sides of the square field.
To find the total distance Laura would walk if she walked from one corner to the opposite corner, draw a diagram.



Use the Pythagorean relationship. Let *c* represent the length of the hypotenuse.

$$\begin{aligned} 31.6228^2 + 31.6228^2 &\approx c^2 \\ 1000.001 + 1000.001 &\approx c^2 \\ 2000.002 &\approx c^2 \\ \sqrt{2000.002} &\approx c \\ 44.721 &\approx c \end{aligned}$$

The diagonal distance would be 44.721 m.
To find the total time it would take Laura to walk along the diagonal, divide 44.721 by 1.5.
$44.721 \div 1.5 \approx 29.814$
It would take Laura 29.814 s to walk along the diagonal.
To find the amount of time she would save, subtract 29.814 s from 42.1637 s.
$42.1637 - 29.814 \approx 12.3497$
She would save 12.3 s.

Section 2.4 Page 81 Question 31

a) Find the value of *s*. Replace *a*, *b*, and *c* with 15, 12, and 10.

$s = \dfrac{a + b + c}{2}$

$s = \dfrac{15 + 12 + 10}{2}$

$s = \dfrac{37}{2}$

$s = 18.5$

Find the value of *A*. Replace *a*, *b*, and *c* with 15, 12, and 10 and s with 18.5.

$A = \sqrt{s(s - a)(s - b)(s - c)}$

$A = \sqrt{18.5(18.5 - 15)(18.5 - 12)(18.5 - 10)}$

$A = \sqrt{18.5(3.5)(6.5)(8.5)}$

$A \approx \sqrt{3577.4375}$

$A = 59.811\ 68$

The area of the triangle is 59.8 cm^2.

b) Find the value of *s*. Replace *a*, *b*, and *c* with 9.3, 11.4, and 7.5.

$s = \dfrac{a + b + c}{2}$

$s = \dfrac{9.3 + 11.4 + 7.5}{2}$

$s = \dfrac{28.2}{2}$

$s = 14.1$

Find the value of *A*. Replace *a*, *b*, and *c* with 9.3, 11.4, and 7.5 and s with 14.1.

$A = \sqrt{s(s - a)(s - b)(s - c)}$

$A = \sqrt{14.1(14.1 - 9.3)(14.1 - 11.4)(14.1 - 7.5)}$

$A = \sqrt{14.1(4.8)(2.7)(6.6)}$

$A = \sqrt{1206.06}$

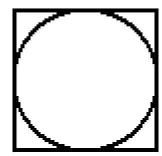
$A \approx 34.7$

The area of the triangle is 34.7 cm^2.

Section 2.4 Page 81 Question 32

Find the area of one of the squares by dividing 52 by 8.
$52 \div 8 = 6.5$
The area of one of the squares is 6.5 cm^2.
Find the side length of the square by finding the square root of 6.5.
$\sqrt{6.5} \approx 2.5495$
The side length of the square is 2.5495 cm.
Multiply 2.5495 by 14 to find the perimeter of the figure.
$2.5495 \times 14 = 36$ (rounded to the nearest centimetre).
The perimeter of the figure is 36 cm.

Section 2.4 Page 81 Question 33



The length of the circle's diameter would be equal to the side length of the square.
To find the side length of the square, calculate the square root of 32.
$\sqrt{32} \approx 5.6569$
The side length of the square is 5.6569 cm.
To find the radius of the circle, divide 5.6569 by 2.
$5.6569 \div 2 \approx 2.8284$
To find the area of the circle, substitute for $r = 2.8284$, in the following formula.
$A = \pi r^2$
$A = \pi (2.8284)^2$
$A \approx 25.1$
The area of the circle is approximately 25.1 cm^2.

Section 2.4 Page 81 Question 34

Replace A with 40 in the formula.
$r = \sqrt{\frac{A}{\pi}}$
$r = \sqrt{\frac{40}{\pi}}$
$r = \sqrt{12.7}$
$r \approx 3.6$
The radius is 3.6 m.

