Practice

1. Evaluate each expression by replacing x with 4.

a) $x + 5$ **b)** $3x$ **c)** $2x - 1$
d) $\frac{x}{2}$ **e)** $3x + 1$ **f)** $20 - 2x$

Mental Math

Find each sum.

- (–2) + (+10)
- (–6) + (–9)
- (+8) + (–7)
- (+11) + (+7)

2. Evaluate each expression by replacing z with 7.

a) $z + 12$ **b)** $10 - z$ **c)** $\frac{(z+5)}{2}$
d) $3(z - 1)$ **e)** $35 - 2z$ **f)** $3 + \frac{z}{7}$

3. Write each algebraic expression in words.
Then, evaluate the expression for $n = 3$.

a) $n - 1$ **b)** $5n + 2$ **c)** $\frac{n}{3} + 5$
d) $n + 1$ **e)** $2(n + 9)$ **f)** $\frac{(n + 7)}{2}$

4. Copy and complete each table. Explain how to get an Output number when you know the Input number.

a)

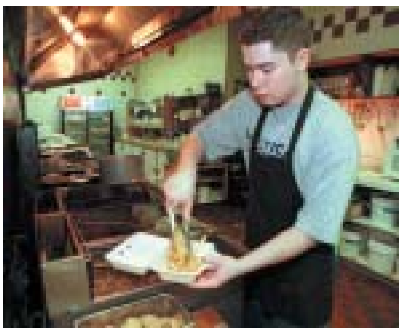
Input x	Output $2x$
1	
2	
3	
4	
5	

b)

Input m	Output $10 - m$
1	
2	
3	
4	
5	

c)

Input p	Output $3p + 4$
1	
2	
3	
4	
5	

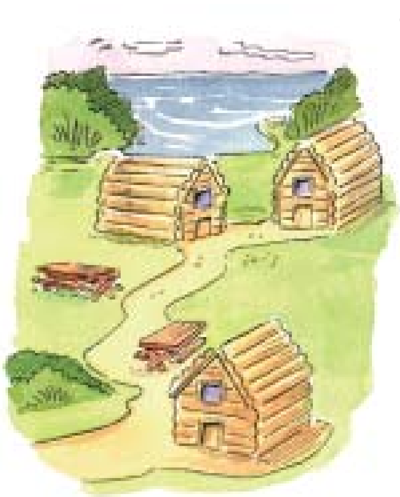


5. Jason works at a local fish and chips restaurant.
He earns \$7/h during the week, and \$9/h on the weekend.

a) Jason works 8 h during the week and 12 h on the weekend. Write an expression for his earnings.

b) Jason works x hours during the week, and 5 h on the weekend. Write an algebraic expression for his earnings.

c) Jason needs \$115 to buy sports equipment.
He worked 5 h on the weekend.
How many hours does Jason need to work during the week to have the money he needs?



6. **Assessment Focus** Kouroche is organising an overnight camping trip. The cost of renting a cabin is $20. The cost of food is $9 per person.

a) How much will the trip cost if 5 people go? 10 people go?

b) Write an algebraic expression for the cost of the trip if p people go.

c) Suppose the cost of food doubles. Write an expression for the total cost of the trip for p people.

d) Suppose the cost of the cabin doubles. Write an expression for the total cost of the trip for p people.

e) Explain why using the variable p is helpful.

7. A value of n is substituted in each expression to get the number in the box. Find each value of n.

a) $5n$	30	b) $3n - 1$	11
c) $4n + 7$	15	d) $5n - 4$	11
e) $4 + 6n$	40	f) $\frac{n}{8} + 1$	5

Take It Further

8. Each table shows patterns. Write an algebraic expression to describe how each Output relates to the Input.

a)

Input x	Output
1	3
2	6
3	9
4	12

b)

Input x	Output
1	1
2	4
3	7
4	10

c)

Input x	Output
5	2
10	7
15	12
20	17

9. Find a value for p and a value for q so that $p - 3q$ has a value of 1. How many different ways can you do this? Explain.

Reflect

Explain why it is important to use the order of operations when evaluating an algebraic expression. Use an example to explain.

10.5 Reading and Writing Equations

Focus Translate statements into equations.

Explore

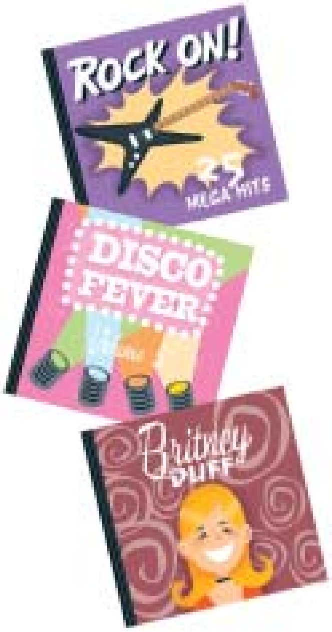
Work with a partner.

- Write an algebraic expression for these statements:
  Think of a number.
  Multiply it by 3.
  Add 4.
- The answer is 13. What is the original number?

Reflect & Share

Compare your answer with that of another pair of classmates.
If you found different values for the original number, who is correct?
Can both of you be correct?
How can you check?

Connect



When we write an algebraic expression as being equal to a number, we have an **equation**.
For example, we have an algebraic expression $3x + 2$.
When we write $3x + 2 = 11$, we have an equation.
An equation is a statement that two expressions are equal.

Here is another example.
Zena bought 3 CDs.
All 3 CDs had the same price.
The total cost was $36.
What was the cost of 1 CD?

We can write an equation for this situation.
Let p dollars represent the cost of 1 CD.
Then $3p = 36$ is an equation that represents this situation.

Example 1

Mark thinks of a number.
He multiplies the number by 2, then adds 15.
The answer is 35. Write an equation for the problem.

Solution

Let n represent the number Mark thinks of.
Multiply the number by 2: $2n$
Then add 15: $2n + 15$
The equation is: $2n + 15 = 35$

Example 2

Write an equation for each sentence.

a) Three more than a number is 15.
b) Five less than a number is 7.
c) A number subtracted from 5 is 1.
d) A number divided by 3 is 10.

Solution

a) Three more than a number is 15.
Let x represent the number.
Three more than x: $x + 3$
The equation is: $x + 3 = 15$

b) Five less than a number is 7.
Let x represent the number.
Five less than x: $x - 5$
The equation is: $x - 5 = 7$

c) A number subtracted from 5 is 1.
Let x represent the number.
x subtracted from 5: $5 - x$
The equation is: $5 - x = 1$

d) A number divided by 3 is 10.
Let x represent the number.
x divided by 3: $\frac{x}{3}$
The equation is: $\frac{x}{3} = 10$

Practice

1. Write an equation for each sentence.
   a) Eight more than a number is 12.
   b) Three times a number is 12.
   c) Eight less than a number is 12.

2. Write a sentence for each equation.
   a) $12 + n = 19$ b) $3n = 18$ c) $12 - n = 5$ d) $\frac{n}{2} = 6$

3. Write an equation for each sentence.
   a) Five added to two times a number is 35.
   b) Eight plus one-half a number is 24.
   c) Six subtracted from three times a number is 11.

4. Write each equation in words.
   a) $5x - 7 = 37$ b) $\frac{x}{3} + 4 = 9$ c) $17 - 2x = 3$

5. Match each equation with the correct sentence.
   a) $n + 4 = 8$ A. Four less than a number is 8.
   b) $4n = 8$ B. Four more than four times a number equals 8.
   c) $4n - 4 = 8$ C. The sum of four and a number is 8.
   d) $n - 4 = 8$ D. Four less than four times a number equals 8.
   e) $4 + 4n = 8$ E. The product of four and a number is 8.

6. Alona thinks of a number. She divides the number by 4, then adds 10. The answer is 14. Write an equation for the problem.

7. **Assessment Focus** Write an equation for each sentence.
   a) Bhavin's age 7 years from now will be 20.
   b) Five times the number of students is 295.
   c) The perimeter of a rectangle with length 15 cm and width w centimetres is 38 cm.
   d) The cost of 2 tickets at x dollars each and 5 tickets at $4 each is $44.

   Which equation was the most difficult to write? Explain.

Mental Math

Find each difference.

- (–7) – (–3)
- (–6) – (+5)
- (+2) – (–5)
- (+5) – (+9)

Reflect

Describe the difference between an equation and an expression. Give an example of each.

10.6 Solving Equations

Focus Solve equations by inspection and by systematic trial.

Explore

Work with a partner.
On the way home from school, 3 students get off the bus at the first stop. Seven get off at the next stop. Five get off at the next stop. Ten get off at the next stop. There are now 2 students left on the bus. How many students were on the bus when it left the school? How many different ways can you solve the problem?

Reflect & Share

Discuss your strategies for finding the answer with another pair of classmates.
Did you use an equation? Did you use reasoning?
Did you draw a picture? Explain.

Connect

Recall the equation about the cost of 1 CD, from *Section 10.5 Reading and Writing Equations,* page 387.
The equation is $3p = 36$, where p is the cost of 1 CD.
When we use the equation to find the value of p,
we **solve the equation.**

Here are 2 ways to solve this equation.

Method 1: By Systematic Trial
$3p = 36$
We choose a value for p and substitute.
When $p = 10$, $3p = 30$
30 is too small, so choose a greater value of p.

When $p = 20$, $3p = 60$
60 is too large, so choose a lesser value of p.

When $p = 15$, $3p = 45$
45 is too large, so choose a lesser value of p.

When $p = 12$, $3p = 36$
This is correct.
The cost of 1 CD is \$12.

Method 2: By Inspection
$3p = 36$
We find a number which, when multiplied by 3, has product 36.
We know that $3 \times 12 = 36$; so, $p = 12$.
The cost of 1 CD is \$12.

We say that the value $p = 12$ makes the equation $3p = 36$ true.
A value $p = 10$ would not make the equation true because 3×10 does not equal 36.
The value $p = 12$ is the only solution to the equation.
That is, there is only one value of p that makes the equation true.

Example 1

Solve by inspection.

a) $x + 7 = 10$
b) $\frac{24}{n} = 6$
c) $40 - y = 30$
d) $9z + 2 = 38$

Solution

a) $x + 7 = 10$
Which number added to 7 gives 10?
We know that $3 + 7 = 10$; so, $x = 3$.

b) $\frac{24}{n} = 6$
This means $24 \div n = 6$.
Which number divided into 24 gives 6?
We know that $24 \div 4 = 6$; so, $n = 4$.

c) $40 - y = 30$
Which number subtracted from 40 gives 30?
We know that $40 - 10 = 30$; so, $y = 10$.

d) $9z + 2 = 38$
9 times which number, plus 2, gives 38?
We know $36 + 2 = 38$
So, 9 times which number is 36?
We know that $9 \times 4 = 36$; so, $z = 4$.

Example 2

Solve by systematic trial.

a) $2a - 28 = 136$

b) $\frac{y}{4} = 220$

Solution

a) $2a - 28 = 136$

When the numbers are large, use a calculator.

Try $a = 50$; then, $2 \times 50 - 28 = 72$

72 is too small, so choose a greater value of a.

Try $a = 100$; then, $2 \times 100 - 28 = 172$

172 is too big, so choose a lesser value of a.

Try $a = 75$; then, $2 \times 75 - 28 = 122$

122 is too small, so choose a greater value of a.

Try $a = 80$; then, $2 \times 80 - 28 = 132$

132 is too small, but it is close to the value we want.

Try $a = 82$; then, $2 \times 82 - 28 = 136$

This is correct.

$a = 82$ is the solution.

b) $\frac{y}{4} = 220$

Use a calculator. We know the number is much greater than 220, because the number is divided by 4 to get 220.

Try $y = 1000$; then, $\frac{1000}{4} = 250$ This is too big.

Try $y = 900$; then, $\frac{900}{4} = 225$ This is closer, but still too big.

Try $y = 850$; then, $\frac{850}{4} = 212.5$ This is too small.

Try $y = 880$; then, $\frac{880}{4} = 220$ This is correct.

$y = 880$ is the solution.

We can write, then solve, an equation to solve a problem.

Example 3

Kiera shared 420 hockey cards equally among her friends.
Each friend had 105 cards.

a) Write an equation that describes this situation.

b) Solve the equation to find how many friends shared the cards.

Solution

a) Let h represent the number of friends who shared the cards.
Then, each friend had $\frac{420}{h}$ cards.
Also, each friend had 105 cards.
So, the equation is: $\frac{420}{h} = 105$

b) Solve $\frac{420}{h} = 105$ by inspection.
Think: $420 \div h = 105$
Which number divides into 420 to give the quotient 105?
We know $400 \div 4 = 100$; so, try $h = 4$.
$420 \div 4 = 105$
So, the solution is $h = 4$.
Four friends shared the cards.

Practice

1. Solve each equation.

a) $x + 3 = 12$ **b)** $y + 9 = 9$
c) $10 + 2z = 20$ **d)** $17 + 3c = 26$

2. Solve each equation.

a) $x - 4 = 3$ **b)** $10 - n = 10$
c) $2z - 7 = 1$ **d)** $13 - 4k = 5$

3. Shenker has 45 CDs.
He gives 10 CDs to his brother.

a) Write an equation you can solve to find how many CDs Shenker has left.
b) Solve the equation.

4. Solve by inspection.

a) $x + 4 = 15$ **b)** $2k - 13 = 3$
c) $3y = 24$ **d)** $\frac{z}{9} = 2$

5. Solve by systematic trial.

a) $n + 5 = 33$ **b)** $8z = 88$
c) $43 - 3y = 16$ **d)** $\frac{x}{7} = 4$

Mental Math

Estimate.

- $\frac{1}{4}$ of 22
- $\frac{2}{5}$ of 36
- $\frac{2}{3}$ of 91
- $\frac{3}{8}$ of 79

6. The perimeter of a square is 156 cm.

a) Write an equation you can solve to find the side length of the square.

b) Solve the equation.

7. The side length of a regular hexagon is 9 cm.

a) Write an equation you can solve to find the perimeter of the hexagon.

b) Solve the equation.

8. Use questions 6 and 7 as a guide.

a) Write your own problem about side length and perimeter of a figure.

b) Write an equation you can use to solve the problem.

c) Solve the equation.

9. Eli has 130 comic books.
He gives 10 to his sister, then shares the rest equally among his friends.
Each friend has 24 comic books.

a) Write an equation you can solve to find how many friends were given comics.

b) Solve the equation.

10. Find the value of n that makes each equation true.

a) $3n = 27$ **b)** $2n + 3 = 27$

c) $2n - 3 = 27$ **d)** $\frac{n}{3} = 27$

e) $\frac{n}{2} + 3 = 27$ **f)** $\frac{3n}{2} = 27$

11. **Assessment Focus** Write a problem that can be described by each equation. Solve each equation.
Which equation was the most difficult to solve? Explain.

a) $2x - 1 = 5$ **b)** $4y = 24$

c) $\frac{z}{38} = 57$ **d)** $5x + 5 = 30$

e) $\frac{25}{y} = 5$ **f)** $52 - 4 = 4x$

Reflect

How does knowing your number facts help you solve an equation by inspection? Give examples in your explanation.

Clothes Buyer

When you buy a pair of jeans, do you ever wonder who bought the jeans for the store to sell to you? The clothes buyer balances all kinds of purchasing variables (purchase price, quantity discounts, foreign exchange, shipping, and taxes) as well as selling variables (profit margin, the effect of price on sales, regional variations) to make the best purchase decision. If he buys too much stock, or at the wrong price, the company could end up selling the clothes at a loss. If the buyer buys too little, he misses out on sales, and customers go elsewhere. The buyer may use a spreadsheet. He can try different "what if" scenarios by changing either the variables or the formulas in the spreadsheet.

A buyer knows that the sales of an item (thousands of units per month) peak a few months after arrival and then slow down over time. However, sales of seasonal or trendy items peak almost immediately, remain steady for a couple of months, and then drop off quickly. What might graphs that show these two sales trends look like?

Choosing a Strategy

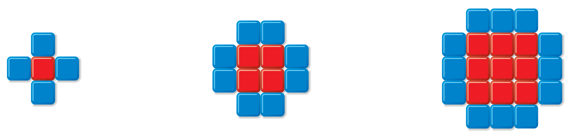
Strategies

- Make a table.
- Use a model.
- Draw a diagram.
- Solve a simpler problem.
- Work backward.
- Guess and check.
- Make an organized list.
- Use a pattern.
- Draw a graph.
- Use logical reasoning.

1. There are 2 schools. Each school has 3 buildings. Each building has 4 floors. Each floor has 5 classrooms. Each classroom has 6 rows of desks. Each row has 7 desks.
How many desks are there in the two schools?

2. **a)** Write the next three terms in this pattern: 1, 4, 3, 6, 5, 8, 7, …
b) What is the pattern rule?
c) Write the 21st and the 50th terms. Explain how you did this.

3. Here is a pattern of tiles.

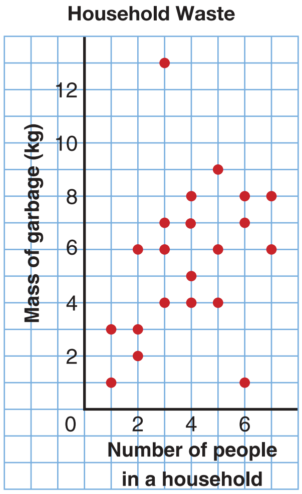


Term 1 **Term 2** **Term 3**

a) Make a table to show the numbers of red and blue tiles in each term.
This pattern continues.
b) How many red tiles will there be in the 20th term?
c) How many blue tiles will there be in the 100th term?
d) What will be the total number of tiles in the 30th term?
e) How many red tiles will be in the term that has 48 blue tiles? How do you know?

4. A can that contains 5 red balls and 3 green balls has a mass of 43 g.
When the can contains 3 red balls and 5 green balls, the mass is 37 g.
When the can contains 1 red ball and 1 green ball, the mass is 19 g.
What is the mass of the can and each ball?

5. Marisha and Irfan have money to spend at the carnival.
If Marisha gives Irfan $5, each person will have the same amount of money. If, instead, Irfan gives Marisha $5, Marisha will have twice as much as Irfan.
How much money does each person have?



6. The graph shows the garbage put out by 21 households in one week.

a) How does the mass of garbage relate to the number of people in the household?

b) Give three possible reasons why one household has 13 kg of garbage.

c) Give three possible reasons why one household has 1 kg of garbage.

7. For a school trip, the charge for using the school bus is $50. The cost of food is $10 per student.

a) Copy and complete this table for up to 10 students.

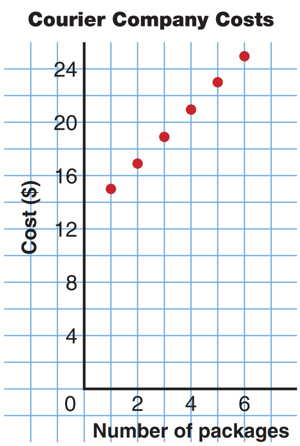
Number of students	1	2	3	4	5
Total cost of trip ($)					

b) What is the total cost for each number of students?

i) 12 **ii)** 15 **iii)** 20

c) Each person pays a fair share. What is the cost per person when each number of students goes on the trip?

i) 5 **ii)** 10 **iii)** 15



8. The graph shows the price charged by a local courier company to collect and deliver packages.

a) What is the cost to have 6 packages collected and delivered?

b) Extend the pattern in the graph. What is the cost to have 8 packages collected and delivered?

c) Why does it cost $15 to collect and deliver one package, but only $17 to collect and deliver 2 packages?

9. I am a 3-digit number.
My hundreds digit is the square of my ones digit.
My tens digit is the product of my hundreds digit and my ones digit.

a) What number, or numbers, could I be?

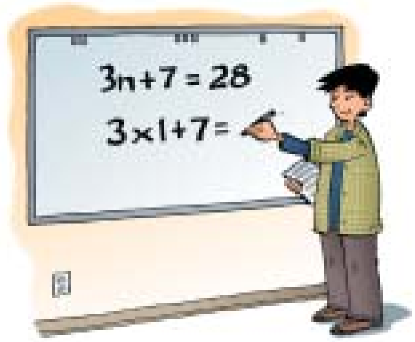
b) What do you notice about your answer(s)?

Unit Review

Review any lesson with etext online tutorial

What Do I Need to Know?

✓ A variable is a letter or symbol that represents a number, or a set of numbers.
A variable can be used to write an expression:
"3 more than a number" is $3 + n$.
A variable can be used to write an equation:
"4 more than a number equals 11" is $4 + n = 11$.



✓ We can solve equations by:
- inspection
- systematic trial

What Should I Be Able to Do?

For extra practice, go to page 447.

LESSON

10.1

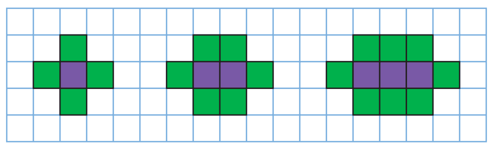
1. For each pattern:
  i) Describe the pattern.
  ii) Write the next 3 terms.
  iii) Find the 20th term.
  Explain how you did this.

  a) 5, 12, 19, 26, …
  b) 3, 9, 27, 81, …
  c) 96, 93, 90, 87, …
  d) 10, 21, 32, 43, …
  e) 9, 13, 17, 21, …

2. Your favourite aunt gives you 1¢ on April 1, 2¢ on April 2, 4¢ on April 3. She continues doubling the daily amount until April 12.
  a) How much will you get on April 12?
  b) What is the total amount you will receive?

3. a) Describe this pattern:
  2, 5, 11, 23, 47, …
  b) Write the next 3 terms.
  c) Write a similar pattern.
  Use a different start number.

