Practise

For help with #1 and #2, refer to Example 1 on page 21.

1. Calculate.

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

b) $2\frac{1}{3} + \left(-1\frac{1}{4}\right)$

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

d) $-2\frac{1}{2} - \left(-3\frac{1}{3}\right)$

e) $-\frac{5}{6} + \frac{1}{3}$

f) $\frac{3}{8} - \left(-\frac{1}{4}\right)$

2. Calculate.

a) $\frac{2}{3} - \frac{3}{4}$

b) $-\frac{2}{9} + \left(-\frac{1}{3}\right)$

c) $-\frac{1}{4} + \left(-\frac{3}{5}\right)$

d) $-\frac{3}{4} - \left(-\frac{5}{8}\right)$

e) $1\frac{1}{2} - 2\frac{1}{4}$

f) $1\frac{2}{5} + \left(-1\frac{3}{4}\right)$

For help with #3 and #4, refer to Example 2 on page 22.

3. Calculate.

a) $\frac{4}{5} \div \frac{5}{6}$

b) $\left(3\frac{1}{3}\right)\left(1\frac{3}{4}\right)$

c) $\frac{1}{8} \times \left(-\frac{2}{5}\right)$

d) $-\frac{9}{10} \div \left(-\frac{4}{5}\right)$

e) $-\frac{3}{8} \times 5\frac{1}{3}$

f) $\frac{1}{10} \div \left(-\frac{3}{8}\right)$

4. Calculate.

a) $-\frac{3}{4} \times \left(-\frac{1}{9}\right)$

b) $1\frac{1}{3} \div 1\frac{1}{4}$

c) $-\frac{3}{8} \div \frac{7}{10}$

d) $-2\frac{1}{8} \div 1\frac{1}{4}$

e) $\left(\frac{7}{9}\right)\left(-\frac{6}{11}\right)$

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

Apply

For help with this section, refer to Example 3 on page 23.

5. Lori owes her mother \$39. Lori pays back $\frac{1}{3}$ of this debt and then pays back $\frac{1}{4}$ of the remaining debt. How much does Lori still owe her mother?

6. A recipe calls for $\frac{2}{3}$ cup of butter. If the recipe is quadrupled, express the amount of butter needed as

a) an improper fraction **b)** a mixed number

7. A carpenter has 64 feet of baseboard. He installs $\frac{1}{2}$ of the baseboard in one room. He installs $\frac{3}{4}$ of the remaining amount of baseboard in another room. How much baseboard does he have left?

9. Predict the next three numbers in each pattern.

a) $-1\frac{1}{2}, -\frac{7}{8}, -\frac{1}{4}, \frac{3}{8}, \ldots$

b) $1\frac{1}{3}, -\frac{2}{3}, \frac{1}{3}, -\frac{1}{6}, \frac{1}{12}, \ldots$

10. Draw a semicircle in your notebook. Imagine travelling counterclockwise around the outside of the semicircle. Indicate the location of each of the following fractional distances.

a) $\frac{1}{2}$ **b)** $\frac{1}{4}$ **c)** $\frac{1}{3}$ **d)** $\frac{1}{6}$

e) $\frac{3}{4}$ **f)** $\frac{2}{3}$ **g)** $\frac{5}{6}$ **h)** $\frac{2}{5}$

11. Taj has three scoops for measuring flour. The largest scoop holds $2\frac{1}{2}$ times as much as the smallest one. The middle scoop holds $1\frac{3}{4}$ times as much as the smallest one. Describe two ways in which Taj could measure each of the following quantities if he can only use full scoops.

a) $3\frac{1}{4}$ times as much as the smallest scoop holds

b) $\frac{1}{2}$ as much as the smallest scoop holds

12. ✓ **Competency Check**

a) Write a subtraction statement involving two negative fractions or negative mixed numbers so that the difference is $-\frac{4}{3}$.

b) Write an addition, a multiplication, and a division statement with the same answer.

c) Compare your statements with a classmate's. How are they alike? How are they different?

Rich Problems

1. a) When you multiply two fractions, the answer is $\frac{4}{7}$. What are two possible fractions?

b) When you multiply two fractions, the answer is close to 1. What are two possible fractions?

2. If a U.S. dollar is worth $1.30 in Canadian dollars, what is a Canadian dollar worth in U.S. dollars? Explain your reasoning.

3. Use the four numbers 3, 4, 5, and 7 to create two fractions that give the biggest and smallest answers when multiplied and divided.

8. Suppose a 1-L can of paint covers 11 m^2.

a) How many cans of paint would you need to paint a ceiling that is 5.2 m by 5.2 m? Show your work.

b) Determine the maximum dimensions of a square ceiling you could paint with 4 L of paint. Express your answer to the nearest tenth of a metre.