Section 2.4 Page 81 Question 35

Since the width is $\frac{1}{3}$ its length, the length is 3 times the width. Let x represent the width, let $3x$ represent the length. Substitute these expressions into the area formula for a rectangle. Replace A with 9.72.

$A = lw$

$9.72 = (3x)(x)$ Multiply.

$9.72 = 3x^2$ Divide both sides by 3.

$3.24 = x^2$ Find the square root of 3.24.

$\sqrt{3.24} = x$

$1.8 = x$

The width of the rectangle is 1.8 cm and the length is 3 × 1.8 or 5.4 cm.

Section 2.4 Page 81 Question 36

Find the inner most square root.

$\sqrt{65\ 536} = 256$

Find the middle square root.

$\sqrt{256} = 16$

Find the outer square root.

$\sqrt{16} = 4$

The expression is equal to 4.

Chapter 2 Review Page 82 Question 1

Two numbers represented by points that are the same distance in opposite directions from zero on a number line: OPPOSITES

Chapter 2 Review Page 82 Question 2

The quotient of two integers, where the divisor is not zero (2 words): RATIONAL NUMBER

Chapter 2 Review Page 82 Question 3

The product of two equal rational factors (2 words): PERFECT SQUARE

Chapter 2 Review Page 82 Question 4

A rational number that cannot be expressed as the product of two equal rational factors (2 words, 1 hyphenated): NON-PERFECT SQUARE

Chapter 2 Review Page 82 Question 5

$$\frac{24}{3} = 8$$

$$\frac{3}{24} = 0.125$$

$$\frac{-8}{2} = -4$$

$$\frac{-10}{-6} = 1.\overline{6}$$

$$\frac{-6}{4} = -1.5$$

$$-\left(\frac{-21}{-7}\right) = -3$$

$$\frac{82}{-12} = -6.8\overline{3}$$

$$-\left(\frac{-225}{15}\right) = 15$$

So, $\frac{3}{24}$, $\frac{-10}{-6}$, $\frac{-6}{4}$, and $\frac{82}{-12}$ cannot be expressed as integers.

Chapter 2 Review Page 82 Question 6

a) $\frac{-9}{6}$ Divide the numerator and denominator by 3.

$= \frac{-9 \div 3}{6 \div 3}$

$= \frac{-3}{2}$

So, $\frac{-9}{6} = \frac{-3}{2}$.

b) –0.86 is to the left of –0.84 on the number line. Therefore, –0.86 < –0.84.

c) $-\frac{3}{5} = -0.6$

–0.6 is to the right of –0.666… on the number line.
Therefore, –0.6 > –0.666…

d) $-1\frac{3}{10} = \frac{-13}{10}$

$-\left(\frac{-13}{-10}\right) = \frac{-13}{10}$

Therefore, $-1\frac{3}{10} = -\left(\frac{-13}{-10}\right)$.

e) $-\frac{8}{12} = -0.\overline{6}$

$-\frac{11}{15} = -0.7\overline{3}$

$-0.7\overline{3}$ is to the left of $-0.\overline{6}$ on the number line.

Therefore, $\frac{-8}{12} > \frac{-11}{15}$.

f) $-2\frac{5}{6} = -2.8\overline{3}$

$-2\frac{7}{8} = -2.875$

$-2.8\overline{3}$ is to the right of –2.875 on the number line.

Therefore, $-2\frac{5}{6} > -2\frac{7}{8}$.

Chapter 2 Review   Page 82   Question 7

a) Example: Axel wrote each fraction in an equivalent form, so both fractions had a common denominator. He then compared the numerators to find that –6 < –5.
$-1\frac{1}{2} < -1\frac{1}{4}$

b) Example: Bree wrote $\frac{-3}{2}$ 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 $\frac{-2}{4} < \frac{-1}{4}$. So $-1\frac{1}{2} < -1\frac{1}{4}$.

d) Example: Caitlin's method is preferred. It involves fewer computations.