4. This pattern continues.



  a) Describe the pattern.
  b) Sketch the next 3 figures.
  c) Describe the 12th figure and the 22nd figure.
  Sketch them if you can.

LESSON

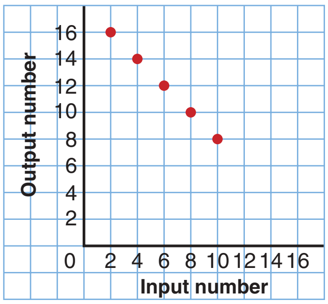
10.2

5. Copy and complete this table for each pattern.

Input	Output
4	
6	
8	
10	
12	

a) Add 3 to each Input number.
b) Multiply each Input number by 2.
c) Subtract 3 from each Input number.
d) Divide each Input number by 2.
e) Divide each Input number by 2, then add 3.
f) Multiply each Input number by 2, then subtract 3.

6. Look at this graph.



a) Make an Input/Output table for the graph.
b) What patterns do you see in the table?
c) Extend the table 3 more rows. Explain how you did this.
d) What happens if you try to extend the table further?

7. a) Describe the patterns in this table.
b) Use the patterns to extend the table 3 more rows.

Input	Output
5	1
15	3
25	5
35	7
45	9
55	11

10.3

8. Write an algebraic expression for each statement.
a) twenty more than a number
b) one less than a number
c) a number increased by ten
d) a number multiplied by thirteen

9. Write each algebraic expression in words.
a) $n + 4$ **b)** $25 - h$
c) $\frac{a}{5}$ **d)** $5 - 2n$

10.4

10. Evaluate each expression for $x = 3$.
a) $x + 8$ **b)** $9x$
c) $2x - 1$ **d)** $\frac{x}{2}$
e) $10x + 4$ **f)** $9 - 3x$

11. A value of n is substituted in each expression to get the number in the box. Find each value of n.
a) $5n$ 40
b) $6n - 1$ 11
c) $2n + 8$ 16
d) $3n - 4$ 14

LESSON

12. One pair of running shoes costs $70.

a) What is the cost of 3 pairs? 7 pairs?

b) What is the cost of *r* pairs of running shoes?

c) Write an algebraic expression for the number of pairs of shoes you could buy for *d* dollars.

10.5 **13.** Write each equation in words.

a) $x + 3 = 17$

b) $3y = 24$

c) $\frac{x}{4} = 5$

d) $3y - 4 = 20$

e) $7 + 4x = 35$

14. Write a problem that can be represented by each equation.

a) $x + 5 = 21$

b) $5n - 2 = 28$

15. Write an equation for each sentence.

a) Six times the number of people in the room is 258.

b) The area of a rectangle with length 6 cm and width *w* centimetres is 36 cm^2.

c) One-half of a number is 6.

16. Write a problem that can be represented by each equation.

a) $x + 2 = 23$

b) $4 - x = 12$

c) $5x = 35$

d) $\frac{x}{9} = 5$

17. Write an equation to find the length of one side of an equilateral triangle with perimeter 24 cm.

10.6 **18.** Solve each equation.

a) $12 = 3n$

b) $21 - n = 18$

c) $\frac{27}{n} = 9$

d) $\frac{n}{9} = 27$

e) $n - 21 = 30$

f) $3n + 2 = 11$

19. Solve each equation.

a) $17 - 3n = 2$

b) $17 + 3n = 47$

c) $3n - 17 = 4$

d) $\frac{n}{17} = 25$

20. At Queen Mary School, 98 students walk to school. There are 250 students in the school.

a) Write an equation you can solve to find how many students do not walk to school.

b) Solve the equation.

21. At Sir Robert Borden School, twice as many students take the bus as walk to school. Seventy-four students walk to school.

a) Write an equation you can solve to find how many students take the bus.

b) Solve the equation.

Practice Test

Input	Output
1	
2	
3	
4	
5	

1. **a)** Copy and complete the table for this pattern:
Multiply each number by 5, then subtract 3.
b) Graph the pattern.
Explain how the graph shows the pattern.
c) Extend the table 3 more rows.
Plot the point for each row on the graph.
d) How can you find the Output number when the Input number is 47?
e) How can you find the Input number when the Output number is 47?
f) Can the Input number be 100? Explain.
g) Can the Output number be 100? Explain.

2. Angelina wins money in a competition.
She is given the choice as to how she is paid.
Choice 1: Get \$1 the 1st day, \$2 the 2nd day, \$4 the 3rd day, \$8 the 4th day, and so on.
This pattern continues for 3 weeks.
Choice 2: Get \$1 000 000 today.
a) With which method of payment will Angelina get more money?
b) How did you use patterns to solve this problem?
c) After how many days will the money Angelina gets from Choice 1 be approximately \$1 000 000?

3. Here are 5 algebraic expressions: $2 + 3n$, $2n + 3$, $3n - 2$, $\frac{2n}{2}$, $\frac{3n}{2}$
Are there any values of n that will produce the same number when substituted in two or more of the expressions?
Investigate to find out. Show your work.

4. Solve each equation by systematic trial or by inspection.
a) $3x + 90 = 147$ **b)** $\frac{84}{h} = 12$
c) $\frac{26}{y} + 3 = 16$ **d)** $147 - 3x = 90$
Explain your choice of method in each case. Show your work.

Unit Problem Fund Raising

Two students raised money for charity in a bike-a-thon. The route was from Timmins to Kapuskasing, a distance of 165 km.

Part 1

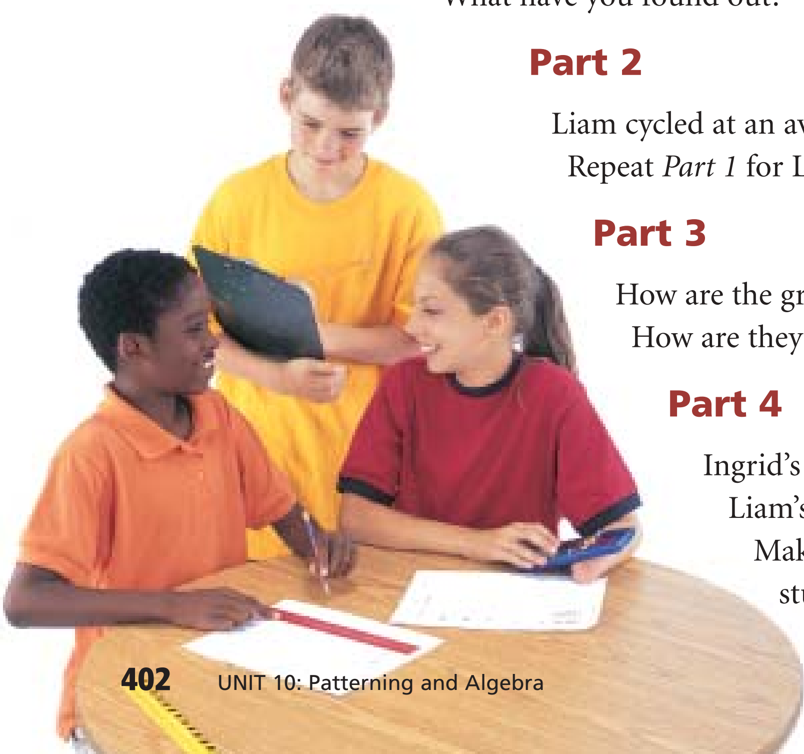
Ingrid cycled at an average speed of 15 km/h.
How far does Ingrid travel in 1 h? 2 h? 3 h? 4 h? 5 h?
Record the results in a table.

Time (h)					
Distance (km)					

Graph the data in the table.
Graph *Time* horizontally and *Distance* vertically.

Write an algebraic expression for the distance Ingrid travels in t hours.
Use the expression to find how far Ingrid travels in 7 h.
How could you check your answer?

Write an equation to represent Ingrid travelling 135 km in t hours.
Solve the equation.
What have you found out?



Part 2

Liam cycled at an average speed of 20 km/h.
Repeat *Part 1* for Liam.

Part 3

How are the graphs for Ingrid and Liam alike?
How are they different?

Part 4

Ingrid's sponsors paid her $25 per kilometre.
Liam's sponsors paid him $20 per kilometre.
Make a table to show how much money each student raised for every 10 km cycled.

Distance (km)	Money Raised by Ingrid ($)	Money Raised by Liam ($)
10		
20		
30		

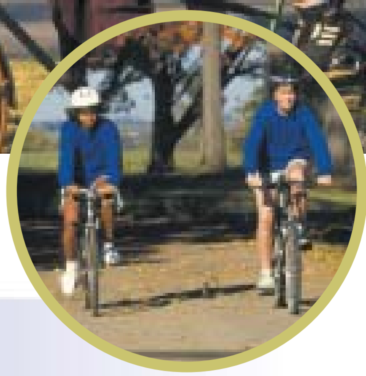
How much money did Ingrid raise if she cycled *d* kilometres?
How much money did Liam raise if he cycled *d* kilometres?

Liam and Ingrid raised equal amounts of money.
How far might each person have cycled? Explain.

Check List

Your work should show:

- ✓ all tables and graphs, clearly labelled
- ✓ the equations you wrote and how you solved them
- ✓ how you know your answers are correct
- ✓ explanations of what you found out

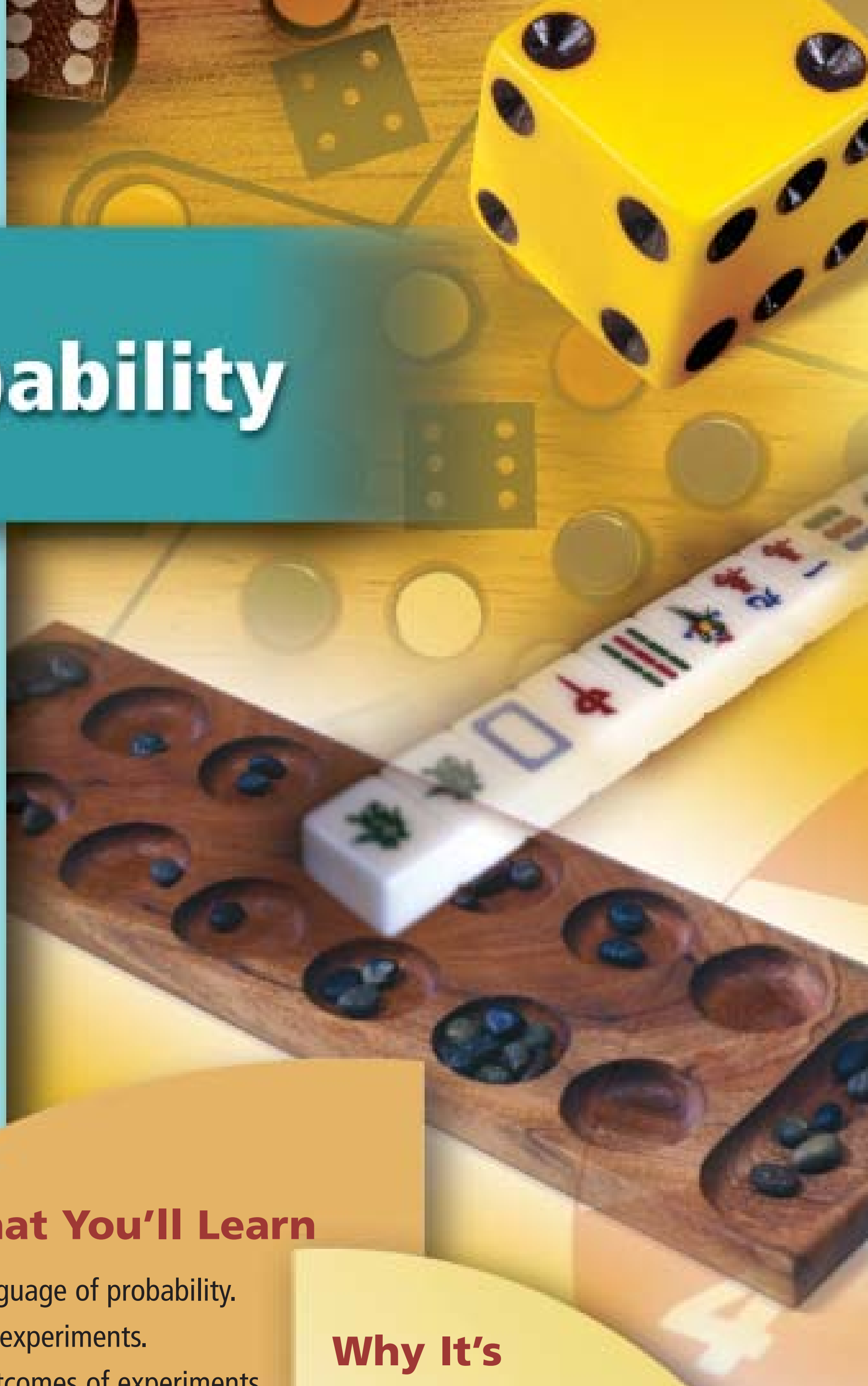


Reflect on the Unit

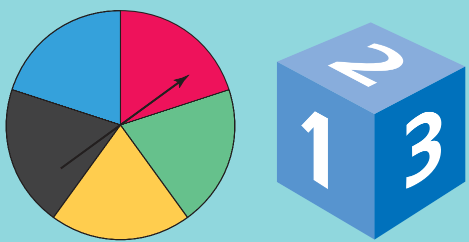
How are number patterns related to algebra?
How are algebraic expressions related to equations?
Give examples in your explanation.

UNIT 11

Probability



Many games involve probability and chance. One game uses this spinner or a number cube labelled 1 to 6.



You can choose to spin the pointer or roll the number cube. You win if the pointer lands on red. You win if you roll a 6. Are you more likely to win if you spin the pointer or roll the number cube? Explain.

What You'll Learn

- Use the language of probability.
- Conduct simple experiments.
- List the possible outcomes of experiments by using tree diagrams, modelling, and lists.
- Identify possible outcomes and favourable outcomes.
- State the probability of an outcome.
- Understand how probability can relate to sports and games of chance.
- Use probability to solve problems.

Why It's Important

In the media, you hear and read statements about the probability of everyday events, such as living to be 100 or winning the lottery.
To make sense of these statements, you need to understand probability.

Key Words

- probability
- outcome
- tree diagram
- relative frequency
- experimental probability
- theoretical probability

UNIT 11

Skills You'll Need

Converting Fractions and Decimals to Percents

Percent (%) means "per hundred" or out of one hundred.

Example

Express each fraction as a decimal, then as a percent.

a) $\frac{9}{50}$ **b)** $\frac{1}{4}$ **c)** $\frac{5}{8}$ **d)** $\frac{7}{16}$

Solution

To convert a fraction to a decimal, try to write an equivalent fraction with denominator 100.

a) $\frac{9}{50} = \frac{18}{100}$ (× 2 numerator and denominator)

$\frac{18}{100} = 0.18$, or 18%

b) $\frac{1}{4} = \frac{25}{100}$ (× 25 numerator and denominator)

$\frac{25}{100} = 0.25$, or 25%

When you cannot write an equivalent fraction, use a calculator to divide.

c) $\frac{5}{8} = 5 \div 8$
$= 0.625$
$= 62.5\%$

d) $\frac{7}{16} = 7 \div 16$
$= 0.4375$
$= 43.75\%$

✓ Check

1. Express each decimal as a percent.

a) 0.1 **b)** 0.01 **c)** 0.24 **d)** 0.05

2. Express each fraction as a decimal, then as a percent.

a) $\frac{7}{10}$ **b)** $\frac{3}{5}$ **c)** $\frac{9}{25}$ **d)** $\frac{3}{4}$

3. Express each fraction as a decimal, then as a percent.

a) $\frac{7}{40}$ **b)** $\frac{3}{8}$ **c)** $\frac{13}{16}$ **d)** $\frac{51}{200}$

11.1 Listing Outcomes

Focus Investigate outcomes of experiments.

When you roll a number cube, the outcomes
are equally likely.
For a spinner with sectors of equal areas,
when the pointer is spun,
the outcomes are equally likely.

Explore

Work with a partner. You will need a number cube labelled 1 to 6, and a spinner similar to the one shown below.

List the possible outcomes of rolling the number cube
and spinning the pointer.
How many outcomes include rolling a 4?
How many outcomes include landing on red?
How many outcomes have an even number on the cube and the pointer landing on blue?

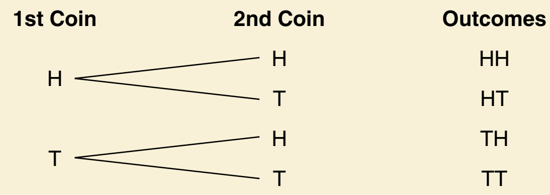
Reflect & Share

Compare the strategy you used to find the outcomes with that of another pair of classmates.
Was one strategy more efficient than another? Explain.

Connect

An outcome is the possible result of an experiment or an action.
When a coin is tossed, the possible outcomes are heads or tails.
To show the possible outcomes for an experiment that has two or more actions, we can use a **tree diagram**.

When 2 coins are tossed, the outcomes for each coin are heads (H) or tails (T).
List the outcomes of the first coin toss.
For each outcome, list the outcomes of the second coin toss.
Then list the outcomes for the coins tossed together.



There are 4 possible outcomes: HH, HT, TH, TT

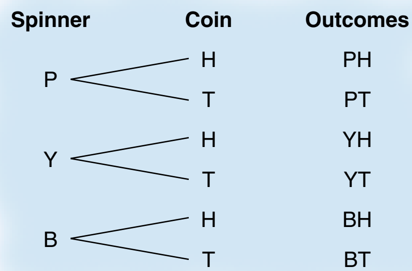
Example

Farah tosses a coin and spins the pointer on this spinner.

a) Draw a tree diagram to show the possible outcomes.
b) List all the possible outcomes.
c) How many outcomes include the pointer landing on pink?
d) How many outcomes include tails?

Solution

a) The sectors on the spinner have equal areas, so the outcomes are equally likely. The possible outcomes for the spinner are: pink (P), yellow (Y), or blue (B). For each colour, the possible outcomes for tossing the coin are: heads (H) or tails (T).



b) The outcomes are: pink/heads, pink/tails, yellow/heads, yellow/tails, blue/heads, blue/tails
c) There are two outcomes with the colour pink: pink/heads, pink/tails
d) There are three outcomes with tails: pink/tails, yellow/tails, blue/tails

Practice

1. List the possible outcomes in each case.
   a) spinning the pointer

   b) rolling a number cube labelled 1 to 6

2. List the possible outcomes in each case.
   a) the colour of a traffic light when you reach it
   b) the gender of a baby who is born
   c) the points scored in a hockey game
   d) the suit of a card pulled from a deck of playing cards

3. The Scenic Railroad sells tickets for trips on Saturdays and Sundays. All-day and half-day trips are available. There are adult, child, and senior fares. Draw a tree diagram to show the possible ticket types.

4. Use a tree diagram to show the possible combinations for breakfast. You must choose one of each:
   - eggs or fruit
   - toast, pancakes, or cereal
   - milk or juice

5. Jim has to choose an outfit. His choices of pants are black, grey, or navy. His sweater choices are red, beige, white, or yellow.
   a) Draw a tree diagram to display all the possible outfits.
   b) How many outfits have either black pants or a white sweater?
   c) How many outfits do not have black pants or do not have a white sweater?
   d) How many outfits have a black sweater?

Mental Math

Simplify.
- $(-3) + (+5)$
- $(-3) + (-5)$
- $(+3) + (-5)$
- $(+3) - (+5)$

6. A deli offers 2 soups, 4 salads, 5 sandwiches, and 3 beverages. How many choices are there for a customer who wants each of the following meals?
   a) a salad and a beverage
   b) soup, a sandwich, and a beverage
   c) soup, a salad, and a beverage
   d) a sandwich or salad, and a soup

7. **Assessment Focus**

a) Copy and complete this table.
Show the sums when two number cubes are rolled.

When one cube shows 1 and the other cube shows 4, then the sum is 5.

Sum of Numbers on Two Cubes						
Number on Cube	**1**	**2**	**3**	**4**	**5**	**6**
1	2	3	4	5	6	7
2						
3						
4						
5						
6						

b) How many different outcomes are there for the sum of the numbers on the cubes?
c) In how many ways can the sum be 6?
d) In how many ways can the sum be 9?
e) In how many ways can the sum be 2 or 12?
f) Why do you think 7 is a lucky number?
g) Draw a tree diagram to show these results.
Why do you think a table was used instead of a tree diagram?
Show your work.

Take It Further

8. A lock combination comprises the four digits from 1 to 4 in any order.
How many possible combinations are there in each case?
a) The digits cannot repeat within the code.
b) The digits can repeat within the code.

Reflect

Explain why a tree diagram is helpful to list the outcomes of an experiment.

11.2 Experimental Probability

Focus Determine probability from experiments.

Explore

Work with a partner.
You will need a coin.
When you toss a coin, which outcome do you think is more likely?
Do you think the outcomes are equally likely? Explain.

Outcome	Tally	Frequency
Heads		
Tails		

➢ Toss the coin 50 times.
How many times do you think you will get heads?
Record the results in a table.

➢ Write the number of heads as a fraction of the total number of tosses.
Write the number of tails as a fraction of the total number of tosses.
Add the fractions. What do you notice?

Reflect & Share

How do the results compare with your prediction?
Combine your results with those of another pair of classmates.
This is same as tossing the coin 100 times.
Write the new fractions for 100 tosses.
Add the fractions. What do you notice?

Connect

The **relative frequency** is the number of times an outcome occurs divided by the total number of times the experiment is conducted.

$$\text{Relative frequency} = \frac{\text{Number of times an outcome occurs}}{\text{Number of times experiment is conducted}}$$

The relative frequency may be written as a fraction, a decimal, or a percent. Relative frequency is also called **experimental probability**.