1.2 Rational Numbers in Decimal Form, pages 14–19

9. Calculate.

a) $-5.68 + 4.73$

b) $-0.85 - (-2.34)$

c) $1.8(-4.5)$

d) $-3.77 \div (-2.9)$

10. Evaluate. Express your answer to the nearest tenth, if necessary.

a) $5.3 \div (-8.4)$

b) $-0.25 \div (-0.031)$

c) $-5.3 + 2.4[7.8 + (-8.3)]$

d) $4.2 - 5.6 \div (-2.8) - 0.9$

11. One evening in Prince George, BC, the temperature decreased from 2.4 °C to −3.2 °C in 3.5 h. What was the average rate of change in temperature per hour?

12. Over a 4-year period, a company lost an average of \$1.2 million per year. The company's total losses by the end of 5 years were \$3.5 million. What was the company's profit or loss in the fifth year?

14. Evaluate.

a) $-\frac{1}{2}\left(-\frac{8}{9}\right)$

b) $-\frac{5}{6} \div \frac{7}{8}$

c) $2\frac{3}{4} \times \left(-4\frac{2}{3}\right)$

d) $-4\frac{7}{8} \div \left(-2\frac{3}{4}\right)$

15. How many hours are there in $2\frac{1}{2}$ weeks? Show your work using decimals and fractions.

16. The area of Manitoba is about $1\frac{1}{5}$ times the total area of the four Atlantic provinces. The area of Yukon Territory is about $\frac{3}{4}$ the area of Manitoba. Express the area of Yukon Territory as a fraction of the total area of the Atlantic provinces.

17. Without doing any calculations, compare the values of the following two quotients. Explain your reasoning.

$96\frac{7}{8} \div 7\frac{3}{4}$

$-96\frac{7}{8} \div \left(-7\frac{3}{4}\right)$

1.4 Order of Operations With Rational Numbers, pages 28–31

18. Calculate.

a) $\left(\frac{1}{7} + \frac{1}{3}\right) \div \left(\frac{1}{3} - \frac{1}{7}\right) + 1\frac{1}{4}$

b) $\sqrt{4 + 0.5^2 \times 12 + (20 \times 0.1)}$

c) $9.7 + 4.9 - 20.5 \times 5.2$

d) $\left(2\frac{2}{3}\right)\left(\frac{2}{5}\right) + \left(-\frac{2}{5}\right) \div \frac{3}{8}$

e) $1.3 \times 2.5 + 5.6 \times (-2.5) \div 1.4$

f) $\sqrt{3.4 + 2.3 - (0.4 \times 5.5) + 5.5}$

8. Solve for each unknown quantity. Do as many as you can using mental math.

a) $\frac{6}{5} = \frac{18}{x}$

b) $\frac{9}{x} = \frac{36}{24}$

c) $\frac{16}{22} = \frac{32}{x}$

d) $\frac{5.5}{x} = \frac{11}{3.6}$

9. Solve for each unknown quantity.

a) $\frac{1}{10} = \frac{x}{24}$

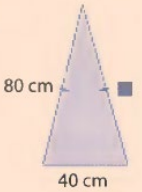
b) $\frac{1}{5} = \frac{x}{12}$

c) $\frac{2}{3} = \frac{x}{16}$

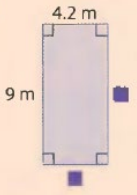
d) $\frac{x}{12} = \frac{4}{30}$

10. Solve for the unknown values.

a)



b)



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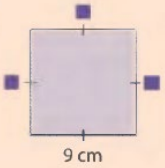
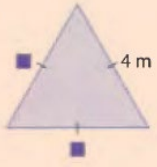


d)



13. Draw a scale diagram of each rectangle. Use a scale of 1 cm represents 2 m.

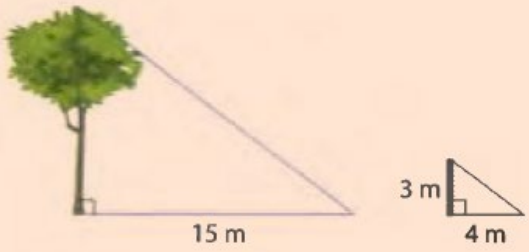
a)

b)

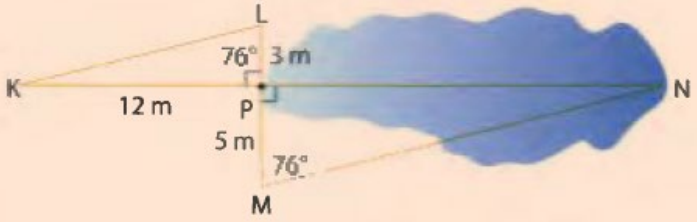
14. A road map uses a scale of 1 cm : 7 km. What is the actual distance between 2 towns that are 6 cm apart on the map?

Apply

7. A pole 3 m tall casts a shadow 4 m long. At the same time, a nearby tree casts a 15-m shadow. What is the height of the tree? Discuss your reasoning with a partner.



8. To find the length of a pond, a surveyor took some measurements. She recorded them on this diagram. What is the length of the pond?



10. Two ladders are leaned against a wall so that they make the same angle with the ground. The 10-foot ladder reaches 8 feet up the wall. How much further up the wall does the 18-foot ladder reach?