Chapter 2 Review   Page 82   Question 8

Example: If the fraction must be between 0 and –1, it must be negative. If its numerator must be 5, its denominator must be –6 or smaller. $\frac{5}{-6}$ and $\frac{5}{-7}$

Chapter 2 Review   Page 82   Question 9

a) –5.68 + 4.73 = –0.95

b) –0.85 – (–2.34) can be rewritten as –0.85 + 2.34.
Subtracting –2.34 is the same as adding the opposite of –2.34.
–0.85 + 2.34 = 1.49

c) 1.8(–4.5) = –8.1

d) –3.77 ÷ –2.9 = 1.3

Chapter 2 Review Page 82 Question 10

a) $5.3 \div (-8.4) = -0.6$ (rounded to the nearest tenth)

b) $-0.25 \div (-0.031) = 8.1$ (rounded to the nearest tenth)

c) $-5.3 + 2.4[7.8 + (-8.3)]$	Perform the operation inside the brackets.
$= -5.3 + 2.4[-0.5]$	Multiply.
$= -5.3 + (-1.2)$	Add.
$= -6.5$	

d) $4.2 - 5.6 \div (-2.8) - 0.9$	Divide.
$= 4.2 - (-2) - (0.9)$	Subtracting an integer is the same as adding the opposite integer.
$= 4.2 + 2 + (-0.9)$	Add from left to right.
$= 5.3$	

Chapter 2 Review Page 82 Question 11

To determine the average rate of change in the temperature, find the total amount that decreased by subtracting –3.2 from 2.4.

$2.4 - (-3.2)$
$= 2.4 + 3.2$
$= 5.6$

Divide the amount decreased by 3.5.
$5.6 \div 3.5 = 1.6$
The temperature decreased 1.6 °C/h.

Chapter 2 Review Page 82 Question 12

To find the company's profit or loss, first multiply the loss of $1.2 million by 4.
–1.2 million × 4 = –4.8 million
Subtract –$4.8 million from –$3.5 million.
–3.5 million – (–4.8 million)
= –3.5 million + 4.8 million
= 1.3 million
The company had a profit of $1.3 million in the fifth year.

Chapter 2 Review **Page 83** **Question 13**

a) $\frac{2}{3} - \frac{4}{5}$ A common denominator of 3 and 5 is 15.

$= \frac{10}{15} - \frac{12}{15}$ Subtracting $\frac{12}{15}$ is the same as adding the opposite of $\frac{12}{15}$.

$= \frac{10}{15} + \frac{-12}{15}$ Add the numerators.

$= -\frac{2}{15}$

b) $-\frac{3}{8} + \left(-\frac{3}{4}\right)$ A common denominator of 8 and 4 is 8.

$= \frac{-3}{8} + \frac{-6}{8}$ Add the numerators.

$= \frac{-9}{8}$

$= -1\frac{1}{8}$

c) $-3\frac{3}{5} + 1\frac{7}{10}$ Rewrite the mixed numbers as improper fractions.

$= \frac{-18}{5} + \frac{17}{10}$ A common denominator of 5 and 10 is 10.

$= \frac{-36}{10} + \frac{17}{10}$ Add the numerators.

$= \frac{-19}{10}$ Rewrite the improper fraction as a mixed number.

$= -1\frac{9}{10}$

d) $2\,2\frac{1}{3} - \left(-2\frac{1}{4}\right)$ Rewrite the mixed numbers as improper fractions.

$= \frac{7}{3} - \frac{-9}{4}$ Subtracting $\frac{-9}{4}$ is the same as adding the opposite of $\frac{-9}{4}$.

$= \frac{7}{3} + \frac{9}{4}$ A common denominator of 3 and 4 is 12.

$= \frac{28}{12} + \frac{27}{12}$ Add the numerators.

$= \frac{55}{12}$ Rewrite the improper fraction as a mixed number.