When a thumbtack is dropped, it can land with its point up or on its side.
Here are the results of 100 drops:

Outcome	Frequency
Point up	46
On its side	54

$$\text{Relative frequency of Point up} = \frac{\text{Number of times Point up}}{\text{Total number of drops}}$$
$$= \frac{46}{100}\text{, or } 0.46$$

$$\text{Relative frequency of On its side} = \frac{\text{Number of times On its side}}{\text{Total number of drops}}$$
$$= \frac{54}{100}\text{, or } 0.54$$

Outcome	Frequency	Relative Frequency
Point up	46	0.46
On its side	54	0.54

The sum of the relative frequencies for an experiment is 1.

That is, $\frac{46}{100} + \frac{54}{100} = 0.46 + 0.54$
$= 1$

Example

The number of times a player goes up to bat is referred to as the player's "at bats."
This table shows the number of at bats and hits for some of the greatest players in the Baseball Hall of Fame.

In baseball, a "batting average" is a relative frequency.

a) Calculate the batting average for each player.
b) Order the players from greatest to least batting average.

Players in Baseball Hall of Fame		
Player	**At Bats**	**Hits**
Aaron	12 364	3771
Cobb	11 429	4191
Gehrig	8 001	2721
Jackson	9 864	2584
Mantle	8 102	2415
Mays	10 881	3283

Solution

a) To calculate each player's batting average, divide the number of hits by the number of at bats.
Round each batting average to 3 decimal places.

Use a calculator to write each fraction as a decimal.

$\text{Aaron} = \frac{3771}{12\,364} \doteq 0.305$

$\text{Cobb} = \frac{4191}{11\,429} \doteq 0.367$

$\text{Gehrig} = \frac{2721}{8001} \doteq 0.340$

$\text{Jackson} = \frac{2584}{9864} \doteq 0.262$

$\text{Mantle} = \frac{2415}{8102} \doteq 0.298$

$\text{Mays} = \frac{3283}{10\,881} \doteq 0.302$

b) The batting averages, from greatest to least, are:
0.367, 0.340, 0.305, 0.302, 0.298, 0.262
The players, from greatest to least batting average, are:
Cobb, Gehrig, Aaron, Mays, Mantle, and Jackson

Practice

Name	At Bats	Hits
Yang Hsi	58	26
Aki	41	20
David	54	23
Yuk Yee	36	11
Eli	49	18
Aponi	42	15
Leah	46	22
Devadas	45	17

1. This table shows data for a baseball team.
Find the batting average of each player.
Round each answer to 3 decimal places.

2. Write each relative frequency as a decimal to 3 decimal places.
a) A telemarketer made 200 phone calls and 35 new customers signed up. What is the relative frequency of getting a customer? Not getting a customer?
b) A quality controller tested 175 light bulbs and found 5 defective. What is the relative frequency of finding a defective bulb? Finding a good bulb?

3. A paper cup is tossed.
The cup lands with the top up 27 times, the top down 32 times, and on its side 41 times.
a) What are the possible outcomes of tossing a paper cup?
b) Are the outcomes equally likely? Explain.
c) State the relative frequency of each outcome.

4. a) Conduct the paper cup experiment in question 3.
Decide how to hold the cup to drop it.
Repeat the experiment until you have 100 results.
b) Compare your results with those from question 3.
Are the numbers different? Explain.

5. Use 3 red counters and 3 yellow counters.
You may place some or all of the counters in a bag.
You then pick a counter without looking.
How many different ways can you place the counters in the bag so you are more likely to pick a red counter than a yellow counter? Explain.

6. Copy and continue the table to show all months of the year.
Have each student write her or his month of birth on the board.
Find the number of students who were born in each month.
a) Complete the table.

Month	Tally	Frequency	Relative Frequency
January			
February			
March			

b) What is the relative frequency for birthdays in the same month as yours?
c) Find the sum of the relative frequencies. Explain why this sum makes sense.

Number Strategies

Find each percent.
- 10% of $325.00
- 15% of $114.00
- 20% of $99.99
- 25% of $500.00

7. **Assessment Focus** A regular octahedron has faces labelled 1 to 8. Two of these octahedra are rolled.
The numbers on the faces the octahedra land on are added.
Work with a partner. Use the regular octahedra you made in Unit 3. Label the faces of each octahedron from 1 to 8.

Conduct an experiment to find the relative frequency of getting a sum of 7 when two regular octahedra are rolled.
a) Report your results.
b) How are the results affected if you conduct the experiment 10 times? 50 times? 100 times? Explain.

Reflect

Suppose you know the relative frequency of one outcome of an experiment.
How can you use that to predict the likelihood of that outcome occurring if you conduct the experiment again?
Use an example to explain.

Mid-Unit Review

LESSON

11.1 **1.** Jenna plays a video game on her computer. Each time she plays, she can choose an easy, intermediate, or challenging level of difficulty. She can also choose 1 or 2 players. Use a tree diagram to show the possible game choices.

2. Use a tree diagram to show the possible lunch choices.

11.2 **3.** Write each relative frequency as a decimal.

a) An air traffic controller's records show 512 planes landed one day. Seventeen planes were 727s. What is the relative frequency of a 727 landing?

b) A cashier served 58 customers in one shift. Thirty-two customers paid cash. What is the relative frequency of a customer paying cash?

c) Qam spun a pointer on a spinner 95 times. The pointer landed on purple 63 times. What is the relative frequency of landing on purple?

4. You will need 4 cubes: 2 of one colour, 2 of another colour; and a bag. Place the cubes in the bag. Pick 2 cubes without looking. Design and conduct an experiment to find the relative frequency of choosing 2 matching cubes.

5. A number cube is labelled 1 to 6.

a) What are the possible outcomes when this cube is rolled?

b) Are these outcomes equally likely? Explain.

c) Design and conduct an experiment to find the relative frequency of each outcome.

d) Do the results confirm your prediction in part b? Explain.

e) How does your answer to part d depend on the number of times you roll the number cube? Explain.

6. There are 3 blue counters and 3 green counters in a bag. You may add to the bag or remove from the bag, as listed below. You put:

a) 1 red counter in the bag

b) 1 more green counter in the bag

c) 2 blue counters in the bag

You then pick a counter without looking. Which of the actions above would make it more likely that you would pick a green counter? Explain.

11.3 Theoretical Probability

Focus Explore and apply theoretical probability.

Explore

Work in a group.
A carnival game has a bucket of different-coloured balls.
Each player is asked to predict the colour of the ball he or she will select.
The player then selects a ball, without looking.
If the guess is correct, the player wins a prize.
After each draw, the ball is returned to the bucket.

Use linking cubes.
Put 4 red, 3 blue, 2 yellow, and 1 green cube in a bag.
Suppose you take 1 cube without looking.
Predict the probability that you will pick each colour.
Play the game 50 times.
What is the experimental probability for picking each colour?
How does each predicted probability compare with the experimental probability?

Reflect & Share

Combine your results with those of another group of students.
How does each experimental probability compare with the predicted probability now?

Connect

Recall that when the outcomes of an experiment are equally likely, the probability of any outcome is:

$$\text{Probability} = \frac{\text{Number of favourable outcomes}}{\text{Number of possible outcomes}}$$

This is called the **theoretical probability**, but we usually say "probability."
You find the probability by analysing the possible outcomes rather than by experimenting.

When you pick an object without looking, the object is picked **at random.**

Twenty counters were put in a bag:
7 green, 6 black, 5 orange, and 2 purple
You take one counter from the bag without looking.
There are 4 outcomes: green, black, orange, and purple
Suppose the favourable outcome is black.
Then, the probability of picking a black counter is: $\frac{6}{20} = 0.3$

Suppose the favourable outcome is green.
Then, the probability of picking a green counter is: $\frac{7}{20} = 0.35$

Note that the outcomes are not equally likely.

We can predict the possible number of times an outcome will occur by multiplying the probability by the number of repetitions.
Suppose we pick a counter at random 54 times.
Then, the predicted number of times a black counter is picked is:
$54 \times 0.3 = 16.2$
We would expect to pick a black counter about 16 times.
However, we may never pick a black counter, or we might always pick a black counter.

Example

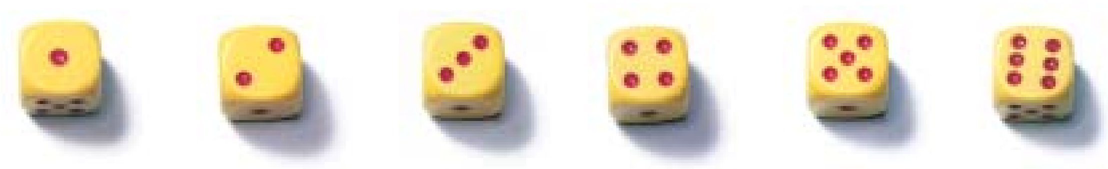
Suppose you roll a number cube 100 times. Predict how many times:

a) a 1 will show
b) a 5 will show
c) a 1 or a 5 will show
d) a 1 or a 5 will not show

How are the answers to parts c and d related?

Solution

When a number cube is rolled, there are six possible outcomes.
The outcomes are equally likely.



a) The probability of rolling a 1 is $\frac{1}{6}$.
So, the predicted number of times a 1 will show in 100 rolls is:
$\frac{1}{6} \times 100 = \frac{100}{6} \doteq 17$

b) The probability of rolling a 5 is also $\frac{1}{6}$.
So, the predicted number of times a 5 will show is also about 17.

c) The probability of rolling a 1 or a 5 is $\frac{2}{6}$, or $\frac{1}{3}$.
So, the predicted number of times a 1 or a 5 will show is:
$\frac{1}{3} \times 100 = \frac{100}{3} \doteq 33$

d) For a 1 and a 5 not to show, a 2, 3, 4, or 6 shows.
The probability of rolling a 2, 3, 4, or 6 is $\frac{4}{6}$, or $\frac{2}{3}$.
So, the predicted number of times a 1 or a 5 does not show is:
$\frac{2}{3} \times 100 = \frac{200}{3} \doteq 67$

The predicted number of times a 1 or a 5 shows and the predicted number of times a 1 or a 5 does not show are:
$33 + 67 = 100$
An outcome occurs or it does not occur. So,

Predicted number of times an outcome occurs	+	Predicted number of times the outcome does not occur	=	Number of times the experiment is conducted

In the *Example* part c, in 100 rolls, a 1 or a 5 will show about 33 times. This does not mean that a 1 or a 5 will show *exactly* 33 times, but the number of times will likely be close to 33.

The more times an experiment is conducted, the closer the experimental probability is to the theoretical probability.

Practice

1. A bag contains these granola bars: 12 apple, 14 banana, 18 raisin, and 10 regular. You pick one bar at random. Find the probability of choosing:
a) a banana granola bar **b)** an apple granola bar

When you see the word "probability" in a sentence, it means theoretical probability.

2. There are 8 names in a hat.
You pick one name without looking. Find each probability.
a) A three-letter name will be picked.
b) A five-letter name will be picked.
c) Laura will be picked.
d) Jorge will not be picked.

Number Strategies

Simplify.

- $\frac{5}{8} + \frac{3}{4}$
- $\frac{4}{5} - \frac{2}{3}$
- $1\frac{3}{10} + 2\frac{1}{2}$
- $\frac{2}{3} + \frac{2}{5} + \frac{3}{10}$

3. Is each statement true or false? Explain.

a) If you toss a coin 10 times, you will never get 10 heads.

b) If you toss a coin 10 times, you will always get exactly 5 heads.

c) If you toss a coin many times, the number of heads should be approximately $\frac{1}{2}$ the number of tosses.

4. The pointer on this spinner is spun 100 times.
Is each statement true or false? Justify your answer.

a) The pointer will land on *Win* about 33 times.

b) The pointer will land on *Win*, *Lose*, and *Tie* an equal number of times.

c) The pointer will land on *Lose* exactly 33 times.

5. Two hundred fifty tickets for a draw were sold.
The first ticket drawn wins the prize.

a) Joe purchased 1 ticket. What is the probability Joe will win?

b) Maria purchased 10 tickets.
What is the probability Maria will win?

c) Ivan purchased 25 tickets.
What is the probability Ivan will *not* win?

6. Assessment Focus

a) Construct a spinner with red, yellow, blue, and green sectors, so the following probabilities are true.

- The probability of landing on red is $\frac{1}{4}$.
- The probability of landing on yellow is $\frac{1}{2}$.
- The probability of landing on blue is $\frac{1}{6}$.
- The probability of landing on green is $\frac{1}{12}$.

Explain how you drew your spinner.

b) In 200 trials, about how many times would the pointer land on each colour?

c) Suppose the spinner had been constructed so the probability of landing on yellow was $\frac{1}{4}$.
What effect would this have on the probability of landing on each other colour? Explain.

Reflect

How are theoretical probability and experimental probability similar? Different?
Use an example to explain.

11.4 Applications of Probability

Focus Solve probability problems.

Explore

Work with a partner.
You will play the *Sum and Product* game.
You will need 4 blank cards and a bag.
Write the numbers from 1 to 4 on the cards.
Place the cards in the bag.
Each person picks a card.
Both of you find the sum and the product of the two numbers.
One of you is Player A, the other is Player B.
If the sum is less than or equal to the product, Player A gets a point.
If the sum is greater than the product, Player B gets a point.

- Who is likely to win? Explain your reasoning.
- Play the game several times; you choose how many times. Who won?
- How does your prediction of the winner compare with your result?

Reflect & Share

Compare your results with those of another pair of classmates.
Work together to come up with an explanation of who is more likely to win.

Connect

- Probability can be expressed as a fraction, a decimal, or a percent. When probability is expressed as a percent, we use the word "chance."
  For example, the weather forecast is a 40% chance of rain today.
  This means that the probability of rain is: $\frac{40}{100} = 0.4$
- When an outcome is certain, the probability of it occurring is 1. For example, when we toss a coin, the probability of it landing heads or tails is 1.
  When an outcome is impossible, the probability of it occurring is 0. For example, when we roll a number cube labelled 1 to 6, the probability of a 7 showing is 0.

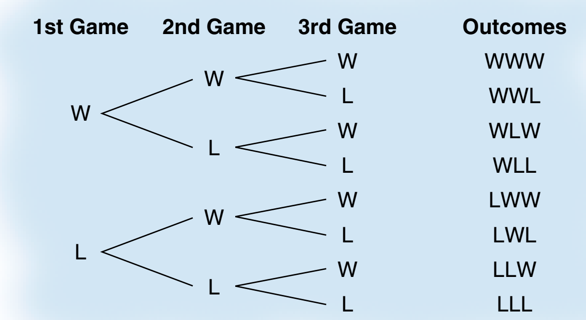
Example

Flick This is an Ultimate Frisbee team.
The team plays 3 games against 3 other teams.
All 4 teams have equal chances of winning.

a) What is the chance that Flick This will win all three of its games?
b) What is the chance that Flick This will win exactly one game?
c) What is the chance that Flick This will win at least two games?

Solution

For any game, the possible outcomes are win (W) or lose (L).
These outcomes are equally likely. Draw a tree diagram to list the possible results of 3 games for Flick This.



There are 8 possible outcomes.

a) There is 1 outcome in which Flick This wins all three games:
WWW
So, the probability of 3 wins is: $\frac{1}{8} = 0.125$
So, the chance of winning 3 games is 12.5%.

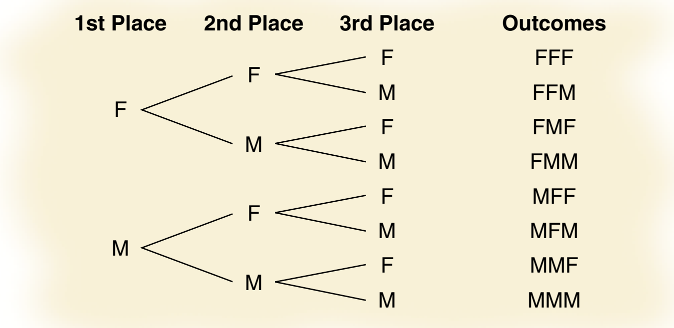
The word "exactly" is included because "winning one game" might be interpreted as winning one or more games.

b) There are 3 outcomes in which Flick This wins exactly one game:
WLL, LWL, LLW
So, the probability of winning exactly 1 game is: $\frac{3}{8} = 0.375$
So, the chance of winning exactly 1 game is 37.5%.

c) There are 4 outcomes in which Flick This wins at least two games: WWW, WWL, WLW, LWW
So, the probability of winning at least 2 games is: $\frac{4}{8} = \frac{1}{2} = 0.5$
So, the chance of winning at least 2 games is 50%.

Practice

1. The 1st, 2nd, and 3rd place winners of a contest can be female or male. This tree diagram shows the possible outcomes of the contest.



a) How many possible outcomes are there?
b) What is the probability that all the winners are female?
c) What is the probability that none of the winners is male?
d) How are the answers to parts b and c related? Explain.

2. On this spinner, the pointer is spun once.
The colour is recorded.
The pointer is spun a second time.
The colour is recorded.

a) Suppose you win if you spin the same colour on both spins.
What are your chances of winning?
b) Suppose you win if you spin two different colours.
What are your chances of winning?

3. **a)** Three coins are tossed. Find the chance of tossing:
i) one heads and two tails **ii)** exactly two heads
iii) at least two tails **iv)** no heads
b) Why do we need the words "at least" in part a, iii?
What if these words were left out?
How would the answer change?
c) Why do we need the word "exactly" in part a, ii? What if this word was left out? How would the answer change?

4. At a carnival, the game with the least chance of winning often has the greatest prize. Explain why this might be.

5. There are four children in a family.
What is the chance of each event?
a) There are two boys and two girls.
b) There is at least one girl.
c) All four children are of the same gender.

6. **Assessment Focus** The school cafeteria has this lunch menu.
A student chooses a sandwich and a vegetable. Assume the choice is random.
a) Find the probability of each possible combination.
b) Suppose 3 desserts were added to the menu. Each student chooses a sandwich, a vegetable, and a dessert.
How would the probabilities of possible combinations change?
Use examples to explain your thinking.

Lunch Menu

Sandwich	Vegetable
Grilled Cheese	Broccoli
Chicken	Carrots
Tuna	

Take It Further

7. At the school carnival, there is a game with two spinners.

Spinner A

Spinner B

You get two spins.
You may spin the pointer on each spinner once, or spin the pointer on one spinner twice.
If you get pink on one spin and yellow on another spin (the order does not matter), you win.
To have the greatest chance of winning, what should you do?
Explain.

Calculator Skills

Which three consecutive prime numbers have a product of 7429 and a sum of 59?

Reflect

How is probability related to chance?
Use an example in your explanation.

Choosing a Strategy

Strategies

- Make a table.
- Use a model.
- Draw a diagram.
- Solve a simpler problem.
- Work backward.
- Guess and check.
- Make an organized list.
- Use a pattern.
- Draw a graph.
- Use logical reasoning.

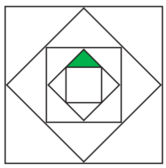
1. For her birthday, Janine was given a row of 25 pennies.
Her father replaced every second coin with a nickel.
Her mother replaced every third coin with a dime.
Her brother replaced every fourth coin with a quarter.
Her uncle replaced every fifth coin with a loonie.
How much did Janine get on her birthday?

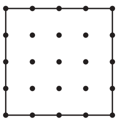
2. Arif has a part-time job.
He was offered \$96 per week or \$4.50/h.
Which is the better deal? Explain.

3. **a)** The perimeter of a rectangle is 36 cm.
What is the maximum possible area of the rectangle?

b) The sum of the length, width, and height of a rectangular prism is 18 cm.
What is the maximum possible volume of the prism?

4. What fraction of this figure is shaded?





5. Divide the square at the left into four congruent figures.
Record each way you find on dot paper.
Find at least ten different ways to do this.

6. Running shoes cost \$79.99. They are on sale for 20% off.
The sales tax of 15% has to be added.
Which would you choose? Explain.

a) Take the 20% off the price, then add the 15% sales tax.

b) Add the 15% sales tax, then take off the 20%.

7. The Magic Money Box doubles any amount of money placed in it, then adds \$1 to it.
Yesterday I placed a sum of money in the box and got a new amount.
Today I put the new amount in the box and got \$75 out.
How much did I put in the box yesterday?

8. Play this game with a partner.
Each of you needs an octahedron and a cube like these:
The faces of a red octahedron are labelled from +1 to +8.
The faces of a white cube are labelled from +1 to +6.
Take turns to roll the two solids.
Subtract the red number from the white number.
The person with the lesser number scores a point.
The first person to reach 20 points is the winner.

9. On your first birthday, you have 1 candle on your cake.
On your second birthday, you have 2 candles on your cake, and so on, every year.
How many candles will be needed to celebrate your first 16 birthdays?

10. A radio station plays an average of 16 songs every hour.
One-half the songs are pop, one-quarter are jazz, one-eighth are country, and the rest are classical.
One show is 3 h long. The songs are played at random.
a) How many classical songs would be played?
b) What is the probability that the first song played is jazz?

11. An octahedron has eight faces labelled 1 to 8.
A cube has six faces labelled 1 to 6.
a) Both solids are rolled. What is the probability that the sum of the numbers is 8?
b) Both solids are rolled. What is the probability that the sum of the numbers is a prime number?

Game

Empty the Rectangles

YOU WILL NEED

2 number cubes labelled 1 to 6; 12 counters

NUMBER OF PLAYERS

2

GOAL OF THE GAME

To remove all counters from all rectangles

What strategies can you use to improve your chances of winning this game?

HOW TO PLAY THE GAME:

1. Each player draws 6 rectangles on a piece of paper.

   Label each rectangle from 0 to 5.