7. At which step did Indira make a mistake? Find the correct answer.

Evaluate the expression $-3(6 - x) + 2x$ for $x = -4$.

Indira's response

$= -3(6 - (-4)) + 2(-4)$ Step 1
$= -3(10) + 2(-4)$ Step 2
$= -30 + 2(-4)$ Step 3
$= -28(-4)$ Step 4
$= 112$ Step 5

For help with #3 and #4, refer to Example 2 on pages 77–78.

3. Evaluate each power.

a) 5^2 **b)** $\left(\frac{4}{3}\right)^3$ **c)** 1^9

4. Copy and complete the table.

	Repeated Multiplication	Exponential Form	Value
a)	$6 \times 6 \times 6$	6^3	
b)	$3 \times 3 \times 3 \times 3$		
c)			49
d)		11^2	
e)			125

Practise

For help with #1 to #3, refer to Example 1 on page 89.

1. Evaluate each expression.

a) $4(2)^5$ **b)** $7(-3)^2$

c) $-2(5^4)$ **d)** $3(-2^3)$

2. Write each expression using a *coefficient* and a *power*. Then, find the value of the expression.

a) $4 \times 2 \times 2 \times 2 \times 2$

b) $3 \times (-2) \times (-2) \times (-2)$

c) $7 \times \left(\frac{1}{10}\right)\left(\frac{1}{10}\right)\left(\frac{1}{10}\right)\left(\frac{1}{10}\right)\left(\frac{1}{10}\right)$

d) $-1 \times 9 \times 9 \times 9 \times 9$

3. Write the calculator key sequence you would use to evaluate each expression. What is the answer?

a) 4×3^2 **b)** $-5(4)^3$

For help with #4 and #5, refer to Example 2 on pages 89–90.

4. Evaluate. Which operation did you do first?

a) $3^2 + 3^2$

b) $(2 + 7)^2 - 11$

c) $7^3 - 3(-4)^3$

d) $9 + (-2)^3 - 2(-6^2)$

e) $[(-7)^2 - (-2)^6]^2$

5. Find the value of each expression.

a) $7 - 2(3^2)$

b) $(-4 - 3)^2 + (-3)^2$

c) $(-2)^6 \div 4^3$

d) $3 - 0.2^2 + 1 \div 0.5^2$

e) $\dfrac{-16 + (-3)^2}{(6 - 2)^2 - (-4)^2}$

8. Identify the incorrect step in the following solution. What is the correct answer?

$(3 + 5)^2 - 4 \times 3^2$
$= 8^2 - 4 \times 3^2$ Step 1
$= 64 - 4 \times 9$ Step 2
$= 60 \times 9$ Step 3
$= 540$ Step 4

9. Evaluate.

a) $4x - 3x^2$ for $x = 2$ **b)** $6x^2 + 14x - 3$ for $x = -3$

10. Maria evaluates 128×5^3. What mistake did she make in her solution?

128×5^3
$= 640^3$
$= 262\,144\,000$

4. Add or subtract.

a) $\frac{1}{4}+\frac{1}{2}$ **b)** $\frac{1}{2}-\frac{3}{5}$ **c)** $-\frac{2}{3}+\frac{1}{6}$ **d)** $-\frac{1}{6}+\left(-\frac{1}{4}\right)$

e) $\frac{3}{8}-\left(-\frac{3}{4}\right)$ **f)** $-\frac{1}{4}-\left(-\frac{1}{6}\right)$ **g)** $\frac{3}{4}+\left(-\frac{1}{3}\right)$ **h)** $-\frac{1}{8}+\frac{1}{4}$

7. Rewrite as a single power.

a) $2^3 \times 2^3$ **b)** $6^2 \times 6^3$ **c)** $(-3)^2(-3)^4$

d) $\frac{10^3}{10^2}$ **e)** $\frac{5^6}{5^6}$ **f)** $\frac{(-7)^4}{(-7)^1}$

Practise

For help with # 1 to #6, refer to Example 1 on pages 117–118.

1. Identify the like terms in each group.

a) $2x$ $9x^2$ 5 $-7.1x$ $-x^2$ -2

b) $3m$ $-2ab$ $\frac{4}{3}m$ $-2ad$ m^2

c) -1.9 $6p^2$ 5 $-2p$ p^2

2. a) What algebraic expression does this illustration model?

b) Use this example to describe a process for adding like terms using algebra tiles.

3. a) What number do you add to 5 to get a total of 0?

b) What expression do you add to $2x$ to get a total of 0?

c) What expression do you add to $x^2 + 2$ to get a total of 0?

d) What do you add to any expression to get a total of 0?

4. a) What algebraic expression does each set of algebra tiles model?

i)

ii)

b) Add the two sets of algebra tiles from part a). Write an equation that shows the sum of the two expressions.

5. a) Describe how you could add the polynomials in #4 without using algebra tiles.

b) Describe a process for adding polynomials without using algebra tiles.