$= 4\frac{7}{12}$

Chapter 2 Review   Page 83   Question 14

a) $-\frac{1}{2}\left(-\frac{8}{9}\right)$ Multiply the numerators and multiply the denominators.

$= \frac{8}{18}$ Write the fraction in lowest terms.

$= \frac{4}{9}$

b) $-\frac{5}{6} \div \frac{7}{8}$ Dividing by $\frac{7}{8}$ is the same as multiplying by the reciprocal of $\frac{7}{8}$.

$= \frac{-5}{6} \times \frac{8}{7}$ Multiply the numerators and multiply the denominators.

$= \frac{-40}{42}$ Write the fraction in lowest terms.

$= -\frac{20}{21}$

c) $2\frac{3}{4} \times \left(-4\frac{2}{3}\right)$ Rewrite the mixed numbers as improper fractions.

$= \frac{11}{4} \times \frac{-14}{3}$ Multiply the numerators and multiply the denominators.

$= \frac{-154}{12}$ Rewrite the improper fraction as a mixed number in lowest terms.

$= -12\frac{5}{6}$

d) $-4\frac{7}{8} \div \left(-2\frac{3}{4}\right)$ Rewrite the mixed numbers as improper fractions.

$= \frac{-39}{8} \div \frac{-11}{4}$ Dividing by $\frac{-11}{4}$ is the same as multiplying by the reciprocal of $\frac{-11}{4}$.

$= \frac{-39}{8} \times \frac{-4}{11}$ Multiply the numerators and multiply the denominators.

$= \frac{156}{88}$ Rewrite the improper fraction as a mixed number in lowest terms.

$= 1\frac{17}{22}$

Chapter 2 Review   Page 83   Question 15

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

Chapter 2 Review Page 83 Question 16

To find the number of hours in $2\frac{1}{2}$ weeks, change $2\frac{1}{2}$ to its decimal equivalent.

$2\frac{1}{2} = 2.5$

Multiply 2.5 by 7 because there are 7 days in a week.
$2.5 \times 7 = 17.5$
There are 17.5 days in 2.5 weeks. Multiply 17.5 by 24 because there are 24 hours in a day.
$17.5 \times 24 = 420$
Therefore, there are 420 h in $2\frac{1}{2}$ weeks.

Chapter 2 Review Page 83 Question 17

To express the area of Yukon Territory as a fraction of the total area of the Atlantic provinces, multiply $\frac{3}{4}$ by $1\frac{1}{5}$.

$\frac{3}{4} \times 1\frac{1}{5}$	Rewrite the mixed number as an improper fraction.
$= \frac{3}{4} \times \frac{6}{5}$	Multiply the numerators and multiply the denominators.
$= \frac{18}{20}$	Rewrite in lowest terms.
$= \frac{9}{10}$	

Yukon Territory is $\frac{9}{10}$ of the area of the Atlantic provinces.

Chapter 2 Review Page 83 Question 18

a) In $\frac{64}{121}$, both the numerator and denominator are perfect squares. $\frac{64}{121}$ can be expressed as the product of two equal rational factors, $\frac{8}{11} \times \frac{8}{11}$. So, $\frac{64}{121}$ is a perfect square.

b) In $\frac{7}{4}$, the numerator, 7, is not a perfect square. $\frac{7}{4}$ cannot be expressed as the product of two equal rational factors. So, $\frac{7}{4}$ is not a perfect square.

c) 0.49 can be expressed in fraction form as $\frac{49}{100}$. In $\frac{49}{100}$, the numerator, 49, and the denominator, 100, are perfect squares. $\frac{49}{100}$ can be expressed as the product of two equal rational factors, $\frac{7}{10} \times \frac{7}{10}$ So, 0.49 is a perfect square.

d) 1.6 can be expressed in fraction form as $\frac{16}{10}$. In $\frac{16}{10}$, the numerator, 16 is a perfect square, but the denominator, 10 is not a perfect square. So, 1.6 is not a perfect square.