2. Each player places her 6 counters in any or all of the rectangles.
   You can place 1 counter in each rectangle, or 2 counters in each of 3 rectangles, or even 6 counters in 1 rectangle.

3. Take turns to roll the number cubes.
   Find the difference of the numbers.
   You remove counters from the rectangle labelled with that number.
   For example, if you roll a 6 and a 4, then $6 - 4 = 2$; so, remove all counters from rectangle 2.

4. The winner is the first person to have no counters left in any rectangle.

Math Link

Sports

You know that a batting average of 0.300 means that a player has an average of 3 hits in 10 at bats. Research other examples of relative frequency in sport. Write what you find out.

Unit Review

Review any lesson with etext online tutorial

What Do I Need to Know?

✓ Relative frequency $= \dfrac{\text{Number of times an outcome occurs}}{\text{Number of times experiment is conducted}}$

✓ Theoretical probability $= \dfrac{\text{Number of favourable outcomes}}{\text{Number of possible outcomes}}$

What Should I Be Able to Do?

For extra practice, go to page 448.

LESSON

11.1

1. **a)** Use a tree diagram to show the possible combinations for a breakfast. You can choose:
- a banana, an orange, or an apple
- carrots, celery, or cucumber, and
- yogurt or cheese

b) How many outcomes have a banana and cheese?

c) How many outcomes have an orange, celery, or a yogurt?

d) How many outcomes do not have an apple?

2. Four coins are tossed.

a) List all the possible outcomes.

b) How many outcomes have exactly 1 head?

c) How many outcomes have exactly 2 tails?

d) How many outcomes have at least 3 tails?

11.2

3. A biologist tested a new vaccine. She found that in 500 trials, the test was successful 450 times.

a) What is the relative frequency that the vaccine is successful?

b) Suppose the vaccine is used on 15 000 people. How many successes can be expected?

4. The owner of a shop recorded customer sales for one week.

Gender	Purchase	No Purchase	Total
Male	125	65	190
Female	154	46	200

Determine the relative frequency of each outcome.

a) A customer is male.

b) A customer is female.

c) A customer makes a purchase.

d) A male does not make a purchase.

e) A female makes a purchase.

LESSON

5. Is each statement true or false? Explain.

a) When a coin is tossed 100 times, it will never show tails 100 times.

b) When a coin is tossed 100 times, it is unlikely to show heads 100 times.

c) When a coin is tossed 100 times, it will show tails exactly 50 times.

d) The more often a coin is tossed, the more likely that $\frac{1}{2}$ the results will be tails.

11.3 **6.** In a game show, each contestant spins the wheel once to win the money shown.

a) Are the probabilities of winning the amounts equally likely? Explain.

b) What is the probability of winning $100?

c) What is the probability of winning less than $50?

d) What is the probability of winning from $30 to $70?

7. Twenty cards are numbered from 1 to 20. The cards are shuffled. A card is drawn. Find the probability that the card has:

a) an odd number

b) a multiple of 4

c) a number that is not a perfect square

d) a prime number

11.4 **8.** Each of the numbers 1 to 15 is written on a separate card. The cards are shuffled and placed in a pile face down. A card is picked from the pile. Its number is recorded. The card is returned to the pile. In 99 trials, about how many times would you expect each outcome?

a) a 6

b) a multiple of 3

c) a number less than 10

d) an even number

9. What is the chance of each outcome?

a) tossing 2 coins and getting:

i) 2 heads

ii) 1 tail and 2 heads

b) tossing 3 coins and getting:

i) 1 head and 2 tails

ii) at least 1 tail

10. An electronic game has three coloured sectors. A colour lights up at random, followed by a colour lighting up at random again. What is the chance the two consecutive colours are the same?

Practice Test

1. A theatre shows movies on Saturday and Sunday.
There are matinee and evening shows.
There are adult, child, and senior rates.
Draw a tree diagram to show the possible ticket types.

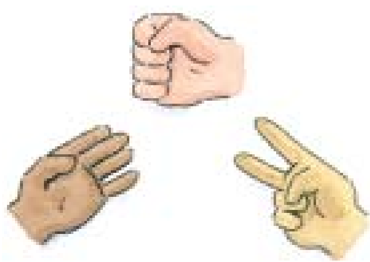
2. A number cube is labelled 1 to 6.
The cube is rolled 60 times.
Predict how many times each outcome will occur.
Explain each answer.

a) 1 is rolled.
b) An even number is rolled.
c) A number greater than 3 is rolled.
d) 9 is rolled.

3. **a)** In Sarah's first 30 times at bat, she had 9 hits.
What is Sarah's batting average?
b) In Sarah's next game, she had 3 hits in 4 times at bat.
What is Sarah's new batting average?
c) How many hits would you expect Sarah to have in 90 times at bat? Explain your reasoning.

4. A number cube is labelled 1 to 6.
Suppose you roll a number cube twice.
Is it more likely you will get a 3 then a 5, or a 3 then a 3?
Explain your reasoning.

5. In the game "rock, paper, scissors," 2 players make hand signs.
Players can make a hand sign for rock, paper, or scissors.
On the count of 3, players show their hand signs.
Suppose the players choose their signs at random.
In 75 games, how many times would you expect to see both players showing rock?



Unit Problem Games of Chance

Part 1

Emma and Jonah created a spinner game called Match/No-Match.
Two people play the game.
A player spins the pointer twice.

If the pointer lands on the same colour (a match), the player scores.
If the pointer lands on different colours (a no-match), the opponent scores.

Jonah and Emma reasoned that, since there are two matching combinations (red/red and green/green), a player should score only 1 point for a match, and the opponent should score 2 points for a no-match.

Play the Match/No-Match game. Take at least 50 turns each.

Use the results to find the relative frequency of a match and of a no-match.

List the possible outcomes of a turn (two spins).
Find the theoretical probability of a match and a no-match.

Do you think the players have equal chances of winning? Explain.

Part 2

Design a game using spinners, number cubes, coins, or any other materials.
The game should use two different items.

Play the game.

Do the players have equal chances of winning? Explain.
Calculate some probabilities related to your game.
Show your work.

Check List

Your work should show:

- ✓ all calculations of frequency or probability, in detail
- ✓ diagrams, tables, or lists to show possible outcomes and results of each game
- ✓ an explanation of players' chances of winning each game
- ✓ correct use of the language of probability

Reflect on the Unit

Give at least two examples of how you use probability in everyday life.

Cross Strand Investigation

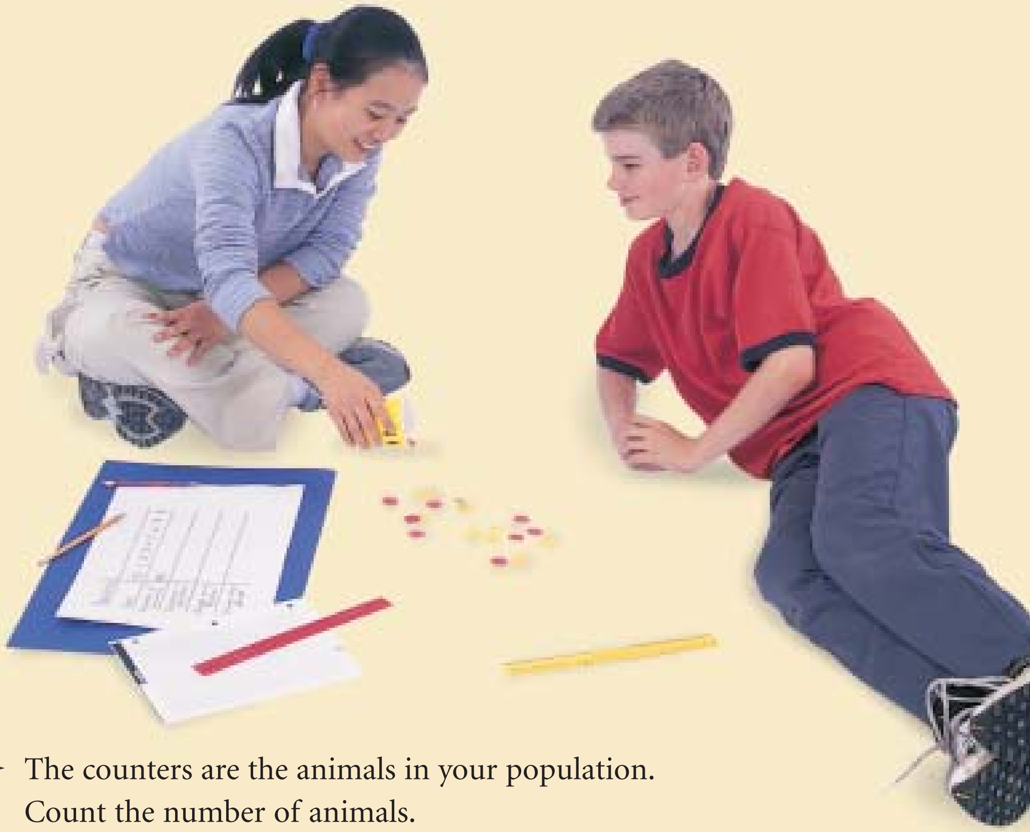
A Population Simulation

Materials:

- a paper cup
- 30 to 40 two-sided counters
- 0.5-cm grid paper

Work with a partner.

An animal population changes from year to year depending on the rates of birth and death, and on the movement of the animals.
A **simulation** is a model of a real situation. You will use a simulation to investigate how an animal population might decline.
As you complete this *Investigation*, include your completed table, graph, and written answers to the questions. You will hand these in.



➢ The counters are the animals in your population.
Count the number of animals.
Record that number for Year 0 in the *Population* table.

➢ Put the counters in the cup.
Choose which colour will be "face up."
Pour the counters from the cup.
Counters that land face up represent animals that died or moved away during the first year. Set them aside.
Count the number of animals left.

Record that number as the population for Year 1.
Calculate and record the decrease in population.
Write the decrease as a fraction of the previous year's population.
Write the fraction as a percent.

➢ Place the counters representing live animals back in the cup.
Repeat the experiment for Year 2.
Record the data for Year 2 in the table.

➢ Continue the simulation. Record your data for up to 8 years, or until you run out of animals.

➢ Graph the population data.
Plot *Year* horizontally and *Number of Animals* vertically.
Explain your choice of graph.
What trends do you see in the graph?

Population									
Year	0	1	2	3	4	5	6	7	8
Number of animals									
Decrease in population									
Change as a fraction									
Change as a percent									

➢ Describe the patterns you see in the table. Approximately what fraction and percent of the population remain from year to year?

➢ Use the patterns to predict the population for Year 9.

➢ How long does it take the population of animals to decrease to one-half its original size?

➢ What would happen to a population if there were no births to add to the population each year?

Take It Further

➢ Suppose you repeated this experiment, beginning with more animals. Would you see the same pattern? Explain.
Combine your data with data of other students to find out.

➢ Which environmental factors may cause an animal population to change?

Cumulative Review

UNIT

1 **1.** Write the first 5 multiplies of each number.
a) 6 b) 9 c) 12

2. Write all the factors of each number.
a) 36 b) 57 c) 75

2 **3.** There are two patchwork quilts.
In quilt A, the ratio of red squares to green squares is 5:7.
In quilt B, the ratio of red squares to green squares is 4:5.
The quilts are the same size.
Which quilt has more red squares?
Use grid paper to show your answer.

3 **4.** a) Write the formula for the surface area of a cube, with edge length *c* units.
b) Write the formula for the surface area of a rectangular prism with dimensions *l* units by *w* units by *h* units.
c) How can you get the formula for the surface area of a cube from the formula for the surface area of a rectangular prism? Use pictures in your explanation.

4 **5.** Add or subtract.
a) $2\frac{3}{4} - 1\frac{1}{3}$
b) $3\frac{1}{3} + 2\frac{3}{5}$
c) $3\frac{4}{5} - 2\frac{1}{10}$
d) $\frac{3}{10} + 1\frac{1}{2}$
e) $\frac{3}{8} + \frac{7}{4} + \frac{7}{2}$
f) $\frac{9}{10} + \frac{1}{2} + \frac{6}{5}$

6. Divide. Round the quotient to the nearest tenth where necessary.
a) $7.22 \div 1.9$
b) $7.22 \div 2.1$
c) $8.97 \div 2.3$
d) $8.98 \div 2.4$

5 **7.** a) The people who run the cafeteria survey students about their favourite foods.
How might the survey results affect the menu?
b) A local hair salon collects data on the number of clients who would like hair appointments on Sundays.
How might these data affect the days the salon is open?

8. Annette's practice times for a downhill ski run, in seconds, are:
122, 137, 118, 119, 124, 118, 120, 118
a) Find the mean time.
b) Find the median time.
c) Find the mode time.
d) Which measure of central tendency best represents the times? Explain.
e) What is the range?
f) What time must Annette get in her next run so the median is 120 s? Explain.
g) What time must Annette get in her next run so the mean is 121 s? Is this possible? Explain.

UNIT

9. a) What does this table show?

Toronto Blue Jays' Average Game Attendance	
Year	Average Attendance
1991	47 966
1992	49 402
1993	49 732
1994	50 098
1995	39 257
1996	31 600
1997	31 967
1998	30 300
1999	26 710
2000	21 058
2001	23 690
2002	20 209
2003	22 215

b) Do you think the average is the mean, the median, or the mode? Explain your choice.

c) Draw a line graph to display these data.

d) What trends does the graph show? Find out what happened to change the trend.

e) Draw a graph to display the data each way.

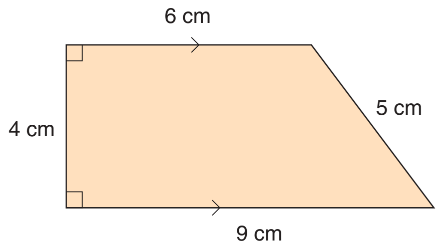
i) The marketing department wants attendance to look as great as possible.

ii) The shareholders want to show that the attendance is too low.

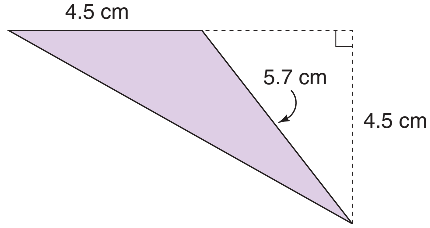
f) Explain how each graph in part e shows what was intended.

6 **10.** Find the area of each figure.

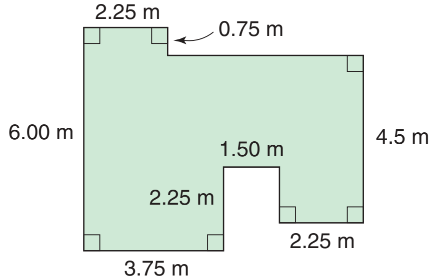
a)



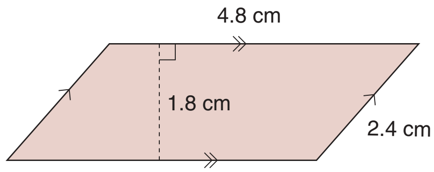
b)



c)



d)



UNIT

11. If you can, find the perimeter of each figure in question 10. For which figures can you not find the perimeter? Explain.

7

12. a) Plot these points on a grid: A(3, 2), B(4, 5), C(7, 5), and D(8, 4). Join the points to draw figure ABCD.
b) Translate the figure in part a.
c) Rotate the figure in part a.
d) Reflect the figure in part a.
Trade grids with a classmate. Identify each of your classmate's transformations.

8

13. A sweater is on sale for 25% off the regular price. The sale price is \$37.50. What was the regular price? Sketch a number line to illustrate the answer.

14. A theatre has 840 seats. For one performance, the theatre was 75% full.
a) How many people were in the theatre?
b) By the end of the performance, 30 people had left. How many people were in the theatre then?
c) Ninety percent of the remaining audience stood to give the performers a standing ovation. How many people were still sitting?

9

15. Order these integers from least to greatest.
$+5, -6, -8, +2, 0, -5, -1$

16. Add or subtract. Use coloured tiles or number lines.
a) $(+5) + (-9)$
b) $(-1) + (-5)$
c) $(+2) - (-8)$
d) $(-9) - (-3)$

17. A rock climber climbed 3 m, was lowered 1 m, then climbed 5 m more.
a) How high did she climb?
b) The total height of the climb is 10 m. How much farther does she have to climb?
Use coloured tiles if they help.

18. The temperature at 6 a.m. is -10°C. During the day, the temperature rises 17°C. What is the new temperature?

10

19. Write each algebraic expression in words.
a) $2 - 3x$
b) $3x - 2$
c) $35 - y$
d) $y + 35$
e) $2(x + 2)$
f) $\frac{z}{5} + 10$

20. Write each statement as an algebraic expression.
a) a number divided by twelve
b) one-twelfth of a number
c) eleven added to five times a number

21. Students are fund raising by washing cars.
The students charge $6.00 per car.

a) Copy and complete this table.

Numbers of Cars	Money Collected ($)
5	
10	
15	
20	
25	
30	

b) Graph the data in the table in part a.

c) What patterns do you see in the table? How could you extend each pattern?

d) Suppose you know how many cars were washed. How can you find how much money was collected in each case?

i) by using the table

ii) by using the graph

e) Suppose 27 cars were washed. How much money was collected?
How many different ways can you find the answer? Explain.

22. Solve each equation.

a) $2x + 3 = 15$

b) $\frac{x}{3} = 15$

c) $\frac{15}{x} = 3$

d) $2x - 3 = 15$

23. Evan had $852.00.
He shared the money equally with his brother and sister.

a) Write an equation you can solve to find out how much money each person got.

b) Solve the equation.

11 **24.** **a)** What are the possible outcomes when 3 coins are tossed?

b) What is the probability of each outcome?

c) Design and conduct an experiment to find the relative frequency of each outcome.

d) Write each relative frequency as a decimal.

e) How do the probabilities and relative frequencies compare?
Is this what you expect? Explain.

25. Each letter of the word PROBABILITY is written on a card.
The cards are placed in a box.
Suppose you pick a card, at random, record the letter, then replace the card.
In 55 trials, about how many times would you expect each outcome?

a) a P **b)** a B **c)** a vowel **d)** an X

26. Anca rolls two number cubes labelled 3 to 8. She adds the numbers that show on the cubes.
List the possible outcomes.
Use a tree diagram if it helps.

Extra Practice

Unit 1

1. Jean bought DVDs that cost \$23, \$18, \$29, \$52, and \$24, including tax. How much did he spend?

2. Canada has 891 163 km^2 of water. One hundred fifty-eight thousand three hundred sixty-four square kilometres of this water is in Ontario. How much water is in the rest of Canada?

3. An auditorium has 1456 seats. There are 28 seats in each row. How many rows are there?

4. One pair of running shoes costs \$99. How much would 99 pairs cost? How can you find out using mental math?

5. The average Canadian walks and runs about 193 000 km in a lifetime.
   a) About how far is this per year? Per week?
   b) Do you think the estimates in part a are reasonable? Explain.

6. Find the factors of each number.
   a) 36 b) 56 c) 96

7. Write the first 10 multiples of each number.
   a) 12 b) 15 c) 20

8. Find the greatest common factor of each pair of numbers.
   a) 18, 42 b) 60, 33
   c) 25, 75 d) 48, 84

9. Find the square of each number.
   a) 7 b) 17
   c) 27 d) 37

10. Find the lowest common multiple of each pair of numbers.
    a) 18, 8 b) 24, 10
    c) 36, 15 d) 42, 24

11. Find a square root of each number. Use grid paper. Draw a diagram to show each square root.
    a) 81 b) 144
    c) 225 d) 400

12. a) Find the area of a square with side length 14 cm.
    b) What is the perimeter of the square?

13. a) Find the side length of a square with area 900 m^2.
    b) What is the perimeter of the square?

14. Find the perimeter of a square with area 169 cm^2.

15. What is the volume of a cube with edge length 15 cm? How can you use exponents to find out?

16. Write in exponent form.
    a) $4 \times 4 \times 4 \times 4 \times 4$
    b) $12 \times 12 \times 12 \times 12$

17. a) Evaluate.
    i) $5 \times 9 + 5$
    ii) $56 \times 9 + 6$
    iii) $567 \times 9 + 7$
    b) Predict the answer for $5678 \times 9 + 8$. Use a calculator to check.

1. **a)** Draw a diagram to show the ratio 6:7.
b) Draw a diagram to show the ratio 2:7.

2. Write each ratio in simplest form.
a) 22:11 **b)** 21:12
c) 25:15 **d)** 14:56

3. Write three ratios equivalent to each ratio. Show your work in tables.
a) 5:7 **b)** 36:10
c) 9:4 **d)** 32:44

4. Use these diagrams.

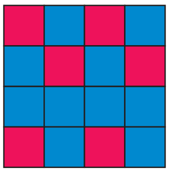


Figure A

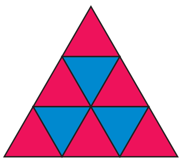


Figure B

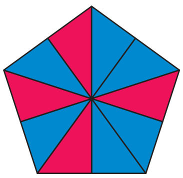


Figure C

Which diagram shows each red to blue ratio?
a) 2:1 **b)** 2:3 **c)** 3:5

5. Arlene is 12 years old.
Her brother is 4 years old.
a) What is the ratio of their ages?
b) What will the ratio be in one year?
c) How old will Arlene and her brother be when the ratio of their ages is 2:1?

6. Two buckets contain equal numbers of Pattern Blocks. In Bucket A, the ratio of triangles to squares is 1:3. In Bucket B, the ratio of triangles to squares is 3:4.
a) Which bucket contains more triangles? More squares? How do you know?
b) What is the ratio of the number of triangles in Bucket A to the number of squares in Bucket B?