6. Add each pair of polynomials using your preferred method.

a) $(5x + 1) + (3x + 2)$

b) $(x^2 + 3) + (2x^2 - 4)$

c) $(2x^2 + 3x + 1) + (x^2 + x + 5)$

d) $(5x^2 - 4x + 7) + (2x^2 + 6x - 3)$

Apply

12. Simplify each expression.

a) $(3m^2 + 5m - 2) + (3m^2 - 6m - 7)$

b) $(k^2 - 2k + 3) - (4k^2 + 3k - 2)$

c) $(2c^2 - 6cd + 5d^2) + (4d^2 - 3cd - 3c^2)$

d) $(2a^2 - 5ab) - (-3a^2 + 5ab + 2b^2)$

e) $(6x^2 + 5x - 7) + (3x^2 - 7x + 8) - (3x^2 - 6x)$

f) $(3p^2 - 4q^2) - (4p^2 - 3q^2) + (2p^2 + 2q^2)$

For help with #7 to #10, refer to Example 2 on pages 118–121.

7. Simplify by collecting like terms.

a) $3x - 2x^2 + x - 2x^2$

b) $-4 - 2n^2 - 3n + 3 + 2n^2$

c) $2q - 4q^2 - 2 + 3q^2 + 2 - 3q$

d) $-4c + 3 + 5c - 7$

e) $h^2 - 3h + 4h^2 + 2h$

f) $3j - 5 + 2j^2 - 1 + 2j - 3j^2$

8. a) Explain what happens when you pair a positive algebra tile with its opposite negative tile.

b) In what situations do you use the process in part a) to model subtraction of two polynomials?

9. Subtract each pair of polynomials using your preferred method.

a) $(4x + 7) - (x + 3)$

b) $(8x + 4) - (3x + 3)$

c) $(5x^2 + 6x + 4) - (2x^2 + 4x + 1)$

d) $(2x^2 - 3x - 1) - (6x^2 - 2x + 4)$

10. Chris rewrote $(4x + 5) - (2x - 6)$ as $(4x + 5) + (-2x + 6)$, then modelled it using algebra tiles. Show whether Chris's method is correct.

For help with #11, refer to Example 3 on pages 121–122.

11. The cost to design a flyer is \$400. The cost to print the flyers is \$100 plus \$0.70 per 100 copies. The cost of shipping is \$125 plus \$0.20 per 100 copies.

a) Write an expression for each cost involved in the printing process. What does your variable represent?

b) Write a simplified expression for the total cost of producing and delivering the flyers.

c) What would the total cost be for 1000 copies? 10 000 copies?

15. Design two examples of subtracting two polynomials that involve negative coefficients. Does the order in which the polynomials are subtracted matter in your examples? Explain.

3. Use a model to divide.

a) $\frac{6x+3}{3}$ **b)** $\frac{8x^2+4x}{2x}$

c) $\frac{5x-10}{-5}$ **d)** $\frac{-2x^2-6x}{-x}$

4. a) How can you use algebra tiles to model dividing $6x^2 - 9x$ by $3x$?

b) How can you check your answer when doing a division question?

5. The method used in Example 1 does not work when dividing a trinomial of degree 2 by a constant, for example, dividing $2x^2 + 4x + 8$ by 2. Why is this?

For help with #6 to #8, refer to Example 2 on page 144.

6. Use algebra to divide.

a) $\frac{14k^2+21k}{7k}$

b) $\frac{-12m+6}{-3}$

c) $\frac{18p^2+12p}{6p}$

d) $\frac{24w^2-16w}{8w}$

7. Describe how to use algebra to divide $\frac{15y^2-10y}{5y}$.

8. Determine each quotient.

a) $\frac{2.8y^2+1.2y-1.6}{4}$

b) $\frac{10g^2+6g-1}{2}$

c) $\frac{-27m^2+15m}{-3m}$

d) $\frac{7x^2+6x-9}{0.5}$

For help with #9, refer to Example 3 on pages 144–145.

9. A rectangle has an area of $9x^2 - 3x$ square units. The width of the rectangle is $3x$ units. What is the length?

Identifying Patterns

You can use words to describe patterns. You can apply the pattern to extend the terms.

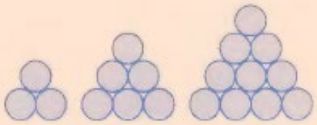
For example,
The pattern −3, 6, 15, … begins with −3, and 9 is added repeatedly to find the next term.
The next two terms are 24 and 33.