Chapter 2 Review Page 83 Question 19

Example: 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.

Chapter 2 Review Page 83 Question 20

To find the number that has a square root of 0.15, square 0.15.
$0.15^2 = 0.0225$
A number that has as its square root 0.15 is 0.0225.

Chapter 2 Review Page 83 Question 21

a) $\sqrt{12.96} = 3.6$

b) $\sqrt{0.05} = 0.224$ (rounded to the nearest thousandth)

Chapter 2 Review Page 83 Question 22

a) Example: when the number is greater than 1. The square root of 49 is 7.

b) Example: when the number is between 0 and 1. The square root of 0.16 is 0.4.

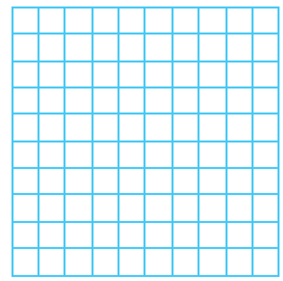
Chapter 2 Review Page 83 Question 23

a) The side length of each small square on the grid is 1.5 cm. Example: one method is to find the square root of 225, and divide by 10.

$\sqrt{225} \div 10$
$= 15 \div 10$
$= 1.5$

The second method is to divide 225 by 100, then find the square root of the quotient.

$225 \div 100 = 2.25$
$\sqrt{2.25} = 1.5$



$A = 225 \text{ cm}^2$

b) The length of the diagonal can be found by using the Pythagorean relationship. The diagonal forms two right triangles. The legs of each right triangle are each 15 cm since the area of the square is 225 cm^2.

$$A = s^2$$
$$225 = s^2$$
$$\sqrt{225} = s$$
$$15 = s$$

Use the Pythagorean relationship.

$$15^2 + 15^2 = c^2$$
$$225 + 225 = c^2$$
$$450 = c^2$$
$$\sqrt{450} = c$$
$$21.2 \approx c$$

The length of the diagonal is 21.2 cm.

Chapter 2 Review Page 83 Question 24

a) Find the area of the ceiling by multiplying 5.2 by 5.2.
$5.2 \times 5.2 = 27.04$
The area of the ceiling is 27.04 m^2.
To find the number of cans of paint needed, divide the area, 27.04 m^2, by 11.
$27.04 \div 11 = 2.5$
To paint the ceiling 2.5 L of paint would be needed.

b) 4 L of paint would cover 44 m^2. To find the dimensions of a square with area of 44 m^2, calculate the square root of 44.
$\sqrt{44} \approx 6.6$
The ceiling would be 6.6 m by 6.6 m.

Chapter 2 Review Page 83 Question 25

To find the time, use the following formula:
$t = \sqrt{\frac{h}{0.81}}$ Replace *h* with 200.
$t = \sqrt{\frac{200}{0.81}}$
$t \approx \sqrt{246.9}$
$t \approx 15.7$
The object would take 15.7 s to reach the surface of the moon.

Chapter 2 Practice Test

Chapter 2 Practice Test Page 84 Question 1

Rewrite $\frac{4}{-6}$ in lowest terms.

$\frac{4}{-6} = \frac{-2}{3}$

Choice A:

Rewrite $-\left(\frac{-10}{15}\right)$ in lowest terms.

$-\left(\frac{-10}{15}\right) = \frac{2}{3}$

$\frac{2}{3}$ is not equal to $\frac{-2}{3}$. $-\left(\frac{-10}{15}\right)$ is choice A. So the answer is A.

Chapter 2 Practice Test Page 84 Question 2

Rewrite $-1\frac{5}{6}$ as a decimal.

$-1\frac{5}{6} = -1.8\bar{3}$

Rewrite $-1\frac{7}{8}$ as a decimal.

$-1\frac{7}{8} = -1.875$

Rewrite $-1\frac{4}{5}$ as a decimal.

$-1\frac{4}{5} = -1.8$

Choice A, $-1.\bar{8}$, is less than $-1\frac{5}{6}$.