7. In a hockey club storeroom, the ratio of sticks to helmets is 5:3.
a) There are 12 helmets.
How many sticks are there?
b) One new stick is added. What is the new ratio of sticks to helmets?

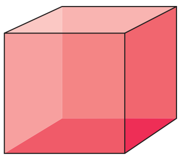
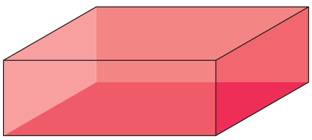
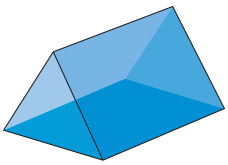
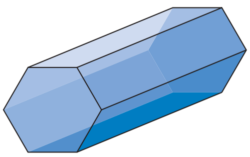
8. On a school trip, the ratio of boys to girls is 4 to 5.
The ratio of girls to adults is 7 to 2.
a) What is the ratio of boys and girls to adults?
b) One hundred forty-six people went on the trip. How many were girls?

9. Find a pair of numbers between 30 and 50 that have a ratio of 6:5. How many different pairs can you find?

10. A spice mixture contains 5 g of coriander, 3 g of cumin, and 2 g of peppercorns.
a) What is the ratio of the mass of each spice to the total mass?
b) How much of each spice is needed to make 1 kg of spice mixture?

1. Use 3 linking cubes.
   Use square dot paper.
   a) Make an object.
      Draw the front, back, side, and top views of the object.
   b) How many different objects can you make with 3 linking cubes?
      Make each additional object.
      Draw its front, back, side, and top views.

2. Find each object in the classroom.
   Sketch its front, back, top, and side views.
   a) bookcase b) table c) pencil

3. Draw a pictorial diagram of each solid.
   a)
   
   b)
   
   c)
   
   d)
   

4. a) Draw the cube in question 3 on isometric dot paper.
   b) Draw the rectangular prism in question 3 on isometric dot paper.

5. Use 4 linking cubes.
   Make an object that is not a rectangular prism.
   Draw the object on isometric dot paper.

6. Use formulas.
   a) Find the area and perimeter of a rectangle with base 12.5 cm and height 3.6 cm.
   b) Find the area and perimeter of a square with side length 5.6 m.

7. Use formulas.
   a) Find the surface area of a rectangular prism with length 6 cm, height 7 cm, and width 4 cm.
   b) Find the volume of the prism in part a.
   c) Find the surface area of a cube with edge length 1.8 cm.
   d) Find the volume of the cube in part c.

8. Anthony is wrapping a birthday gift in a box that measures 30 cm by 20 cm by 8 cm.
   a) What is the surface area of the box?
   b) How much wrapping paper is needed if allowance is made for overlap? Sketch a diagram to illustrate your answer.

9. A shed has the shape of a rectangular prism. It is 2 m high, 3 m wide, and 4 m long. The walls and doors are to be painted inside and out. The roof, ceilings, and floor are to be painted. The shed has two windows; each measures 1 m by 1 m. What is the area that will be painted?

Unit 4

1. Write in simplest form.

a) $\frac{18}{12}$ b) $\frac{12}{27}$ c) $\frac{6}{9}$ d) $\frac{8}{4}$

2. Draw a diagram to show how to write each improper fraction as a mixed number.

a) $\frac{5}{3}$ b) $\frac{7}{5}$ c) $\frac{14}{4}$ d) $\frac{22}{6}$

3. Use a calculator.
Write each fraction as a decimal.

a) $\frac{17}{18}$ b) $\frac{13}{4}$ c) $\frac{3}{5}$ d) $\frac{7}{3}$

4. Use fraction strips and number lines to add.

a) $\frac{2}{3} + \frac{3}{2}$ b) $\frac{1}{4} + \frac{7}{8}$
c) $\frac{3}{5} + \frac{2}{10}$ d) $\frac{5}{3} + \frac{1}{12}$

5. The sum: $\frac{2}{3} + \frac{1}{5}$ is $\frac{13}{15}$.
Use this result to add these fractions.

a) $1\frac{2}{3} + 1\frac{1}{5}$ b) $3\frac{2}{3} + \frac{1}{5}$
c) $\frac{1}{3} + \frac{1}{5} + \frac{1}{3}$ d) $\frac{1}{5} + 1\frac{2}{3}$

6. Use fraction strips and number lines to subtract.

a) $\frac{7}{8} - \frac{1}{2}$ b) $\frac{7}{6} - \frac{2}{4}$
c) $1 - \frac{5}{8}$ d) $\frac{11}{6} - \frac{2}{3}$

7. Add.

a) $\frac{1}{5} + \frac{3}{8}$ b) $\frac{5}{4} + \frac{1}{6}$
c) $\frac{4}{3} + \frac{1}{5}$ d) $\frac{7}{6} + \frac{1}{8}$

8. Subtract.

a) $\frac{7}{4} - \frac{4}{3}$ b) $\frac{6}{5} - \frac{5}{6}$
c) $\frac{3}{5} - \frac{2}{4}$ d) $\frac{7}{8} - \frac{4}{5}$

9. Add.

a) $\frac{2}{3} + \frac{1}{2} + \frac{3}{4}$ b) $\frac{2}{5} + \frac{3}{10} + \frac{5}{2}$
c) $\frac{4}{9} + \frac{5}{6} + \frac{1}{3}$ d) $\frac{3}{2} + \frac{1}{6} + \frac{4}{5}$

10. Write each sum as a multiplication question.

a) $\frac{3}{5} + \frac{3}{5} + \frac{3}{5} + \frac{3}{5} + \frac{3}{5}$
b) $\frac{7}{4} + \frac{7}{4} + \frac{7}{4}$

11. Find each sum in question 10.

12. Multiply.
Draw a diagram to show each answer.

a) $\frac{2}{8} \times 5$ b) $\frac{11}{6} \times 3$
c) $4 \times \frac{7}{2}$ d) $6 \times \frac{1}{8}$

13. Multiply.
Draw a picture on grid paper to show the product.

a) 2.3×3.4 b) 1.8×2.2
c) 4.1×3.7 d) 1.7×2.9

14. Divide.

a) $3.5 \div 1.4$ b) $18.2 \div 5.2$
c) $10.08 \div 3.6$ d) $6.75 \div 4.5$

15. Find the area of a rectangular vegetable plot with length 10.8 m and width 5.2 m.

16. A rectangular quilt has area 3.15 m^2.
The quilt is 2.1 m long.
What is its width?

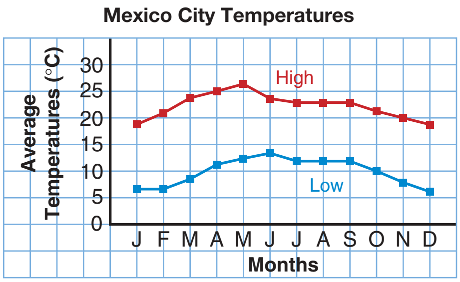
17. One kilogram of grapes cost $5.89.

a) How much do 2.4 kg cost?
b) How much change is there from a $20-bill?

18. Evaluate.

a) $3.5 + 2.4 \times 1.7 - 3.8$
b) $15.3 - 8.75 \div 2.5 \times 1.2$

1. This graph was produced with a spreadsheet program.



a) What is the approximate high temperature in May? In June?
b) Estimate the difference between the average high and the average low temperatures in October.
c) During which months does the average high temperature increase? When does the average low temperature increase?
d) Write one question for which each following statement is the answer.
   i) The highest temperature is about 26°C.
   ii) The lowest temperature is about 13°C.

2. The table shows the approximate areas of some countries.

Country	Area (km^2)
Austria	84 000
Costa Rica	51 000
Denmark	43 000
Greece	132 000
Japan	378 000
Italy	301 000
Spain	195 000

a) Draw a bar graph. Explain why a line graph would not be appropriate.
b) Use your graph. Estimate the difference between the areas of Greece and Italy.
c) Use the table. Estimate the difference between the areas of Greece and Italy.
d) Look at a map of Europe. Are your answers for parts b and c reasonable?
e) Estimate the sum of the areas of Austria, Denmark, and Spain. Explain how you estimated the sum.

3. Here are the heights in centimetres of some 12-year-old students.
125, 152, 134, 141, 153, 127, 168, 154, 139, 147, 132, 137, 163, 133
a) Draw a stem-and-leaf plot.
b) What is the median height?
c) What is the mode? The mean?

4. The median shoe size of eight 12-year-old boys is $6\frac{1}{2}$. What might the shoe sizes be? Explain your answer.

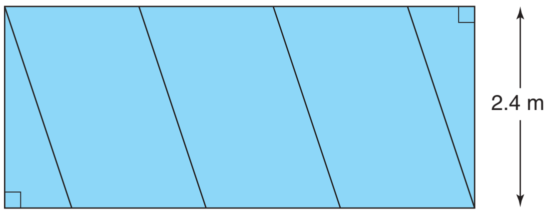
5. Here are the times, in minutes and seconds, for 28 swimmers who raced in the 200-m backstroke:
2:25, 3:01, 1:45, 3:15, 2:30, 2:54, 3:10, 1:59, 2:25, 3:10, 3:09, 2:43, 2:18, 3:04, 2:53, 2:28, 3:14, 2:37, 3:03, 2:39, 2:27, 2:43, 3:09, 2:54, 3:11, 2:38, 2:42, 2:57
a) Draw a stem-and-leaf plot.
b) What is the range?
c) Which stem has the most leaves? What does this mean?
d) What is the median time?
e) What is the mode time?

1. **a)** On 0.5-cm grid paper, draw 3 different parallelograms with base 5.5 cm and height 8.5 cm.
b) What is the area of each parallelogram in part a?

2. On 0.5-cm grid paper, draw 3 different parallelograms with area 24 cm^2.
What is the base and height of each parallelogram?

3. Use a formula.
Find the area of a parallelogram with base 11.3 cm and height 5.7 cm.

4. The window below consists of 5 pieces of glass. Each piece that is a parallelogram has a base of 1.6 m. What is the area of one parallelogram?



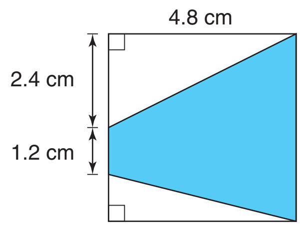
5. The base of each triangle in the window above is 0.8 m.
a) What is the area of one triangle?
b) What is the area of the window? Explain how you found the area.

6. **a)** On 0.5 cm-grid paper, draw 3 different triangles with base 4.5 cm and height 7.5 cm.
b) What is the area of each triangle in part a?

7. On 0.5-cm grid paper, draw 3 different triangles with area 12 cm^2.
a) What is the base and height of each triangle?
b) How are the triangles in part a related to the parallelograms in question 2?

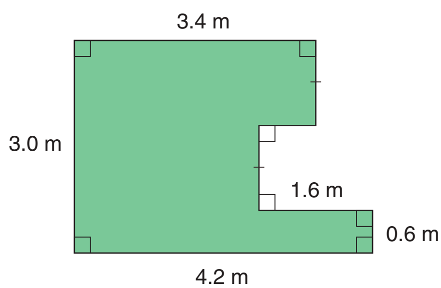
8. Use a formula.
Find the area of a triangle with base 4.3 cm and height 2.6 cm.

9. **a)** Find the area of the shaded region in the square below.

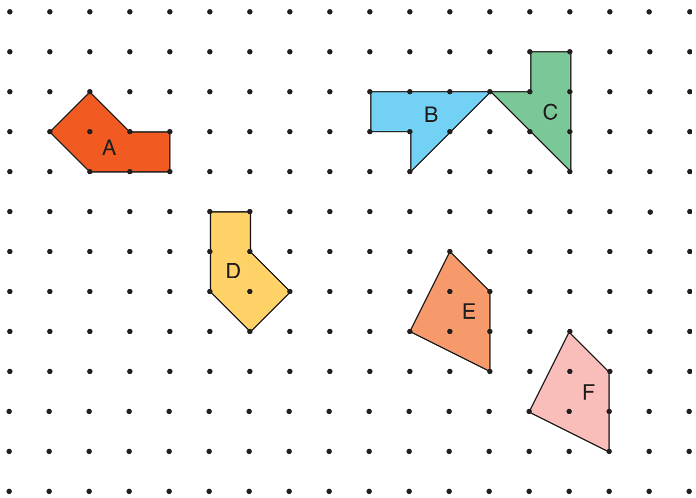


b) How many different ways can you find the area?
Explain each way.
c) Estimate the perimeter of the shaded region in part a.
d) Can you calculate the perimeter of the shaded region in part a? Explain.

10. Calculate the perimeter and area of this figure.



Use these figures for questions 1 to 5.



1. Classify each figure.
Describe its attributes.

2. Identify pairs of congruent figures.
Explain how you know the figures are congruent.

3. Identify the transformation that each pair of congruent figures represents.

4. **a)** Use one figure from each pair. Try to tile the plane with each figure. Identify the figures that tile the plane.
b) For each figure that does not tile the plane:
- Find another figure that combines with the figure to tile the plane.
- Tile the plane with the two figures combined.

5. Use one tiling pattern from question 4. Use one of each type of figures. Explain how you can use transformations to tile the plane.

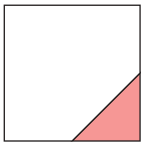
6. Use square dot paper or isometric dot paper. Draw each polygon.
a) an equilateral triangle with side length 3 units
b) a rhombus with base 4 units and an angle of 60°
c) an acute isosceles triangle

7. Which figures in question 6 have line symmetry? Draw the lines of symmetry on the figures.

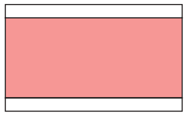
8. Plot these points on a grid:
A(10, 8), B(10, 10), C(12, 12), D(13, 9)
Join the points to make a quadrilateral.
Draw the image of the quadrilateral after each transformation.
a) a translation 3 units right and 4 units up
b) a reflection in a vertical line through (7, 0)
c) a rotation of a $\frac{1}{4}$ turn clockwise about A

1. Estimate what percent of each figure is shaded. Explain your strategy.

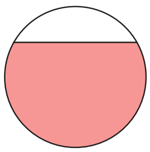
a)



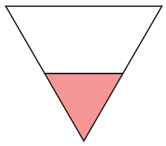
b)



c)



d)



2. Write each fraction as a percent, then as a decimal.

a) $\frac{3}{4}$ b) $\frac{3}{2}$ c) $\frac{3}{5}$ d) $\frac{3}{20}$

3. Find each percent.

a) 10% of $200 b) 1% of $85
c) 10% of $60 d) 1% of $187
e) 10% of $55 f) 10% of $140
g) 1% of $5 h) 15% of $10

4. Find each percent. Explain your strategy.

a) 2% of $100
b) 4% of $300
c) 2% of $700
d) 3% of $800
e) 5% of $3000
f) 9% of $500
g) 4% of $100
h) 5% of $1000

5. Leigh drove 1470 km from Smith Falls, ON to Thunder Bay, ON. She stopped 370 km from Smith Falls. About what percent of her trip had she completed when she stopped?

6. Calculate the 15% sales tax and the total cost of each item.

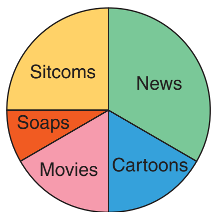
a) a bicycle that costs $349.99
b) a CD that costs $17.98

7. This year 27 students will graduate from Central School. This is 15% of the school's population. What is the population of the school?

8. The depth of deep sea trenches is measured from sea level. The Tonga Trench in the South Pacific is 10 800 m deep. Yap Trench in the West Pacific is 79% of the depth of the Tonga Trench. How deep is the Yap Trench, to the nearest 10 m?

9. This graph shows how much time is spent in one day watching different types of TV programs.

TV Programs



a) Which type of program is watched for the greatest amount of time?
b) Which two types of programs are watched for approximately the same amount of time?
c) Estimate the fraction of time spent watching sitcoms.
d) Suppose TV is watched for 1000 days. Estimate how much time is spent watching sitcoms.

1. Use an integer to describe each situation.
- **a)** The water level of Lake Superior rises 5 cm after low tide.
- **b)** The lowest recorded temperature is 89°C below 0°C recorded at Vostok, Antarctica, in 1983.
- **c)** A submarine river known as the Cromwell current flows below the surface of the Pacific ocean at depths up to 400 m.
- **d)** Mount Manaslu in Nepal has a height of 8156 m.

2. Use an integer to describe each situation.
- **a)** The time is 9 s before take-off.
- **b)** You earned $25 since yesterday.
- **c)** The average temperature close to the South Pole is 50°C below 0°C.

3. Sketch a number line. Show the integer that is 3 less than +2.

4. Replace each ☐ with < or > to make a true statement.
- **a)** −3 ☐ +5 **b)** −2 ☐ −4
- **c)** +1 ☐ 0 **d)** +8 ☐ −10

5. Order the integers from least to greatest.
0, −2, +4, −15, +1, −1, +5

6. Write the integer that is out of order.
- **a)** −5, −2, +1, +17, +13
- **b)** −34, −7, +3, +7, −12
- **c)** −11, +11, +13, −13, +27
- **d)** −4, −3, +2, −1, 0

7. Add.
- **a)** (+6) + (+9) **b)** (−4) + (−7)
- **c)** (−8) + (−6) **d)** (−11) + (+5)
- **e)** (+7) + (−8) **f)** (−9) + (−12)
- **g)** (+13) + (−3) **h)** (−5) + (−8)

8. Subtract.
- **a)** (−14) − (+7) **b)** (+12) − (+9)
- **c)** (+16) − (−4) **d)** (−11) − (−8)
- **e)** (+22) − (+3) **f)** (+14) − (−7)
- **g)** (−19) − (−11) **h)** (+18) − (−3)

9. Add.
Write the addition equation.
- **a)** (+4) + (+2) **b)** (−2) + (+3)
- **c)** (−3) + (−2) **d)** (+5) + (−6)
- **e)** (−23) + (+4) **f)** (−19) + (−3)
- **g)** (+13) + (−2) **h)** (+9) + (+13)

10. Subtract.
Write the subtraction equation.
- **a)** (+5) − (+3) **b)** (+3) − (−4)
- **c)** (−5) − (+3) **d)** (−7) − (−4)
- **e)** (+13) − (−12) **f)** (−22) − (+32)
- **g)** (−23) − (−23) **h)** (−7) − (+10)

11. On December 11, the predicted high and low temperatures in Kenora, ON, were −1°C and −9°C.
- **a)** Which is the high temperature and which is the low temperature?
- **b)** What is the difference in temperatures?

12. Add or subtract as indicated.
- **a)** (+6) + (+6) **b)** (+6) + (−6)
- **c)** (−6) + (+6) **d)** (−6) + (−6)
- **e)** (+6) − (+6) **f)** (+6) − (−6)
- **g)** (−6) − (+6) **h)** (−6) − (−6)

Unit 10

1. Each pattern continues.
For each pattern:
i) Describe the pattern.
ii) Write the next 3 terms.
iii) Find the 15th term.
Explain how you found it.
a) 2, 5, 8, 11, 14, …
b) 1, 3, 6, 8, 11, …
c) 1, 3, 6, 10, 15, …
d) 3, 6, 11, 18, 27, …

2. **a)** Copy and complete this table for this pattern:
Multiply each Input number by 4, then subtract 1.

Input	Output
1	
2	
3	
4	
5	

b) Extend the table 3 more rows.
c) What patterns do you see in the table?
d) Graph the data.
e) Explain how the graph shows the patterns in the table.

3. Write each algebraic expression in words.
a) $x + 2$ **b)** $5 - y$ **c)** $3p$ **d)** $\frac{z}{2}$

4. Write an algebraic expression for each statement.
a) four more than two times a number
b) four less than two times a number
c) a number divided by four
d) two less than four times a number

5. Evaluate each expression by replacing n with 3.
a) $4 + n$ **b)** $4 - n$ **c)** $4 + \frac{3}{n}$
d) $4 - \frac{6}{n}$ **e)** $\frac{(n + 5)}{4}$ **f)** $\frac{(n - 1)}{2}$

6. Write an equation for each sentence.
a) Three more than a number is 18.
b) The sum of 6 and a number is 71.
c) A number divided by 5 is 14.
d) The product of 4 and a number is 64.

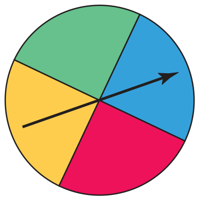
7. Write each equation in words.
a) $3p = 9$ **b)** $\frac{15}{n} = 3$
c) $r - 6 = 13$ **d)** $24n = 552$

8. Write an equation you can solve to answer each question.
a) Ray scored 14 points in the game. Tung scored 8 more points than Ray. How many points did Tung score?
b) Nema has 4 times as many hockey cards as Tamar. Tamar has 156 cards. How many cards does Nema have?
c) Adriel cycled 80 km less than Alona cycled. Alona cycled 218 km. How far did Adriel cycle?

9. Solve by inspection.
a) $n + 5 = 30$ **b)** $n - 5 = 30$
c) $5n = 30$ **d)** $\frac{n}{5} = 30$
e) $\frac{30}{n} = 5$ **f)** $5n + 10 = 30$

10. Solve by systematic trial.
a) $3x + 5 = 26$ **b)** $3x - 5 = 25$
c) $24 - 3x = 6$ **d)** $24 + 3x = 66$
e) $\frac{x}{13} = 19$ **f)** $\frac{414}{x} = 18$

1. The 12 face cards (J, Q, K) from a deck of cards are placed in a bag. One card is taken from the bag at random. The pointer on this spinner is spun.



a) List the possible outcome of taking a card and spinning the pointer.
b) How many outcomes include taking the Jack of spades?
c) How many outcomes include landing on a green sector?