3. Describe each pattern and determine the next two terms.

a) 1, 3, 5, 7, …

b) 12, 7, 2, …

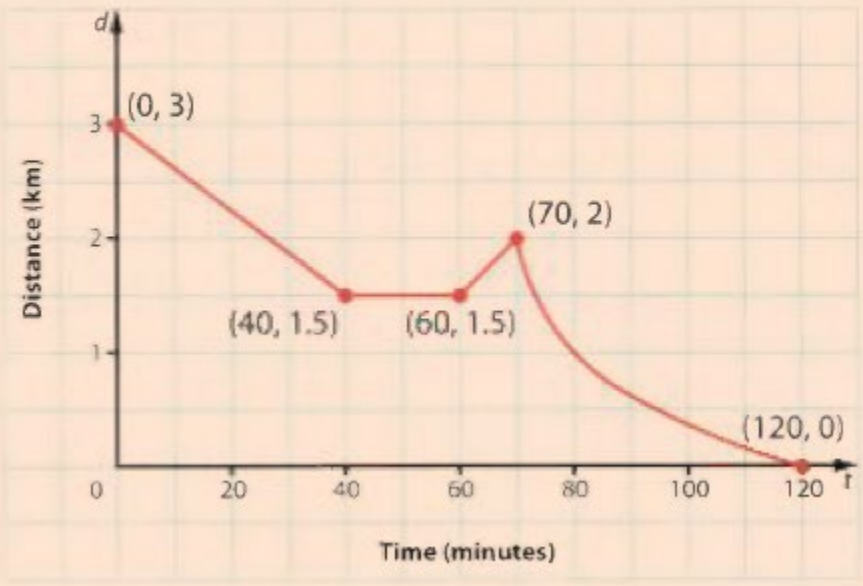
c)



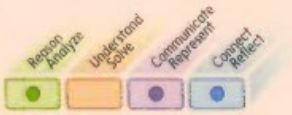
d)

4. Make up your own pattern of numbers or pictures. Give it to a classmate to describe and extend.

Rowan is at the park with his dog. The graph shows the distance from home as he walks the dog back home.



15. ✓ **Competency Check** The table of values shows the relationship between the volume of gasoline remaining in a car's tank and the distance driven.



Distance Driven (km)	Volume of Gasoline (L)
0	50
100	40
200	30
300	20
400	10

a) Plot a graph showing this relationship.

b) Describe the relationship. Explain your reasoning.

c) Estimate the volume of gasoline remaining after driving 150 km. Explain how you did it.

d) Estimate how far this car drove if 5 L of gasoline remains. Explain how you did it.

e) Are you more confident in your answer to part c) or part d)? Why?

Apply

11. Consider the graphs of the following relations. How are the graphs similar? How are they different?

a) $y = -2x + 5$ **b)** $y = -2x - 8$

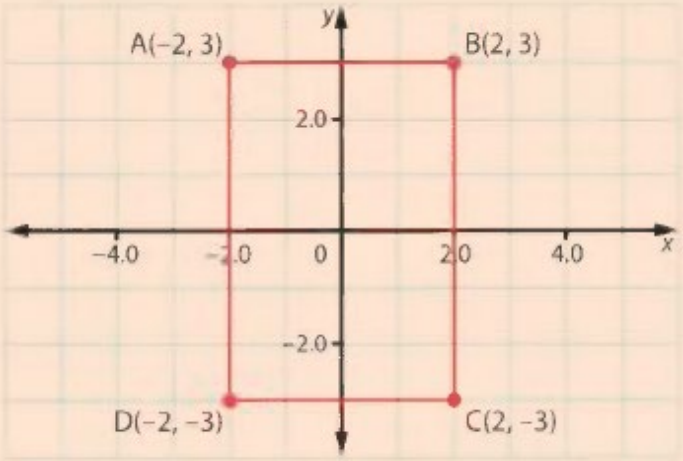
c) $y = -2x$ **d)** $y = -2x - 1$

12. Consider the graphs of the following relations. Identify what is similar and what is different.

a) $y = 8x - 3$ **b)** $y = -3$

c) $y = -x - 3$ **d)** $y = 2x - 3$

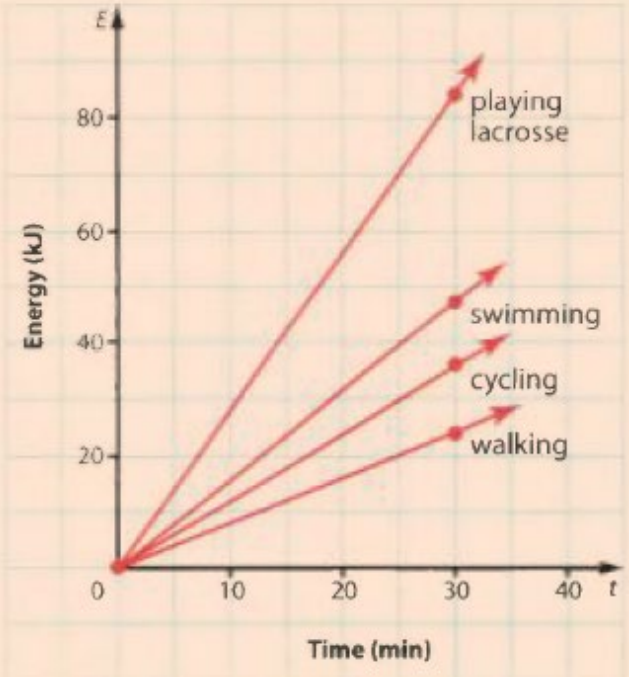
14. Represent each side of rectangle ABCD with an equation.