Choice B, $-1\frac{7}{8}$, is less than $-1\frac{5}{6}$.

Choice C, $-1.8\bar{3}$, is equal to $-1\frac{5}{6}$.

Choice D, $-1\frac{4}{5}$, is greater than $-1\frac{5}{6}$.

So, the answer is D.

Chapter 2 Practice Test Page 84 Question 3

Change each fraction to its decimal equivalent.
Choice A:
$\frac{-17}{50}$ = –0.34
Choice B:
$\frac{-9}{25}$ = –0.36
Choice C:
$\frac{-7}{20}$ = –0.35
Choice D:
$\frac{35}{100}$ = 0.35
So, the value between –0.36 and –0.34 is choice C, $\frac{-7}{20}$ = –0.35.

Chapter 2 Practice Test Page 84 Question 4

–3.78 – (–2.95) Subtracting –2.95 is the same as adding the opposite of –2.95.
= –3.78 + 2.95
= –0.83
So, the answer is choice B

Chapter 2 Practice Test   Page 84   Question 5

Multiply the numerators and multiply the denominators.

$$\frac{3}{5} \times \left(-\frac{6}{7}\right) = -\frac{18}{35}$$

Choice A:

$$-\frac{3}{7} \times \left(\frac{6}{5}\right) = -\frac{18}{35}$$

Choice B:

$$\frac{3}{-5} \times \frac{6}{7} = -\frac{18}{35}$$

Choice C:

$$\frac{-3}{5} \times \left(\frac{-6}{-7}\right) = -\frac{18}{35}$$

Choice D:

$$\frac{-3}{-5} \times \frac{6}{7} = \frac{18}{35}$$

$-\frac{18}{35}$ is not equal to $\frac{18}{35}$, so the answer is D.

Chapter 2 Practice Test   Page 84   Question 6

To determine which value is the best estimate for $\sqrt{1.6}$, square each number. The one that is closest to 1.6 is the best estimate.

Choice A:

$2.6^2 = 6.76$

Choice B:

$1.3^2 = 1.69$

Choice C:

$0.8^2 = 0.64$

Choice D:

$0.4^2 = 0.16$

Choice B, 1.69, is the closest. So, the answer is B.

Chapter 2 Practice Test Page 84 Question 7

Choice A:

In $\frac{1}{25}$, both the numerator and denominator are perfect squares. $\frac{1}{25}$ can be expressed as the product of two equal rational factors, $\frac{1}{5} \times \frac{1}{5}$. So, $\frac{1}{25}$ is a perfect square.

Choice B:

Rewrite 0.16 as a fraction.

$0.16 = \frac{16}{100}$

In $\frac{16}{100}$, both the numerator and denominator are perfect squares. $\frac{16}{100}$ can be expressed as the product of two equal rational factors, $\frac{4}{10} \times \frac{4}{10}$. So, $\frac{16}{100}$ is a perfect square.

Choice C:

Rewrite 0.9 as a fraction.

$0.9 = \frac{9}{10}$

In $\frac{9}{10}$, the numerator is a perfect square, but the denominator is not a perfect square. So, $\frac{9}{10}$ cannot be a perfect square.

The answer is C.

Chapter 2 Practice Test Page 84 Question 8

Find the side length of the square, by finding the square root of 1.44.

$\sqrt{1.44} = 1.2$

The side length of the square is 1.2 m.

To find the perimeter, multiply the side length by 4.

$1.2 \times 4 = 4.8$

The perimeter of the square is 4.8 m.

Chapter 2 Practice Test Page 84 Question 9

Rewrite $-3\frac{5}{11}$ as a decimal.

$-3\frac{5}{11} = -3.\overline{45}$

Since $-3.\overline{45}$ is less than –3.4545, $-3\frac{5}{11}$ would be to the left of –3.4545 on a number line.

Chapter 2 Practice Test Page 84 Question 10

Example: any integer can be written as a quotient of two integers by making the integer the dividend and the number, 1, the divisor.