2. You will need a deck of playing cards.
a) Make a table with these headings.

Outcome	Tally	Frequency	Relative Frequency

b) A card is picked at random from the deck. Assume the suit does not matter. List the possible outcomes in the *Outcome* column.
c) Are the outcomes in part b equally likely? Explain.
d) Pick a card at random from the deck. Record it in the *Tally* column. Return the card to the deck. Return this experiment until you have 50 results. Complete the *Frequency* column.
e) Calculate and record the relative frequencies.
f) Do the results confirm your answer in part c? Explain.

3. A number cube is labelled 1 to 6. The number cube is rolled 150 times. Predict the number of times:
a) a 1 will show
b) a multiple of 3 will show
c) a number less than 4 will show

4. A box contains 3 red, 2 green, and 4 white candies. Carmen picked one candy at random, found it was white, and ate it. She picked a second candy at random, found it was red, and ate it. Carmen picked a third candy at random. Which colour is it most likely to be? Explain.

5. In the game SCRABBLE, there are 100 tiles. Two tiles are blank. Here is the number of tiles for each letter: A, 9; B: 2; C: 2; D: 4; E: 12; F: 2; G: 3; H: 2; I: 9, J: 1; K: 1; L: 4; M: 2; N: 6; O: 8; P: 2; Q: 1; R: 6; S: 4; T: 6; U: 4; V: 2; W: 2; X: 1; Y: 2; Z: 1.
The 100 tiles are placed in a bag.
One tile is picked at random.
a) Which letter has the greatest probability of being picked?
b) What is the probability of picking a blank?
c) Which letter has the least probability of being picked?
d) Which letters have the same probability of being picked? What are these probabilities?
e) Does any letter have a 0% chance of being picked? Explain.

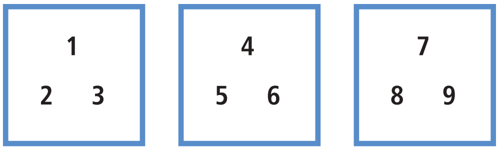
Take It Further

1. Find 2 consecutive prime numbers whose product is 899.

2. Use four 6s to make 42.

3. Use 25 coins to make $1.

4. Move one number from one box to another box so the sums of the numbers in the boxes will then be equal.



5. Use the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 to make a true equation.
$(\square + \square - \square + \square - \square + \square) \times$
$(\square - \square + \square - \square) = 0$

6. Lloyd gave $\frac{1}{2}$ his hockey cards to Jenny. He then gave $\frac{2}{3}$ of his remaining cards to Jerome. Lloyd ended up with 10 cards. How many cards did he start with?

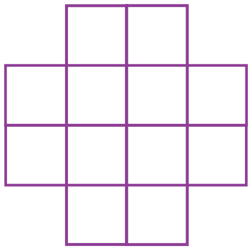
7. Find 4 consecutive odd numbers that add to 120.

8. Leave the numerals in the order shown below. Place only + and − signs to make a true equation.
1 2 3 4 5 6 7 8 9 0 = 100

9. Use five 5s to make 30.

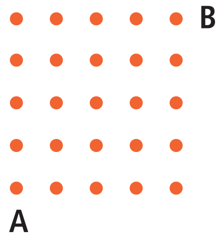
10. Use 3 five times to make 31.

11. Copy this figure on grid paper. How many rectangles are there in the figure?



12. Use the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 to make a true equation.
$\square\,\square + \square\,\square + \square + \square\,\square + \square + \square + \square$
$= 99$

13. Use square dot paper.
Outline a square array of 25 dots.
Move only up and to the right.
How many paths can you take from A to B?



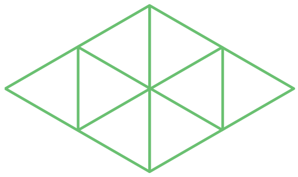
14. Use seven 4s to make 100.

15. Without using a calculator, find the sum of the whole numbers from 1 to 100, inclusive.
Try to find a quick way to do this.
Explain your thinking.

16. Twenty-four players enter a singles tennis tournament. How many matches must be played to find a winner?

Take It Further

17. Copy this diagram. How can you remove 6 line segments from this figure to get 2 triangles?



18. Two organisms are placed in a container. Their numbers double every 24 h. At the end of 14 days, the container is full. When was it half full?

19. The number 2 is special because $2 + 2 = 4$ and $2 \times 2 = 4$. Find another pair of numbers whose sum equals their product. Don't use 0. The numbers may be different.

20. The sum of the digits of a 2-digit number is 5. When the digits are reversed, the new number is 9 less than the original number. What was the original number?

21. Ali started a job on Monday, June 1. He was paid 1¢ the first day, 2¢ the second day, 4¢ the third day, and so on. His earnings doubled each day. He worked Monday to Friday all through June. How much did he earn altogether?

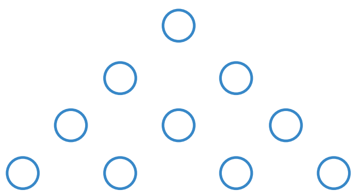
22. Suppose you have a 5-L container and an 8-L container. You need exactly 2 L of water in one of the containers. How can you do this?

23. Joanne had a bag of potatoes. When she counted them by 2s, she had 1 left over.
When she counted them by 3s, there were 2 left over.
When she counted them by 4s, there were 3 left over.
When she counted them by 5s, there were none left over.
How many potatoes were in the bag?

24. Ms. Jones built a fence around her square vegetable garden.
Each side had 10 fence posts.
How many fence posts did she use?

25. Choose a digit. Use 3 of these digits to make 30. Try to find more than one way to do this.

26. Use counters to make this triangle. How can you move 3 of the counters to make the triangle point down instead of up?

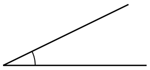


27. A kettle leaked 2 drops the first day, 4 drops the second day, and 8 drops the third day. It continues to leak following this pattern.
When will the 500th drop leak?

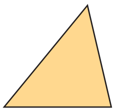
28. The mass of a bag of stone chips is 20 kg plus half a bag of stone chips.
What is the mass of a bag and a half of stone chips?

Illustrated Glossary

acute angle: an angle measuring less than 90°

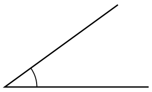


acute triangle: a triangle with three acute angles



algebraic expression: a mathematical expression containing a variable: for example, $6x - 4$ is an algebraic expression

angle: the figure formed by two rays from the same endpoint



approximate: a number close to the exact value of an expression; the symbol $\doteq$ means "is approximately equal to"

area: the number of square units needed to cover a region

array: an arrangement in rows and columns

assumption: something that is accepted as true, but has not been proved

average: a single number that represents a set of numbers; see *mean*, *median*, and *mode*

bar graph: a graph that displays data by using horizontal or vertical bars (see page 175)

bar notation: the use of a horizontal bar over a decimal digit to indicate that it repeats; for example, $1.\overline{3}$ means 1.333 333 …

base: the side of a polygon or the face of a solid from which the height is measured; the factor repeated in a power

bias: an emphasis on characteristics that are not typical of the entire population

capacity: the amount a container can hold

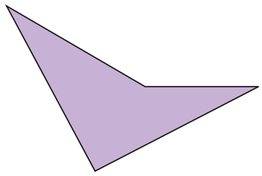
circle graph: a diagram that uses parts of a circle to display data (see page 307)

common denominator: a number that is a multiple of each of the given denominators; for example, 12 is a common denominator for the fractions $\frac{1}{3}, \frac{5}{4}, \frac{7}{12}$

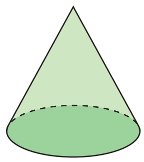
common factor: a number that is a factor of each of the given numbers; for example, 3 is a common factor of 15, 9, and 21

composite number: a number with three or more factors; for example, 8 is a composite number because its factors are 1, 2, 4, and 8

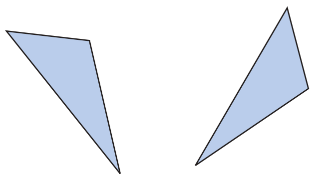
concave polygon: has at least one angle greater than 180°



cone: a solid formed by a region and all line segments joining points on the boundary of the region to a point not in the region

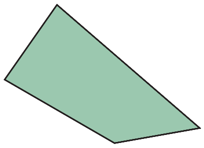


congruent: figures that have the same size and shape, but not necessarily the same orientation



consecutive numbers: integers that come one after the other without any integers missing; for example, 34, 35, 36 are consecutive numbers, so are −2, −1, 0, and 1

convex polygon: has all angles less than 180°

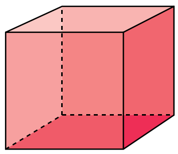


coordinate axes: the horizontal and vertical axes on a grid

coordinate grid: a two-dimensional surface on which a coordinate system has been set up

coordinates: the numbers in an ordered pair that locate a point on the grid

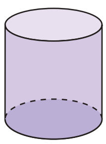
cube: a solid with six congruent square faces



cube number: a power with exponent 3; for example, 8 is a cube number because $8 = 2^3$

cubic units: units that measure volume

cylinder: a solid with two parallel, congruent, circular bases

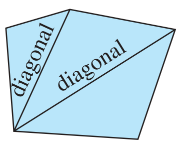


data: facts or information

database: an organized collection of facts or information, often stored on a computer

denominator: the term below the line in a fraction

diagonal: a line segment that joins two vertices of a figure, but is not a side



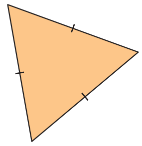
digit: any of the symbols used to write numerals; for example, in the base-ten system the digits are 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9

dimensions: measurements, such as length, width, and height

dodecahedron: a polyhedron with 12 faces

equation: a mathematical statement that two expressions are equal

equilateral triangle: a triangle with three equal sides



equivalent: having the same value; for example, $\frac{2}{3}$ and $\frac{6}{9}$ are equivalent fractions; 2:3 and 6:9 are equivalent ratios

estimate: a reasoned guess that is close to the actual value, without calculating it exactly

evaluate: to substitute a value for each variable in an expression

even number: a number that has 2 as a factor; for example, 2, 4, 6

event: any set of outcomes of an experiment

experimental probability: the probability of an event calculated from experimental results; another name for the *relative frequency* of an outcome

exponent: a number, shown in a smaller size and raised, that tells how many times the number before it is used as a factor; for example, 2 is the exponent in 6^2

expression: a mathematical phrase made up of numbers and/or variables connected by operations

factor: to factor means to write as a product; for example, $20 = 2 \times 2 \times 5$

formula: a rule that is expressed as an equation

fraction: an indicated quotient of two quantities

fraction strips: strips of paper used to model fractions (see page 121)

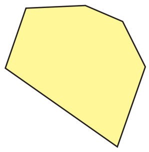
frequency: the number of times a particular number occurs in a set of data

frustum: part of a cone or pyramid that remains when a cut is made parallel to the base, and the top of the cone or pyramid is removed (see page 90)

greatest common factor (GCF): the greatest number that divides into each number in a set; for example, 5 is the greatest common factor of 10 and 15

hectare: a unit of area that is equal to 10 000 m^2

hexagon: a six-sided polygon



horizontal axis: the horizontal number line on a coordinate grid

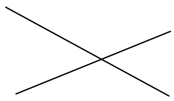
icosahedron: a polyhedron with 20 faces

image: the figure that results from a transformation

improper fraction: a fraction with the numerator greater than the denominator; for example, both $\frac{6}{5}$ and $\frac{5}{3}$ are improper fractions

integers: the set of numbers … $-3, -2, -1, 0, +1, +2, +3, \ldots$

intersecting lines: lines that meet or cross; lines that have one point in common



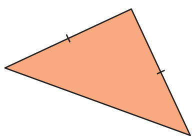
isometric view: a representation of an object as it would appear in three dimensions

isosceles acute triangle: a triangle with two equal sides and all angles less than 90°

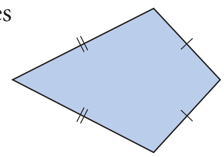
isosceles obtuse triangle: a triangle with two equal sides and one angle greater than 90°

isosceles right triangle: a triangle with two equal sides and a 90° angle

isosceles triangle: a triangle with two equal sides



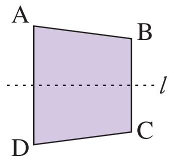
kite: a quadrilateral with two pairs of equal adjacent sides



line graph: a graph that displays data by using points joined by line segments (see page 189)

line segment: the part of a line between two points on the line

line symmetry: a figure has line symmetry when it can be divided into 2 congruent parts, so that one part concides with the other part when the figure is folded at the line of symmetry; for example, line *l* is the line of symmetry for figure ABCD



lowest common multiple (LCM): the lowest multiple that is the same for two numbers; for example, the lowest common multiple of 12 and 21 is 84

magic square: an array of numbers in which the sum of the numbers in any row, column, or diagonal is always the same (see page 326)

magic sum: the sum of the numbers in a row, column, or diagonal of a magic square

mass: the amount of matter in an object

mean: the sum of a set of numbers divided by the number of numbers in the set

median: the middle number when data are arranged in numerical order; if there is an even number of data, the median is the mean of the two middle numbers

midpoint: the point that divides a line segment into two equal parts

mixed number: a number consisting of a whole number and a fraction; for example, $1\frac{1}{18}$ is a mixed number

mode: the number that occurs most often in a set of numbers

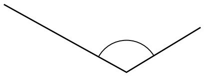
multiple: the product of a given number and a natural number; for example, some multiples of 8 are 8, 16, 24,…

natural numbers: the set of numbers 1, 2, 3, 4, 5,…

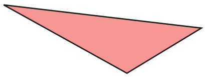
negative number: a number less than 0

numerator: the term above the line in a fraction

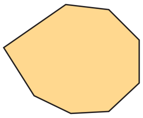
obtuse angle: an angle greater than 90° and less than 180°



obtuse triangle: a triangle with one angle greater than 90°



octagon: an eight-sided polygon



octahedron: a polyhedron with 8 faces

odd number: a number that does not have 2 as a factor; for example, 1, 3, 7

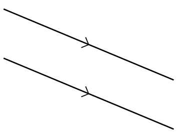
operation: a mathematical process or action such as addition, subtraction, multiplication, or division

opposite integers: two integers with a sum of 0; for example, +3 and −3 are opposite integers

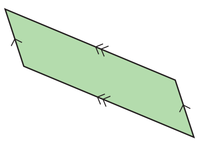
order of operations: the rules that are followed when simplifying or evaluating an expression

outcome: a possible result of an experiment or a possible answer to a survey question

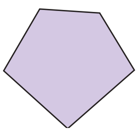
parallel lines: lines on the same flat surface that do not intersect



parallelogram: a quadrilateral with both pairs of opposite sides parallel



pentagon: a five-sided polygon



per capita: for each person

percent: the number of parts per 100; the numerator of a fraction with denominator 100

perfect cube: a number that is the cube of a whole number; for example, 64 is a perfect cube because $64 = 4^3$

perfect square: a number that is the square of a whole number; for example, 16 is a perfect square because $16 = 4^2$

perimeter: the distance around a closed figure

perpendicular lines: intersect at 90°

pictograph: a graph that uses a symbol to represent a certain number, and repetitions of the symbol illustrate the data (see page 176)

pictorial diagram: shows the shape of an object in two dimensions

polygon: a closed figure that consists of line segments; for example, triangles and quadrilaterals are polygons

polyhedron (*plural*, polyhedra): a solid with faces that are polygons

population: the set of all things or people being considered

positive number: a number greater than 0

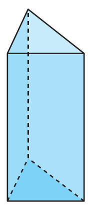
power: an expression of a product of equal factors; for example, $4 \times 4 \times 4$ can be expressed as 4^3; 4 is the base and 3 is the exponent

prediction: a statement of what you think will happen

primary data: data collected by oneself; first-hand

prime number: a whole number with exactly two factors, itself and 1; for example, 2, 3, 5, 7, 11, 29, 31, and 43

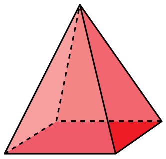
prism: a solid that has two congruent and parallel faces (the *bases*), and other faces that are parallelograms



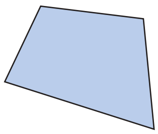
probability: the likelihood of a particular outcome; the number of times a particular outcome occurs, written as a fraction of the total number of outcomes

product: the result when two or more numbers are multiplied

pyramid: a solid that has one face that is a polygon (the *base*), and other faces that are triangles with a common vertex



quadrilateral: a four-sided polygon



quotient: the result when one number is divided by another

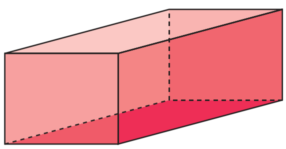
range: the difference between the greatest and least numbers in a set of data

rate: a certain quantity or amount of one thing considered in relation to a unit of another thing

ratio: a comparison of two or more quantities with the same unit

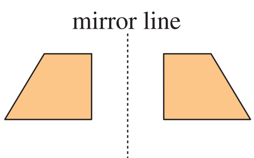
rectangle: a quadrilateral that has four right angles

rectangular prism: a prism that has rectangular faces

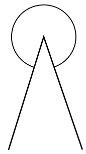


rectangular pyramid: a pyramid with a rectangular base

reflection: a transformation that is illustrated by a figure and its image in a mirror line



reflex angle: an angle between 180° and 360°



regular dodecahedron: a regular polyhedron with 12 congruent faces; each face is a regular pentagon (see page 90)

regular hexagon: a polygon that has six equal sides and six equal angles

regular icosahedron: a regular polyhedron with 20 congruent faces; each face is an equilateral triangle (see page 90)

regular octagon: a polygon that has eight equal sides and eight equal angles

regular octahedron: a regular polyhedron with 8 congruent faces; each face is an equilateral triangle (see page 90)

regular polygon: a polygon that has all sides equal and all angles equal

regular polyhedron: a solid with faces that are congruent regular polygons, with the same number of edges meeting at each vertex (see page 76)

related denominators: two fractions where the denominator of one fraction is a factor of the other; their lowest common denominator is the greater of the two denominators

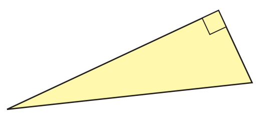
relative frequency: the number of times a particular outcome occurred, written as a fraction of the total number of times the experiment was conducted

repeating decimal: a decimal with a repeating pattern in the digits that follow the decimal point; it is written with a bar above the repeating digits; for example, $\frac{1}{11} = 0.\overline{09}$

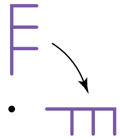
rhombus: a parallelogram with four equal sides

right angle: a 90° angle

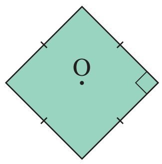
right triangle: a triangle that has one right angle



rotation: a transformation in which a figure is turned about a fixed point



rotational symmetry: a figure that coincides with itself in less than one full turn is said to have rotational symmetry; for example, a square has rotational symmetry of order 4 about its centre O



sample/sampling: a representative portion of a population

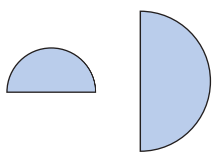
scale: the ratio of the distance between two points on a map, model, or diagram to the distance between the actual locations; the numbers on the axes of a graph

scalene triangle: a triangle with all sides different

scatter plot: a graph of data that is a set of points

secondary data: data not collected by oneself, but by others; data found from the library, or the Internet

similar figures: figures with the same shape, but not necessarily the same size



simplest form: a ratio with terms that have no common factors, other than 1; a fraction with numerator and denominator that have no common factors, other than 1

spreadsheet: a computer-generated arrangement of data in rows and columns, where a change in one value results in appropriate calculated changes in the other values

square: a rectangle with four equal sides

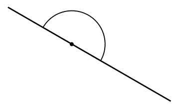
square number: the product of a number multiplied by itself; for example, 25 is the square of 5

square root: a number which, when multiplied by itself, results in a given number; for example, 5 is a square root of 25

statistics: the branch of mathematics that deals with the collection, organization, and interpretation of data

stem-and-leaf plot: an arrangement of data; for two-digit numbers, the tens digits are shown as the "stems" and the ones digits as the "leaves" (see page 179)

straight angle: an angle measuring 180°



straightedge: a strip of wood, metal, or plastic with a straight edge, but no markings

surface area: the total area of the surface of an object

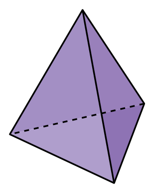
symmetrical: possessing symmetry; see *line symmetry* and *rotational symmetry*

term: of a fraction is the numerator or the denominator of the fraction

terminating decimal: a decimal with a certain number of digits after the decimal point; for example, $\frac{1}{8} = 0.125$

tessellation: a tiling pattern

tetrahedron: a solid with four triangular faces; a triangular pyramid

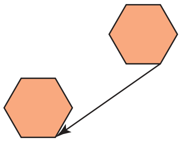


theoretical probability: the number of favourable outcomes written as a fraction of the total number of possible outcomes

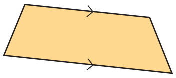
three-dimensional: having length, width, and depth or height

transformation: a translation, rotation, or reflection

translation: a transformation that moves a point or a figure in a straight line to another position on the same flat surface



trapezoid: a quadrilateral that has at least one pair of parallel sides



tree diagram: a diagram that resembles the roots or branches of a tree, used to count outcomes (see page 408)

triangle: a three-sided polygon

two-dimensional: having length and width, but no thickness, height, or depth

unit fraction: a fraction that has a numerator of 1

unit price: the price of one item, or the price of a particular mass or volume of an item

unit rate: the quantity associated with a single unit of another quantity; for example, 6 m in 1 s is a unit rate; it is written as 6 m/s

unrelated denominators: two fractions where the denominators have no common factors; their lowest common denominator is the product of the two denominators

variable: a letter or symbol representing a quantity that can vary

vertex (*plural,* vertices): the corner of a figure or a solid

vertical axis: the vertical number line on a coordinate grid

volume: the amount of space occupied by an object

whole numbers: the set of numbers 0, 1, 2, 3,…

zero pair: two opposite numbers whose sum is equal to zero

Index

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Answers

Unit 1 Patterns in Whole Numbers, page 4

Skills You'll Need, page 7

1. a) 40 **b)** 40 **c)** 80 **d)** 360
2. a) 300 **b)** 800 **c)** 600 **d)** 2400
3. a) 30 **b)** 5000 **c)** 1310 **d)** 6300
4. For example: When we multiply by 10, each number gets 10 times as great. Each digit in the number moves 1 place to the left in a place-value chart. We use 0 as a place holder.
5. a) 3600 **b)** 10 800 **c)** 132 000
6. a) 21 **b)** 17 **c)** 18
d) 26 **e)** 70 **f)** 15
g) 18 **h)** 50 **i)** 5
7. a) 53 **b)** 290 **c)** 425
d) 98 100 **e)** 2079 **f)** 496
8. b: 492, and c: 12 345
9. For example: 864, 1212, 2451, 10 548
10. a: 870
11. a) 1, 2, 3, 4, 5, 6, 10 **b)** 1, 7

1.1 Numbers All Around Us, page 12

1. a) 115 **b)** 208 **c)** 861 **d)** 73
e) 124 **f)** 336 **g)** 6500 **h)** 1050
i) 2075 **j)** 78 **k)** 181 **l)** 35
2. a) 6952 **b)** 7113 **c)** 3336
d) 2898 **e)** 31 **f)** 403
3. For example:
a) About 190; 100 + 90 = 190
b) About 100; 120 – 20 = 100
c) About 630; 70 × 9 = 630
d) About 6; 420 ÷ 70 = 6
4. a) Eight hundred fifteen million thirty-six thousand dollars.
b) For example, estimate:
\$1 000 000 000 – \$800 000 000 = \$200 000 000
Exact answer: \$184 964 000
5. 140 000 sandwiches
6. About 65 000 000 cm; 650 000 m; 650 km
7. a) 3600 bagels **b)** \$1440.00
8. 220 h
9. For example:
a) About 1280; low **b)** About 3200; low
c) About 4; low **d)** About 2; low
10. For example: Last week, Sunil worked Monday, Tuesday, Wednesday, and Saturday. How much money did Sunil earn last week? Answer: \$126
11. About 210 mm of rain fell in 2 days. About how much rain will fall in 3 days? What assumptions did you make? Answer: About 315 mm; I assumed rain continued falling at the same rate for 3 days.
12. a) No. The numbers are approximate.
b) 2 373 800 **c)** 593 450
d) About 5 times as many
e) For example: Approximately how many times as many people live in PEI and Nova Scotia as live in Newfoundland and Labrador? Answer: Approximately 2 times as many.
13. a) 4 and 6 **b)** 11 and 7 **c)** For example: 38 and 36
Part c has more than one answer.