15. The graph shows the average amount of food energy used by a 50-kg person while taking part in various activities.

a) How much food energy is used per minute for each activity?

b) State an equation representing the energy used with each activity.



Practise

For help with #1 to #3, refer to Example 1 on pages 209–211.

1. Solve and check.

a) $3x + 4 = 10$

b) $8 = 5y - 2$

c) $-2k + 3 = -57$

d) $\frac{x}{3} - 2 = -6$

e) $9 = \frac{y}{7} + 1$

f) $-\frac{w}{4} + 2 = -5$

2. Solve and check.

a) $\frac{x}{3} + \frac{1}{2} = \frac{2}{3}$

b) $\frac{y}{5} - \frac{5}{6} = -\frac{1}{3}$

c) $\frac{4}{3}x + \frac{3}{4} = \frac{1}{2}$

d) $\frac{3}{4} - \frac{k}{3} = \frac{3}{8}$

e) $\frac{6}{5} = 3 + \frac{x}{4}$

f) $-4\frac{2}{5} = -3\frac{1}{5} + \frac{7}{10}h$

g) $\frac{x}{3} + \frac{x}{6} = 4$

h) $\frac{m}{2} - \frac{3m}{5} = 7$

3. Akio used this method to solve the equation $\frac{x}{3} - \frac{3}{2} = \frac{1}{4}$. Do you agree with his method? Explain.

$$\frac{x}{3} - \frac{3}{2} = \frac{1}{4}$$
$$\frac{4x}{12} - \frac{18}{12} = \frac{3}{12}$$
$$\frac{4x - 18}{12} = \frac{3}{12}$$
$$4x - 18 = 3$$
$$4x = 3 + 18$$
$$4x = 21$$
$$x = \frac{21}{4}$$

For help with #4 to #5, refer to Example 2 on page 212.

4. Solve and check.

a) $2 + 12.5v = 0.55$

b) $-0.77 = -0.1x - 0.45$

5. Solve.

a) $0.74d - 3.4 = 0.707$

b) $67 = 5.51 + 4.3a$

Practise

For help with #1 to #3, refer to Example 1 on pages 217–218.

1. Solve and check.

a) $10 = 2(x + 4)$

b) $-3(y + 5) = 6$

c) $5(k - 7) = 12$

d) $9 = -(x - 3)$

e) $5 = 4(6 + m)$

f) $2(g - 1.5) = 4.5$

g) $2(3p - 1) = 11$

h) $2.4 = -1.6(0.4c + 3.2)$

2. Solve and check.

a) $\frac{f + 2}{5} = 3$

b) $7 = \frac{w - 6}{4}$

c) $\frac{m + 3}{2} = \frac{2}{5}$

d) $\frac{5}{2} = \frac{y - 2}{3}$

3. Jorge solved the equation $4(m + 2.5) = 6.5$ as follows.

$$\begin{aligned} 4(m + 2.5) &= 6.5 \\ 4m + 10 &= 26 \\ 4m + 10 - 10 &= 26 - 10 \\ 4m &= 16 \\ m &= 4 \end{aligned}$$

a) What is the error in Jorge's reasoning? Explain.

b) Write the correct solution.

4. Describe the first step you would take to solve each equation. Explain your reasoning.

a) $5(k - 3) = 10$

b) $\frac{4y + 3}{2} = 8$

c) $x + (x + 2) + (x + 4) = 12$

For help with #7 and #8, refer to Example 3 on page 220.

7. Solve and check. Leave answers in reduced fraction form.

a) $\frac{4}{9}(x + 1) = \frac{8}{3}$

b) $-\frac{2}{3}(5w - 8) = 7$

c) $\frac{7}{6} = \frac{2(5 - g)}{3}$

d) $-\frac{5}{3}(4k - 1) = \frac{2}{5}$

8. The formula $C = \frac{5}{9}(F - 32)$ converts temperature from degrees Fahrenheit to degrees Celsius. Convert each temperature as indicated.

a) 60 °F to Celsius

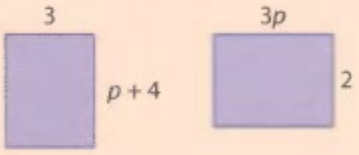
b) 10 °C to Fahrenheit

c) 28 °C to Fahrenheit

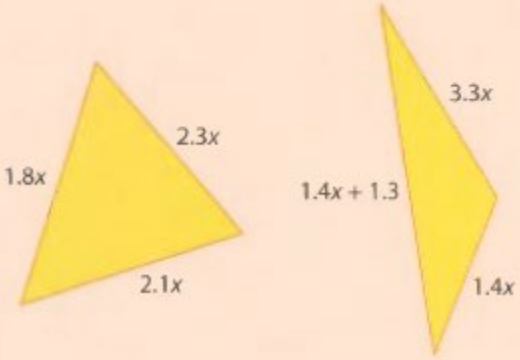
Practise

For help with #1 and #2, refer to Example 1 on page 227.