Example: $9 = \frac{9}{1}$

Chapter 2 Practice Test Page 84 Question 11

To arrange the numbers in descending order, rewrite each fraction as its decimal equivalent. Then, compare their value by locating them on a number line.

$\frac{19}{20} = 0.95$

$\frac{9}{10} = 0.9$

$\frac{9}{-10} = -0.9$

The numbers in descending order are $\frac{19}{20}$, 0.94, $\frac{9}{10}$, $\frac{9}{-10}$, –1.2, $-1.\overline{2}$.

Chapter 2 Practice Test Page 84 Question 12

Between –2 and –3 there would be 5 fractions with a denominator of 6.

$-2\frac{1}{6}$, $-2\frac{2}{6}$, $-2\frac{3}{6}$, $-2\frac{4}{6}$, $-2\frac{5}{6}$

Three of these fractions can be rewritten in lowest terms.

$-2\frac{2}{6} = -2\frac{1}{3}$

$-2\frac{3}{6} = -2\frac{1}{2}$

$-2\frac{4}{6} = -2\frac{2}{3}$

Chapter 2 Practice Test Page 84 Question 13

a) $1\frac{4}{5} - 2\frac{2}{3}$ Rewrite the mixed numbers as improper fractions.

$= \frac{9}{5} - \frac{8}{3}$ A common denominator of 5 and 3 is 15.

$= \frac{27}{15} - \frac{40}{15}$ Subtracting $\frac{40}{15}$ is the same as adding the opposite of $\frac{40}{15}$.

$= \frac{27}{15} + \frac{-40}{15}$ Add the numerators.

$= -\frac{13}{15}$

b) –3.21 + 1.84

= –1.37 Line up the decimals.

c) $\frac{5}{8} \div \left(-\frac{11}{12}\right)$ Multiply by the reciprocal of the divisor.

$= \frac{5}{8} \times \frac{-12}{11}$ Multiply the numerators and multiply the denominators.

$= \frac{-60}{88}$ Rewrite in lowest terms.

$= -\frac{15}{22}$

d) $-2\frac{5}{7}\left(-3\frac{1}{2}\right)$ Rewrite the mixed numbers as improper fractions.

$= \frac{-19}{7} \times \frac{-7}{2}$ Multiply the numerators and multiply the denominators.

$= \frac{133}{14}$ Change the improper fraction to a mixed number in lowest terms.

$= 9\frac{1}{2}$

e) –3.66 ÷ (–1.5)

= 2.44

f) $-\frac{5}{6}+\left(-\frac{1}{12}\right)$ A common denominator of 6 and 12 is 12.

$= \frac{-10}{12}+\frac{-1}{12}$ Add the numerators.

$= -\frac{11}{12}$

Chapter 2 Practice Test Page 84 Question 14

Since Donovan Bailey beat Frankie Fredericks that means that Fredericks' time was $\frac{5}{100}$ greater than Bailey's time. To find Fredericks' time, change $\frac{5}{100}$ into its decimal equivalent.

$\frac{5}{100} = 0.05$
Add 0.05 to 9.84.
$0.05 + 9.84 = 9.89$
Fredericks' time was 9.89 s.

Chapter 2 Practice Test Page 85 Question 15

The sum of a number and its opposite is zero. So, the average would be zero.
Examples:

$[1.2 + (-1.2)] \div 2$
$= 0 \div 2$
$= 0$

$\left(-\frac{5}{8} + \frac{5}{8}\right) \div 2$
$= 0 \div 2$
$= 0$

Chapter 2 Practice Test Page 85 Question 16

Rewrite 31.36 as a fraction.
$31.36 = \frac{3136}{100}$
In $\frac{3136}{100}$, both the numerator and denominator are perfect squares. $\frac{3136}{100}$ can be expressed as the product of two equal rational factors, $\frac{56}{10} \times \frac{56}{10}$. So, $\frac{3136}{100}$ is a perfect square.