1.2 Factors and Multiples, page 16

1. For example:
a) 5, 10, 15, 20 **b)** 14, 21, 28, 42 **c)** 48, 56, 80, 88
2. a) 1, 2, 3, 6, 9, 18 **b)** 1, 2, 4, 5, 10, 20
c) 1, 2, 4, 7, 14, 28 **d)** 1, 2, 3, 4, 6, 9, 12, 18, 36
e) 1, 37 **f)** 1, 3, 5, 9, 15, 45
3. a) 1, 2, 5, 10, 25, 50 **b)** 1, 3, 17, 51
c) 1, 67 **d)** 1, 3, 5, 15, 25, 75
e) 1, 2, 3, 4, 6, 7, 12, 14, 21, 28, 42, 84
f) 1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 20, 24, 30, 40, 60, 120
4. a) Composite; 18 has more than 2 factors.
b) Prime; 13 has only 2 factors: itself and 1.
c) Composite; 9 has more than 2 factors.
d) Prime; 19 has only 2 factors: itself and 1.
e) Prime; 61 has only 2 factors: itself and 1.
f) Prime; 2 has only 2 factors: itself and 1.
5. a) 5 **b)** 4 **c)** 5 **d)** 3 **e)** 3
6. a) 12 **b)** 10 **c)** 36 **d)** 50 **e)** 54
7. a) Yes **b)** Yes
8. a) 1 or 3 **b)** 1, 2, 3, or 6
9. In 12 days
10. For example: 4 and 16 are "near-perfect" because the sum of all its factors, except itself, is one less than the number. 32 is also "near-perfect."

1.3 Squares and Square Roots, page 21

1. a) 64 **b)** 256 **c)** 1 **d)** 841
2. a) 16 **b)** 289 **c)** 169 **d)** 2704
3. a) i) 1 **ii)** 100 **iii)** 10 000 **iv)** 1 000 000
b) i) 100 000 000 **ii)** 1 000 000 000 000

4.a) 4 **b)** 2 **c)** 30 **d)** 12

5.a) 10 m **b)** 8 cm **c)** 9 m

6.a) $\sqrt{9}$, 4, $\sqrt{36}$, 36 **b)** $\sqrt{100}$, 15, 19, $\sqrt{400}$

7. 8, 9, 10, 11, 12, 13, 14

8. 1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169, 196, 225, 256, 289, 324, 361, 400

9.a) 12 m **b)** 48 m **c)** 20

10. 5 m

Unit 1 Mid-Unit Review, page 22

1.a) About 1 220 000; I rounded to the nearest ten thousand.

b) 135 880; but, since the numbers of Smiths and Jones change with every birth and death, we can never know the exact number.

c) For example: Approximately how many more adults have the surnames Jones and Williams than Smith? Answer: (400 000 + 280 000) – 540 000 = 140 000

2. $90

3.a) 1, 5, 7, 35 **b)** 1, 2, 3, 4, 6, 8, 12, 24

4. For example:

a) 2, 3 **b)** 5, 2 **c)** 7, 2

d) 5, 3 **e)** 3, 9 **f)** 7, 3

5. 6, 12, 18, 30, 36, 42 are in the loop with multiples of 6; 8, 16, 32, 40, 56, 64 are in the loop with multiples of 8; 24 and 48 are in the overlapping part of the loops.

6.a) 3 **b)** 30

7.a) 7 has only 2 factors: 1 and itself.

b) 8 has more than 2 factors.

8. No, because no even numbers are prime (except for 2).

9. 9 m

10.a) 7 **b)** 64 **c)** 10 **d)** 81

11. $8^2 + 6^2 = 64 + 36 = 100$

12. $100 = 10^2 = \sqrt{10\,000}$

13. Since 1 × 1 = 1 and $1^2 = 1$, then $\sqrt{1} = \sqrt{1^2} = 1$

1.4 Exponents, page 25

1.a) 2 **b)** 3 **c)** 7 **d)** 10 **e)** 6 **f)** 8

2.a) 5 **b)** 2 **c)** 1 **d)** 5 **e)** 10 **f)** 4

3.a) 2 × 2 × 2 × 2 **b)** 10 × 10 × 10 **c)** 6 × 6 × 6 × 6 × 6

d) 4 × 4 **e)** 2 **f)** 5 × 5 × 5 × 5

4.a) 3^4 **b)** 2^3 **c)** 5^6 **d)** 10^3 **e)** 79^2 **f)** 2^8

5.a) $5^2 = 25$ **b)** $3^4 = 81$ **c)** $10^5 = 100\,000$

d) $2^3 = 8$ **e)** $9^3 = 729$ **f)** $2^7 = 128$

6.a) 16 **b)** 1000 **c)** 243

d) 343 **e)** 256 **f)** 4

7.a) 10^2 **b)** 10^4 **c)** 10^5 **d)** 10^1 **e)** 10^3 **f)** 10^6

The exponent equals the number of zeros when the number is written in standard form.

8.a) 2^2 **b)** 2^4 **c)** 2^6 **d)** 2^8 **e)** 2^5 **f)** 2^1

9.a) $2^3 < 3^2$; $8 < 9$ **b)** $2^5 > 5^2$; $32 > 25$

c) $3^4 > 4^3$; $81 > 64$ **d)** $5^4 < 4^5$; $625 < 1024$

10. $5^2, 3^4, 6^3, 3^5$

11.a) 531 441 **b)** 343 **c)** 15 625

d) 65 536 **e)** 43 046 721 **f)** 8 388 608

12.a) **i)** $16 = 2^4 = 4^2 = 16^1$ **ii)** $81 = 3^4 = 9^2 = 81^1$

iii) $64 = 2^6 = 4^3 = 8^2 = 64^1$

b) For example: $256 = 2^8 = 4^4 = 16^2 = 256^1$; $729 = 3^6 = 9^3 = 27^2 = 729^1$

13.a) For example: 8^2 **b)** 5^2 units squared

c) 9^3 units cubed

1.5 Number Patterns, page 30

1.a) 15, 17, 19 **b)** 625, 3125, 15 625

c) 16, 19, 22 **d)** 10 000, 100 000, 1 000 000

e) 16, 15, 14 **f)** 71, 69, 67

2.a) 13, 18, 24 **b)** 25, 36, 49

c) 141, 151, 161

d) 12 345, 123 456, 1 234 567

e) 256, 1024, 4096 **f)** 16, 8, 4

3.a) Start at 200. Subtract 1. Add 2. Increase the number by 1 each time you add or subtract. 202, 197, 203

b) Start at 4. Add 3. Increase the number added by 2 each time. 28, 39, 52

c) Start at 100. Subtract 1. Increase the number subtracted by 1 each time. 90, 85, 79

d) Start at 2. Add 4. Increase the number added by 2 each time. 30, 42, 56

e) Start at 50. Subtract 2. Increase the number subtracted by 2 each time. 30, 20, 8

f) Start at 2. Multiply by 3 to get the next term. 162, 486, 1458

4. For example: 23, 24, 27, 32, …

Start at 23. Add 1. Increase the number added by 2 each time. 39, 48, 59

5. 1089; 10 989; 109 989…; 10 999 999 989

2178; 21 978; 219 978…; 21 999 999 978

3267; 32 967; 329 967…; 32 999 999 967

⋮ ⋮ ⋮ ⋮

9801; 98 901; 989 901…; 98 999 999 901

6.a) 10, 15, 21 **b)** 1, 3, 6, 10, 15, 21

c) 28, 36; start at 1. Add 2. Increase the number added by 1 each time.

d) 4, 9, 16, 25, 36, 49, 64; these are perfect squares. 81, 100, 121

e) 2, 3, 4, 5, 6, 7, 8; each number is 1 greater than the previous number. 9, 10, 11

7.a) 64, 125, 216 **b)** 343, 512, 729; this is $7^3, 8^3, 9^3$

8.a) 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024

b) 2, 4, 8, 6 repeated

c) Every fourth term has the units digit 6.
2^{40} is the fortieth term and 40 is divisible by 4, so its units digit is 6.

d) For example: In the first 10 powers of 3, the units digit follows the pattern 3, 9, 7, 1, repeated. Every fourth term has the units digit 1, so, 3^{64} would have the units digit 1.

9. For example:

a) 1, 2, 4, 8, 16, 32, … Multiply each term by 2.

b) 1, 4, 9, 16, 25, 36, 49, … Start at 1. Add 1. Square each number added.

c) 5, 25, 125, 625, 3125, … Multiply each term by 5.

Reading and Writing in Math: Using Different Strategies, page 33

1. 45 m

2. 144

3. Twenty-five 1 by 1 squares; sixteen 2 by 2 squares; nine 3 by 3 squares; four 4 by 4 squares; one 5 by 5 square.

Unit 1 Unit Review, page 35

1.a) 12 542 **b)** 1000 **c)** 420
d) 3375 **e)** 1372 **f)** 78

2.a) 132 002

b) For example: How many more points did Kareem Abdul-Jabbar score than Michael Jordan?
Answer: 9110

3.a) For example: 99 + 100 + 101; 58 + 59 + 60 + 61 + 62

b) For example: The number of terms is equal to 300 divided by the middle term. The sum of the outside terms is double the middle term.

c) Yes; unless the number is prime.

4.a) 45 min, assuming he did not stop, and he maintained the same speed.

b) In a 5-weekend month, Tana will make $275, assuming she babysits the same amount of time at the same rate each weekend.

5. $2328

6.a) 1, 2, 3, 4, 6, 9, 12, 18, 36 **b)** 1, 2, 5, 10, 25, 50
c) 1, 3, 5, 15, 25, 75 **d)** 1, 7, 11, 77

7.a) 9, 18, 27, 36, 45, 54, 63, 72, 81, 90
b) 7, 14, 21, 28, 35, 42, 49, 56, 63, 70
c) 12, 24, 36, 48, 60, 72, 84, 96, 108, 120
d) 15, 30, 45, 60, 75, 90, 105, 120, 135, 150

8.a) 6 **b)** 180

9. One. Two is the only even prime number. All other even numbers have more than two factors.

10.a) 11 **b)** 13 **c)** 15

11.a) 5 **b)** 10 **c)** 9

12.a) 49 cm^2 **b)** 289 cm^2 **c)** 8649 m^2

13. 36 m

14. 25

15.a) 3^4; 3; 4; $3 \times 3 \times 3 \times 3$; 81
b) 2^5; 2; 5; $2 \times 2 \times 2 \times 2 \times 2$; 32
c) 10^7; 10; 7; $10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$; 10 000 000
d) 5^4; 5; 4; $5 \times 5 \times 5 \times 5$; 625
e) 4^4; 4; 4; $4 \times 4 \times 4 \times 4$; 256

16.a) 10 000 g **b)** 10^4

17. $4^4, 5^3, 3^4, 2^6$

18.a) **i)** 11, 12, 14 **ii)** 16, 32, 64
iii) 25, 36, 49 **iv)** 13, 18, 24

b) **i)** Start at 3. Add 2. Add 1. Continue to alternate the number added.
ii) Start at 1. Multiply by 2 to get the next term.
iii) Start at 1. Add 3. Increase the number added by 2 each time.
iv) Start at 3. Add 1. Increase the number added by 1 each time.

19.a) $1^2 + 2^2 = 5$; $2^2 + 3^2 = 13$; $3^2 + 4^2 = 25$; $4^2 + 5^2 = 41$
b) $5^2 + 6^2 = 61$; $6^2 + 7^2 = 85$
c) Start at 5. Add 8. Increase the number added by 4 each time.

20.a) $1^2 + 2^2 + 3^2 + 4^2 + 5^2 = 55$;
$1^2 + 2^2 + 3^2 + 4^2 + 5^2 + 6^2 = 91$
b) For example: The difference between consecutive terms is equal to a square number.

Unit 1 Practice Test, page 37

1. For example:
a) 1970 **b)** 45 **c)** 30 000

2. 3950

3. 4, 8, 12, 16, 24, 48 are in the loop for factors of 48;
9, 18 are in the loop for factors of 18.
1, 2, 3, 6 are in the overlapping part of the loops.
GCF = 6

4. 30, 60, 90, 120, 150, 180

5. 78

6. Once

7.a) $\sqrt{25}, 5^2, 3^3, 2^5, 10^2$
b) $2^3, 3^2, 17, \sqrt{400}, 10 \times 10 \times 10$

8. 64 cm^2

9.a) 15, 21, 28; start at 1. Add 2. Increase the number added by 1 each time.
b) 29, 31, 33; start at 23. Add 2 to get each new term.
c) 36, 25, 16; start at 100. Subtract 19. Decrease the number subtracted by 2 each time.

10.a) $1^2 + 3^2 + 5^2 = 35$ **b)** $6^2 - 1^2 = 35$
c) $4^2 + 19 = 35$

Unit 1 Unit Problem: Fibonacci Numbers, page 38

1.a) 6, 8; 7, 13
b) 1, 1, 2, 3, 5, 8, 13
A term is equal to the sum of the two preceding terms.
2.b) The Fibonacci numbers are the numbers of bees in each generation going back: 1, 1, 2, 3, 5, 8, 13, 21
3. 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, 610
a) Even **b)** 3 **c)** 5
4. 5, 13, 34; they match every second term of the Fibonacci numbers, beginning at the fifth term. 89, 233

Unit 2 Ratio and Rate, page 40

Skills You'll Need, page 42

1.a) 15 **b)** 9 **c)** 14 **d)** 6
2.a) 4, 8, 12, 16, 20, 24 **b)** 7, 14, 21, 28, 35, 42
c) 9, 18, 27, 36, 45, 54 **d)** 12, 24, 36, 48, 60, 72
3.a) 36 **b)** 70 **c)** 80
4.a) 180 **b)** 12 **c)** 60
5.a) 12.8 m **b)** 0.68 km **c)** 2.454 kg **d)** 1.987 L
e) 820 cm **f)** 1250 m **g)** 450 g **h)** 2300 mL

2.1 What is a Ratio?, page 47

1.a) 3:15 **b)** 1:15 **c)** 7:4
2.a) Green to red counters is 9:7
b) Girls to boys is 8:3
c) Fiction to non-fiction books is 2:5
3. 5:7
4. For example:
a) 8:15 **b)** 15:8 **c)** 8:23 **d)** 6:21
5. For example:
a) red:green = 3:5; cats:total pets = 3:5
b) apples:bananas = 7:1
6. No. The ratio of shells for Jeff to Maria is 2:3. Jeff got $\frac{2}{5}$ of the shells and Maria got $\frac{3}{5}$.
7.a) **i)** 8:3 **ii)** 5:1 **iii)** 3:5 **iv)** 8:25
b) **i)** 5:3 **ii)** 3:1 **iii)** 3:3 **iv)** 4:16
8.a) 11 cups **b)** 3:2; 2:3
c) 5:11 **d)** 2:2, 2:3; 4:10
e) For example: If 2 cups of pecans are added to the salad, what is the ratio of pecans to oranges and apples? Answer: 2:5
9.a) For example: Red circles to red squares and red triangles is 3:5; red figures to green figures and blue figures is 8:3; triangles to circles is 5:3; green figures to blue figures is 2:1
b) Change 1 red circle to a green square. Then, red figures to green figures is 7:3; circles to triangles is 2:5.

2.2 Equivalent Ratios, page 52

1.a) For example: 6:8, 9:12, 30:40
b) For example: 7:2, 28:8, 70:20
2.a) 5:4 **b)** 1:3 **c)** 3:1 **d)** 1:2
3. 2:3 = 6:9; 9:12 = 3:4; 8:5 = 16:10; 1:2 = 3:6
4.a) For example: 30 non-fiction books and 10 fiction books
b) Many answers are possible.
5. 30 cm by 15 cm
6. For example: red:blue = 5:6, blue:green = 6:8; red:blue = 10:12, blue:green = 12:16

2.3 Comparing Ratios, page 55

1. A
2.a) For example: 35 **b)** The box with ratio 3:2
3. Madhu; Alison made 54 of 117 shots and Madhu made 65 of 117 shots; 65 > 54
4.a) 5 cans of white paint mixed with 7 cans of blue paint
b) 3 cans of white paint mixed with 4 cans of blue paint
5.a) A 2:1; B 3:2
b) Add 1 can of concentrate to B.
6.a) Ms. Arbuckle's class; 2 more
b) No
7. Amin's party

Unit 2 Mid-Unit Review, page 57

1.a) 7:4 **b)** 3:2 **c)** 7:16 **d)** 3:11
2.a) **i)** 2:3 **ii)** 5:3 **iii)** 5:10 or 1:2
b) **i)** 1:2 **ii)** 4:2 or 2:1 **iii)** 4:7
3.a) 7:4 **b)** 3:4 **c)** 3:11
4.a) For example: 10:6, 50:30, 55:33
b) For example: 18:72, 30:120, 600:2400
5.a) **i)** 1:3 **ii)** 3:1 **iii)** 3:8
b) **i)** purple to blue **ii)** yellow to red, purple to green
6.a) 12 girls **b)** 3:2
7.a) Stronger **b)** Weaker

2.4 Applications of Ratios, page 60

1.a)

8	10
4	5
12	15
6	7.5

b) 1:3 **c)** 9 L **d)** 6 L
e) 20 cans orange concentrate, 10 cans cranberry concentrate, and 30 cans water
2.a) 1:50 **b)** 176 cm **c)** 13.5 m
3.a) 1:20 **b)** 7 cm **c)** 0.6 m **d)** 0.1 m
4. No. The units must be the same when writing ratios of measurement.
5.a) 63 g **b)** 10 L

6.a) His father **b)** 80 m **c)** 20 m

2.5 What Is a Rate?, page 64

1.a) 60 words/min **b)** 25 m/min **c)** 20 pages/h
2.a) 15 km/h **b)** 36 km/h **c)** 600 km/h
3. 120 beats/min
4.a) \$0.48/m **b)** \$2.40 **c)** 25 m
5.a) 25 km **b)** 25 km/h
6.a) \$50.00 **b)** £12
7. 8 min/km
8.a) **i)** 7 min/km **ii)** 8 min/km **iii)** 8.5 min/km
b) For example: 8.8 min/km; 6 h 27 min

Unit 2 Unit Review, page 69

1.a) 10:9 **b)** 19:4 **c)** 4:19
2. For example: Red to yellow is 2:9, green to blue is 2:3, red and green to blue is 1:1, blue to yellow is 2:3
3. For example: Divide each number by 5, 5:2; multiply each number by 2, 50:20
4. Length to width is 24:16
5. Ms. Beveridge's class
6.a) 2:45 or 1:22.5 **b)** 320 cm **c)** 13.5 m
7.a) 9 **b)** 12 red, 8 white
8.a) 40 km/h **b)** 250 m/min **c)** \$8/h
9.a) Lion **b)** 11:9 lion to zebra

Unit 2 Practice Test, page 71

1.a) **i)** 9:1 **ii)** 1:2 **iii)** 5:6
b) 27
2.a) Tigers; they have 21 wins for 12 losses. The Leos have 20 wins for 12 losses.
b) Leos; they would have 10 wins for 5 losses. The Tigers would have 7 wins for 5 losses.
3.a) 160 cm **b)** 1.25 m
4.a) Car A 5 m/s, Car B 4.5 m/s **b)** 2 m
5. No. For example: If both tests were out of 60, Trevor's mark would be $\frac{40}{60}$ and Anne's mark would be $\frac{45}{60}$. Anne's mark is higher.