1. Determine the value of p that makes the areas of these rectangles equal.



2. Determine the value of x that makes the perimeters of these two triangles equal.



For help with # 3 to #6, refer to Example 2 on pages 228–229.

3. In Example 2 Part a), Corinne suggests subtracting $5x$ from both sides first. What advantage would that have?

4. Solve and check.

a) $7a + 8 = 5a - 2$

b) $3h - 1 = -h - 13$

c) $6 - 3g = 2g$

d) $-5e + 4e - 6e + 7 = 9 - 10e$

e) $0.5x = 1.6 + 0.25x$

f) $2.6 + 2.1y = -15.8 + 4.3y$

5. Solve and check.

a) $2(x + 3) = 20 - x$

b) $-5(3m - 4) = 15m$

c) $3(w + 6) = 5(w - 2)$

d) $n + 2(n + 1) + 3(n - 2) = 4(3n - 2)$

e) $\frac{6f - 3}{5} = \frac{4f - 1}{3}$

f) $\frac{2x - 1}{2} = \frac{2x + 1}{3}$

6. Solve and check.

a) $\frac{y}{2} = \frac{y}{3} + 1$

b) $\frac{r}{3} - \frac{2}{5} = \frac{r}{5}$

c) $\frac{x}{4} = 10 - \frac{x}{6}$

d) $\frac{2}{5}(n + 7) = 3$

e) $\frac{2}{3}(5c - 1) = -\frac{3}{5}(c + 2)$

f) $-\frac{3}{4}(p + 3) = \frac{4}{5}(3p - 2)$

For help with #7, refer to Example 3 on page 230.

7. A spaceship left the planet Xeron's atmosphere, travelling at 14 000 km/h. A second spaceship left Xeron's atmosphere two hours later, travelling 22 000 km/h, chasing the first spaceship.

a) After how many hours did the second spaceship catch up to the first one?

b) How far were they from Xeron's atmosphere at that point?

c) Explain to a partner how you set up your equation and then solved it.

8. a) Determine a value of x that would make the equation $2x - 5 = 3x + 4$ false.

b) How many false answers are there? Explain.

9. State whether each of the following is always true, sometimes true, or never true. Compare answers with a partner's. Justify your answers.

a) $x + 3 = 3 + x$

b) $y - 3 = 3 - y$

c) $k + 5 = k - 2$

d) $2(m + 1) = 2m + 1$

10. Solve and check each equation. Express fractions in lowest terms.

a) $17 = (6n + 7) - (3n - 10)$

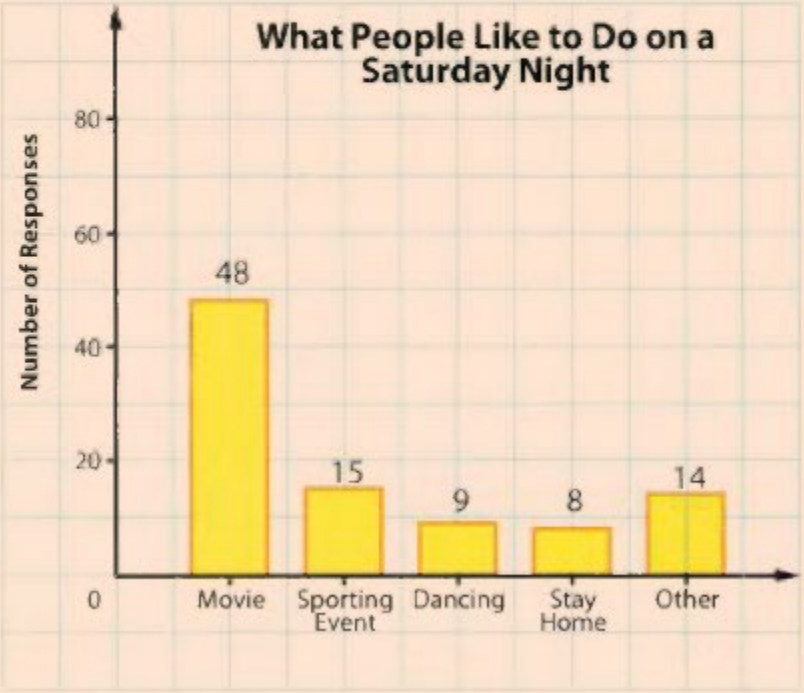
b) $4(x - 3) = 2 - (2x - 6)$

c) $3(w + 7) - (4w - 1) = -5(2w - 3) + 1$

d) $8 - (3k - 2) = -5(k - 3) - (4k - 3)$

11. How is solving $3x + 2 = 18 + x$ similar to solving $-3x - 2 = -18 - x$? How are they different?

You have a part-time job at a movie theatre. Your manager asks you to ask the first 100 customers who buy tickets what they like to do on a Saturday night. The graph shows the results. Identify any sampling errors and explain why the sample and the display might be biased.