Chapter 2 Practice Test Page 85 Question 17

a) To find the number whose square root is 6.1, square 6.1.
$6.1^2 = 37.21$
$\sqrt{37.21} = 6.1$

b) $\sqrt{0.1369} = 0.37$

c) $\sqrt{7} \approx 2.645\ 751\ 311$
$\sqrt{7} = 2.65$ (rounded to the nearest hundredth)

Chapter 2 Practice Test Page 85 Question 18

a) The perimeter of the shape is made up of 16 side lengths of the squares. To find the side length of one square, divide 40 cm by 16.
$40 \div 16 = 2.5$
The side of each square is 2.5 cm.
The area of one square is found by squaring 2.5.
$2.5^2 = 6.25$
The area of one square is 6.25 cm^2.
To find the area of 10 squares, multiply 6.25 cm^2 by 10.
$6.25 \times 10 = 62.5$
The area of the shape is 62.5 cm^2.

b) To find the area of one square, divide 75 cm^2 by 10.
$75 \div 10 = 7.5$
The area of one square is 7.5 cm^2.
To find the side length of one square, find the square root of 7.5
$\sqrt{7.5} \approx 2.7$
The side length of one square is 2.7 cm.
To find the perimeter of the shape, multiply 2.7 cm by 16.
$2.7 \times 16 = 43.2$
The perimeter of the shape is 43.2 cm.

Chapter 2 Practice Test Page 85 Question 19

To find how much Ron received for each share, multiply 75 by $15.64.
$75 \times 15.64 = 1173$
Ron received $1173 when he sold his shares. This represents a loss of $260.25, so add $1173 to $260.25
$1173 + 260.25 = 1433.25$
Divide $1433.25 by 75 to find the cost per share when Ron bought the shares.
$1433.25 \div 75 = 19.11$
Ron paid $19.11 per share when he bought the shares.

Chapter 2 Practice Test Page 85 Question 20

a) Example: the sum must be 1 because no other elements make up a quarter's content.

b) $\frac{11}{500} + \frac{19}{500} + \frac{47}{50}$

$= \frac{11}{500} + \frac{19}{500} + \frac{470}{500}$ A common denominator of 500 and 50 is 500.

$= \frac{500}{500}$ Add the numerators.

$= 1$

c) Divide the mass of the steel by the sum of the masses of the nickel and the copper.
Rewrite each fraction as a decimal.

$\frac{11}{500} = 0.022$ (the mass of nickel)

$\frac{19}{500} = 0.038$ (the mass of copper)

$\frac{470}{500} = 0.94$ (the mass of steel)

The sum of the masses of the nickel and copper is $0.022 + 0.038 = 0.06$.

$0.94 \div 0.06 = 15.\overline{6}$

The mass of the steel is $15.\overline{6}$ times as great as the combined mass of the nickel and the copper.

d) Find the mass of copper in one quarter by multiplying 4.4 g by $\frac{19}{500}$.

Rewrite $\frac{19}{500}$ as a decimal. $\frac{19}{500} = 0.038$

$0.038 \times 4.4 = 0.1672$

The mass of copper in one quarter is 0.1672 g.

To find the mass of copper in 40 quarters, multiply 0.1672 by 40. $0.1672 \times 40 = 6.688$

The mass of copper in 40 quarters is 6.688 g.

Find the mass of nickel in one quarter by multiplying 4.4 by $\frac{11}{500}$.

Rewrite $\frac{11}{500}$ as a decimal. $\frac{11}{500} = 0.022$

$0.022 \times 4.4 = 0.0968$

The mass of nickel in one quarter is 0.0968 g.

To find the mass of nickel in 40 quarters, multiply 0.0968 by 40. $0.0968 \times 40 = 3.872$

The mass of nickel in 40 quarters is 3.872 g.

To find how much greater the mass of copper is than the mass of nickel, subtract 3.872 g from 6.688 g. $6.688 - 3.872 = 2.816$

The difference in mass is 2.816 g.