Your Turn

Multiply and then combine like terms.

a) $(x + 3)(5x - 2) + 4(x - 1)(2x + 5)$

b) $2(3x - 2) - (4x + 7)(2x - 5)$

3. Multiply using the distributive property.

a) $(x + 5)(x - 2)$

b) $(x - 3)^2$

c) $(c - d)(c + d)$

d) $(4x + y)(x + y)$

e) $(y + 3)^2$

f) $(4j + 2k)(6j - 3k)$

4. Use the distributive property to determine each product.

a) $x(3x^2 - 5x + 8)$

b) $a(7b^2 + b - 1)$

c) $(x - 3)(6x^2 - 4x - 12)$

d) $(2x - 1)(5x^2 + 4x - 5)$

e) $(4s^2 + s)(3s^2 - 2s + 6)$

f) $(2y^2 + 3y - 1)(y^2 + 4y + 5)$

6. State the missing factor.

a) $6a^2bc + 9ab^2 = (\blacksquare)(2ac + 3b)$

b) $3s^2 - 15 = 3(\blacksquare)$

c) $3d^2 - 21d = 3d(\blacksquare)$

d) $16x^2 - 2x = 2x(\blacksquare)$

e) $12x^2y^2 - 16xy = (\blacksquare)(3xy - 4)$

7. Factor the following polynomials.

a) $3y(y - 2) + 4(y - 2)$

b) $5a(a - 4) - 2(a - 4)$

c) $2cx - 8x + 7c - 28$

d) $3x^2 - 9x - 8x + 24$

e) $2y^4 + y^3 - 10y - 5$

Apply

8. Mei is stacking toy blocks that are 12 cm tall next to blocks that are 18 cm tall. What is the shortest height at which the two stacks will be the same height?

Factor, if possible.

a) $x^2 + 5x + 4$

b) $x^2 + 4x + 6$

c) $x^2 - 29x + 28$

d) $x^2 + 3xy - 18y^2$

2. Use algebra tiles or a diagram to factor each trinomial.

a) $2x^2 + 5x + 3$

b) $3x^2 + 7x + 4$

c) $3x^2 + 7x - 6$

d) $6x^2 + 11x + 4$

3. Identify two integers with the given product and sum.

a) product = 45, sum = 14

b) product = 6, sum = −5

c) product = −10, sum = 3

d) product = −20, sum = −8

4. Factor, if possible.

a) $x^2 + 7x + 10$

b) $j^2 + 12j + 27$

c) $k^2 + 5k + 4$

d) $p^2 + 9p + 12$

e) $d^2 + 10d + 24$

f) $c^2 + 4cd + 21d^2$

6. Factor, if possible.

a) $2x^2 + 7x + 5$

b) $6y^2 + 19y + 8$

c) $3m^2 + 10m + 8$

d) $10w^2 + 15w + 3$

e) $12q^2 + 17q + 6$

f) $3x^2 + 7xy + 2y^2$

7. Factor, if possible.

a) $4x^2 - 11x + 6$

b) $w^2 + 11w + 25$

c) $x^2 - 5x + 6$

d) $2m^2 + 3m - 9$

e) $6x^2 - 3xy - 3y^2$

f) $12y^2 + y - 1$

g) $6c^2 + 7cd - 10d^2$

h) $4k^2 + 15k + 9$

i) $a^2 + 11ab + 24b^2$

j) $6m^2 + 13mn + 2n^2$

Extend

17. Find three values of k such that the trinomial $3x^2 + kx + 5$ can be factored over the integers.

18. A square has an area of $9x^2 + 30xy + 25y^2$ square centimetres. What is the perimeter of the square? Explain how you determined your answer.

19. You have been asked to factor the expression $30x^2 - 39xy - 9y^2$ Explain how you would factor this expression. What are the factors?

20. The area of a certain shape can be represented by the expression $8x^2 + 10x - 7$.

a) Identify a possible shape.

b) Write expressions for the possible dimensions of the shape you identified in part a).

5.4 Factoring Special Trinomials, pages 238–251

13. Factor fully.

a) $x^2 - 100$ **b)** $c^2 - 25$ **c)** $9x^2 - 16$

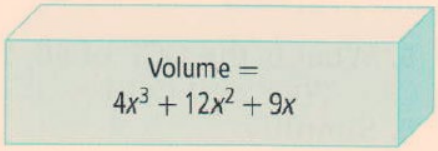
d) $128 - 18x^2$ **e)** $1 - 225y^2$ **f)** $-3x^2 + 27y^2$

14. Verify that each trinomial is a perfect square. Then, factor.

a) $y^2 + 16y + 64$ **b)** $x^2 - 20x + 100$

c) $225 - 90y + 9y^2$ **d)** $121c^2 + 308cd + 196d^2$

15. a) Write algebraic expressions for the dimensions of the rectangular prism.



b) Describe the faces of the prism.

c) Calculate the surface area if $x = 3$ cm.