Unit 2 Unit Problem: Who's the Smartest?, page 72

1. Human 40:1; monkey 70:1; camel 800:1
For example: Humans are the smartest because they have a greater brain mass to body mass ratio.
2. Human 10:1; monkey 6:1; camel 40:3
For example: Monkeys are the smartest because they have a greater brain length to body length ratio.
3. 0.5 cm long; 30 cm long

Unit 3 Geometry and Measurement, page 74

Skills You'll Need, page 76

1.a) For example: All of them have a base, faces, edges, and vertices. They have different shapes.
b) For example: Pentagonal prism—barn; triangular prism—Toblerone chocolate bar; square pyramid—pyramid in Egypt; hexagonal pyramid—top of church tower; cube—sugar cube; tetrahedron—juice pack

3.1 Sketching Views of Solids, page 79

1.a) Front view; adult and child
b) Top or bottom view; airplane
c) Side view; person in a wheelchair
2. J: Top or bottom view of D
K: Top or bottom view of E
L: Side view of B; side and back view of C; back view of E; side and back view of D
M: Side view of E
N: Side, front, and back view of A; front and back view of B
P: Top or bottom view of A
Q: Front and side view of D; front and side view of C; side view of B; front view of E
8.a) No. For example: A cube is the only prism with congruent faces, so all views are the same.
b) For example: A square pyramid or square prism
c) For example: A triangular prism
d) For example: A chair

3.2 Sketching Solids, page 86

6.c) \$31.80 **d)** Yes. Answers vary.
e) Answers vary.

3.3 Building Objects from Nets, page 91

1.a) Triangular prism
b) For example: The object has 2 congruent triangular faces, and 3 non-congruent rectangular faces. The 2 triangular faces are parallel.
2.a) Yes. For example: It is a solid with faces that are polygons.
3.a) Octa means eight, and an octahedron has eight sides.
b) It has 8 congruent triangular faces. It is regular because all the faces are congruent.
4.a) For example: A pyramid with a trapezoid base; it has 2 triangular congruent faces, 2 triangular non-congruent faces, and 1 trapezoid base.

b) For example: A pyramid with a parallelogram base; it has 2 pairs of congruent triangular faces and 1 parallelogram as a base.

Both of them are pyramids with 5 faces. Their bases are different.

5. The dodecahedron has 12 congruent faces that are regular pentagons.

6. A soccer ball is made up of pentagons and hexagons. Each hexagon is attached to 3 hexagons and 3 pentagons.

7.a) The bases are 2 congruent pentagons. The faces are 5 congruent rectangles.

b) A pentagonal prism.

8. For example: All of them are polyhedra.

Unit 3 Mid-Unit Review, page 93

4. For example: 5 different views; there might be a hidden cube that you would not see on isometric dot paper.

5. A pentagonal prism; 2 congruent pentagons that are parallel, 2 pairs of congruent rectangular faces, and 1 non-congruent rectangular face.

6.a) For example: Cube; rectangular prism

b) For example: Triangular prism; square pyramid

3.4 Using Variables in Measurement Formulas, page 96

1.a) 20 cm **b)** 36 cm **c)** 8 cm **d)** 32 cm

2.a) 18 cm^2 **b)** 22 cm^2

3.a) **i)** $b = 3$; $h = 2$ **ii)** $b = 5$; $h = 4$ **iii)** $b = 2$; $h = 2$

b) For example: *b* and *h* can be replaced by any value, but the formula for the area stays the same.

c) *b* and *h* have the same value.

4.a) $A = 48$ cm^2; $P = 32$ cm

b) $A = 31.5$ cm^2; $P = 27$ cm

5.a) $P = 11.2$ cm; $A = 7.84$ cm^2

b) $P = 12.4$ cm; $A = 9.61$ cm^2

6. The perimeter is equal to two times the base plus two times the height. The formulas are the same, because they show that all 4 side lengths are added.

3.5 Surface Area of a Rectangular Prism, page 99

1.a) 160 cm^2 **b)** 216 cm^2 **c)** 82 cm^2

2. $SA = 72$ cm^2

3.a) 76 cm^2 **b)** 135 cm^2 **c)** 133.6 cm^2

4.a) 6 $units^2$

b) The surface area is multiplied by 4.

c) The surface area is multiplied by 9.

d) 96 $units^2$; it is 6 times the square of the edge length.

5.b) For example: The surface area is $\frac{1}{4}$ of the original surface area. The length and width of each face is halved, so the area of each face is $\frac{1}{4}$ of the original area.

6.a) 5 cans of paint

b) For example: There are no windows, and the inside of the door is painted.

7. For example: When each length is doubled, the surface area quadruples. When each length is halved, the surface area is reduced to $\frac{1}{4}$ of its original value.

8.a) 832 cm^2 **b)** 436 cm^2 **c)** 1580 cm^2

9.a) 9 cm^2 **b)** 3 cm

10.a) 400-g box: $SA = 1964$ cm^2; 750-g box: $SA = 2610$ cm^2

b) Ratio of surface areas is 3:4; ratio of masses is 1:2

c) No. Answers vary.

11. 2 m by 2 m by 5 m

12. 3 cm by 4 cm by 6 cm

3.6 Volume of a Rectangular Prism, page 102

1.a) $A = 40$ cm^2; $V = 120$ cm^3

b) $A = 81$ cm^2; $V = 729$ cm^3

c) $A = 200$ cm^2; $V = 6000$ cm^3

2.a) 67.5 cm^3 **b)** 96 cm^3 **c)** 25.2 cm^3

3. 36 cm by 1 cm by 1 cm; 18 cm by 2 cm by 1 cm; 12 cm by 3 cm by 1 cm; 9 cm by 4 cm by 1 cm; 9 cm by 2 cm by 2 cm; 6 cm by 6 cm by 1 cm; 6 cm by 3 cm by 2 cm; 4 cm by 3 cm by 3 cm

4.a) 1260 cm^3 **b)** 42 cm^3

c) For example: 3 rows of 10, or 10 rows of 3

d) For example: 2 cm by 7 cm by 3 cm

5.a) The volume is doubled.

b) The volume is quadrupled.

c) The volume is multiplied by 8.

6. For example: The volume doubles if you double one of the lengths. The total surface area does not double.

7.a), b) 1 prism: 1, 2, 3, 5, 7, 11, 13, 17, 19 cubes;
2 prisms: 4, 6, 9, 10, 14, 15 cubes;
3 prisms: 8 cubes;
4 prisms: 12, 16, 18, 20 cubes

c) For example: Any prime number will make exactly 1 rectangular prism.

8.a) For example: 6 cm by 2 cm by 2 cm; 12 cm by 2 cm by 1 cm; 4 cm by 3 cm by 2 cm

b) For example: Greatest surface area = 76 cm^2; least surface area = 52 cm^2

c) For example: 24 cm by 1 cm by 1 cm; $SA = 98$ cm^2

d) For example: 4 cm by 2 cm by 3 cm; $SA = 52$ cm^2

Unit 3 Unit Review, page 107

2.a) **i)** Top view: a railway

ii) Side view: a fish and a line with a hook

3.a) For example: It has 8 faces.

b) For example: It is made up of hexagons and triangles.

4.a) 49 cm^2 **b)** 36 m^2

5.a) $SA = 6c^2$ **b)** 96 cm^2

6.a) 268 m **b)** \$805; 23 bundles are needed.

7.a) $SA = 72$ m^2; $V = 36$ m^3 **b)** $SA = 114$ cm^2; $V = 72$ cm^3

c) $SA = 15\,000$ cm^2; $V = 125\,000$ cm^3

8.a) 11 rolls of wallpaper, 1 can of paint

b) For example: There are no windows, and the inside of the door will be painted.

9. The cube has edge length 6 units.

10. 28 m by 1 m by 1 m, $SA = 114$ m^2;
14 m by 2 m by 1 m, $SA = 88$ m^2;
7 m by 4 m by 1 m, $SA = 78$ m^2;
7 m by 2 m by 2 m, $SA = 64$ m^2

12.a) $h = 3$ m; 1 m by 6 m by 3 m

b) $h = 4$ cm; 5 cm by 3 cm by 4 cm

13. For example: 10 cm

Unit 3 Practice Test, page 109

2.a) It has an equilateral triangle base with 3 congruent trapezoid faces, and an equilateral triangle top.
Name: truncated tetrahedron (frustum)

3.a) $SA = 776$ m^2, $V = 1344$ m^3

4.b) $V = s^3 = 343$ cm^3; $SA = 6s^3 = 294$ cm^2

5.b) Area of material = 3.6 m^2, $V = 2.7$ m^3;
Area of material = 3.25 m^2, $V = 2.64$ m^3

c) For example: The second design, because the volumes are almost the same, but the second design uses less material.

6. For example: A pentagonal pyramid

Unit 4 Fractions and Decimals, page 114

Skills You'll Need, page 116

1.a) 1 **b)** $\frac{5}{6}$ **c)** $\frac{5}{3}$ **d)** $\frac{3}{2}$

2.a) $\frac{1}{2}$ **b)** $\frac{1}{2}$ **c)** $\frac{5}{6}$ **d)** $\frac{1}{6}$

3.a) 0.5 **b)** 9.8 **c)** 12.4 **d)** 3.26 **e)** 0.72
f) 0.06 **g)** 0.056 **h)** 0.276 **i)** 0.008

4.a) 15.8 **b)** 7.61 **c)** 125.88 **d)** 3.72
e) 1276.38 **f)** 123.913 **g)** 16.45 **h)** 833.82

5.a) 3.1, 3.79, 4.116, 4.12, 7.32

b) 0.62, 0.65, 2.591, 4.15, 4.4

c) 1.25, 1.43, 2.55, 2.81, 3.62

d) 1.752, 1.8, 2.67, 3.669, 3.68

4.1 Combining Fractions, page 122

1.a) $\frac{2}{3}$ **b)** $\frac{3}{4}$ **c)** $\frac{5}{8}$ **d)** $\frac{5}{6}$

2.a) **i)** $\frac{2}{5}$ **ii)** 1 **iii)** $\frac{7}{10}$ **iv)** $\frac{3}{4}$

b) Since the denominator stays the same, just add the numerators.

3.a) $\frac{3}{10}$ **b)** $\frac{5}{6}$ **c)** $\frac{1}{2}$ **d)** $\frac{3}{8}$

4.a) $\frac{7}{8}$ **b)** $\frac{5}{6}$ **c)** $\frac{6}{10}$ or $\frac{3}{5}$ **d)** 1

5. For example: $\frac{3}{10} + \frac{7}{10} = 1$; $\frac{5}{10} + \frac{1}{2} = 1$; $\frac{1}{3} + \frac{2}{3} = 1$

6.a) Meena ate $\frac{1}{8}$.
Her brother ate $\frac{2}{8}$ and her mother ate $\frac{3}{8}$.

b) Her brother's fraction can also be written as $\frac{1}{4}$.

c) $\frac{6}{8}\left(\text{or } \frac{3}{4}\right)$ of the pizza was eaten, and $\frac{2}{8}\left(\text{or } \frac{1}{4}\right)$ was left over.

7.a) 7 **b)** 2 **c)** 8

8. For example: $\frac{1}{6} + \frac{4}{6} = \frac{5}{6}$; $\frac{2}{3} + \frac{1}{6} = \frac{5}{6}$; $\frac{1}{2} + \frac{2}{6} = \frac{5}{6}$

4.2 Adding Fractions Using Models, page 126

1.a) $\frac{3}{4}, \frac{9}{12}$ **b)** $\frac{4}{12}, \frac{1}{3}$

2.a) $\frac{5}{4}$ **b)** $\frac{17}{10}$ **c)** $\frac{7}{5}$ **d)** $\frac{14}{8}$ or $\frac{7}{4}$

3. For example: $\frac{1}{2} + \frac{2}{2} = \frac{3}{2}$; $\frac{1}{6} + \frac{4}{3} = \frac{3}{2}$; $\frac{1}{4} + \frac{5}{4} = \frac{3}{2}$

4.a) $\frac{11}{8}$ **b)** $\frac{13}{10}$ **c)** $\frac{5}{4}$ **d)** $\frac{9}{6}$ or $\frac{3}{2}$

5.a) $\frac{9}{8}$ **b)** $\frac{6}{4}$ or $\frac{3}{2}$ **c)** $\frac{10}{6}$ or $\frac{5}{3}$ **d)** $\frac{14}{10}$ or $\frac{7}{5}$

6.a) One denominator is a multiple of the other.

b) The common denominator is one of the two denominators.

7.a) $\frac{7}{6}$ **b)** $\frac{9}{10}$ **c)** $\frac{13}{12}$ **d)** $\frac{16}{10}$ or $\frac{8}{5}$

8.a) The product of the 2 denominators tells the number line to use.

b) Each denominator is not a multiple or a factor of the other.

c) The product of the unrelated denominators gives the common denominator, and the number line to use.

9. $\frac{1}{2} + \frac{1}{3} + \frac{3}{4} = \frac{19}{12}$ or $1\frac{7}{12}$

10. Yes. $\frac{1}{2} + \frac{1}{4} + \frac{3}{8} + \frac{5}{8} = \frac{14}{8} < 2$

11.a) For example: $\frac{1}{2} + \frac{3}{4}$; $\frac{1}{3} + \frac{5}{6}$; $\frac{3}{4} + \frac{5}{6}$ **b)** $\frac{5}{6} + \frac{1}{4} = \frac{13}{12}$ or $1\frac{1}{12}$

12. There is $\frac{13}{8}$ of the chocolate left.

13. The pitcher holds 2 cups.

14.a) twenty-fourths **b)** fifteenths

c) twentieths **d)** twelfths

4.3 Adding Fractions, page 130

1.a) $\frac{5}{6}$ **b)** $\frac{8}{15}$ **c)** $\frac{9}{20}$ **d)** $\frac{11}{30}$

2.a) 1 **b)** 8 **c)** 2 **d)** 20

3.a) $\frac{13}{10}$ or $1\frac{3}{10}$ **b)** $\frac{13}{12}$ or $1\frac{1}{12}$ **c)** $\frac{22}{15}$ or $1\frac{7}{15}$ **d)** $\frac{17}{12}$ or $1\frac{5}{12}$

4.a) $\frac{8}{9}$ **b)** $\frac{7}{12}$ **c)** $\frac{7}{8}$ **d)** $\frac{13}{8}$ or $1\frac{5}{8}$

5.a) $\frac{13}{12}$ or $1\frac{1}{12}$ **b)** $\frac{11}{18}$ **c)** $\frac{41}{30}$ or $1\frac{11}{30}$ **d)** $\frac{21}{20}$ or $1\frac{1}{20}$

6. $\frac{3}{16}$

7. $\frac{3}{4} + \frac{4}{5}$; $\frac{31}{20} > \frac{9}{6}$

8.a) $\frac{13}{8}$ or $1\frac{5}{8}$ **b)** $\frac{43}{20}$ or $2\frac{3}{20}$ **c)** $\frac{35}{18}$ or $1\frac{17}{18}$

9.a) $3\frac{2}{3}$ **b)** $4\frac{5}{6}$ **c)** $6\frac{13}{24}$

10. $9\frac{5}{12}$

11. Statement b is true. The sum of the fractions must be less than or equal to 1 whole.

12. For example: $\frac{1}{2}+\frac{1}{5}+\frac{3}{10}=1$

13. 1

4.4 Subtracting Fractions Using Models, page 134

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

2.a) Subtract the numerators while keeping the same denominator.

b) For example: $\frac{3}{10}-\frac{2}{10}=\frac{1}{10}$; $\frac{7}{9}-\frac{5}{9}=\frac{2}{9}$; $\frac{5}{6}-\frac{4}{6}=\frac{1}{6}$

3.a) $\frac{5}{6}-\frac{1}{3}=\frac{3}{6}=\frac{1}{2}$ **b)** $\frac{5}{4}-\frac{1}{2}=\frac{3}{4}$ **c)** $\frac{11}{8}-\frac{3}{4}=\frac{5}{8}$

4.a) $\frac{1}{8}$ **b)** $\frac{1}{6}$ **c)** $\frac{3}{4}$ **d)** $\frac{1}{10}$

5.a) $\frac{1}{4}$ **b)** $\frac{3}{8}$ **c)** $\frac{1}{2}$ **d)** $\frac{1}{3}$

6. Aaron has $\frac{1}{6}$ cup of raisins left.

7.a) $\frac{5}{12}$ **b)** $\frac{7}{6}$ or $1\frac{1}{6}$ **c)** $\frac{3}{10}$ **d)** $\frac{7}{6}$ or $1\frac{1}{6}$

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

9.a) $\frac{3}{2}$ or $1\frac{1}{2}$ **b)** $\frac{2}{5}$ **c)** $\frac{3}{4}$ **d)** $\frac{1}{3}$

10. No; he needs $\frac{1}{12}$ cup more.

11.a) $\frac{1}{2}$ **b)** $\frac{4}{5}$ **c)** 5, 3

12.a) More; she used $\frac{5}{8}$ of a tank.

b) She used $\frac{1}{8}$ more.

13.a) Part iii

b) For example: By using estimation, or number lines

4.5 Subtracting Fractions, page 137

1.a) $\frac{2}{5}$ **b)** $\frac{1}{3}$ **c)** $\frac{1}{3}$ **d)** $\frac{2}{7}$

2.a) $\frac{1}{8}$ **b)** $\frac{1}{9}$ **c)** $\frac{11}{10}$ or $1\frac{1}{10}$ **d)** $\frac{5}{6}$

3.a) $\frac{11}{18}$ **b)** $\frac{1}{3}$ **c)** $\frac{3}{8}$ **d)** $\frac{13}{30}$

4.a) $\frac{1}{12}$ **b)** $\frac{7}{4}$ or $1\frac{3}{4}$ **c)** $\frac{2}{15}$ **d)** $\frac{9}{20}$

5.a) $\frac{1}{6}$ **b)** $\frac{11}{12}$ **c)** 2 **d)** $\frac{1}{12}$

6.a) $4\frac{3}{7}$ **b)** $1\frac{5}{18}$ **c)** $2\frac{1}{10}$ **d)** $2\frac{1}{10}$

7.a) Terri; she bikes $3\frac{3}{4}$ h the next Saturday, and Sam only bikes $3\frac{1}{2}$ h.

b) Terri bikes $\frac{1}{4}$ h longer than Sam.

c) How to add and subtract fractions

8. The recipe uses $\frac{1}{12}$ cup more walnuts.

9. For example: $\frac{5}{4}-\frac{1}{2}=\frac{3}{4}$; $\frac{8}{4}-\frac{5}{4}=\frac{3}{4}$; $\frac{4}{4}-\frac{1}{4}=\frac{3}{4}$

10. The other fraction is between $\frac{1}{2}$ and $\frac{3}{4}$.

Unit 4 Mid-Unit Review, page 140

1.a) $\frac{5}{6}$ **b)** $\frac{5}{6}$ **c)** $\frac{3}{4}$ **d)** $\frac{4}{5}$

2.a) $1\frac{13}{10}$ or $2\frac{3}{10}$ **b)** $7\frac{13}{10}$ or $8\frac{3}{10}$

3.a) $\frac{7}{5}$ or $1\frac{2}{5}$ **b)** $\frac{7}{6}$ or $1\frac{1}{6}$ **c)** $\frac{4}{3}$ or $1\frac{1}{3}$ **d)** $\frac{11}{6}$ or $1\frac{5}{6}$

4.a) $\frac{19}{12}$ or $1\frac{7}{12}$ **b)** $\frac{13}{6}$ or $2\frac{1}{6}$ **c)** $\frac{11}{10}$ or $1\frac{1}{10}$ **d)** $\frac{25}{18}$ or $1\frac{7}{18}$

5.a) $\frac{11}{5}$ or $2\frac{1}{5}$ **b)** $\frac{13}{8}$ or $1\frac{5}{8}$ **c)** $\frac{25}{18}$ or $1\frac{7}{18}$

6.a) $5\frac{2}{3}$ **b)** $3\frac{7}{12}$ **c)** $5\frac{1}{8}$

7.a) $\frac{1}{8}$ **b)** $\frac{9}{10}$ **c)** $\frac{1}{2}$ **d)** $\frac{7}{6}$ or $1\frac{1}{6}$

8. Samantha's; $\frac{7}{8}>\frac{4}{5}$

9.a) $\frac{11}{12}$ **b)** $\frac{1}{12}$

10.a) $\frac{13}{10}$ or $1\frac{3}{10}$ **b)** $\frac{1}{2}$ **c)** $\frac{13}{12}$ or $1\frac{1}{12}$ **d)** $\frac{7}{10}$

11.a) $\frac{5}{4}$ or $1\frac{1}{4}$ **b)** $\frac{3}{8}$

12.a) $1\frac{1}{4}$ **b)** $1\frac{1}{4}$

4.6 Exploring Repeated Addition, page 142

1.a) $3\times\frac{1}{4}$ **b)** $5\times\frac{2}{7}$ **c)** $4\times\frac{3}{10}$

2.a) $\frac{1}{8}+\frac{1}{8}+\frac{1}{8}+\frac{1}{8}+\frac{1}{8}$ **b)** $\frac{2}{5}+\frac{2}{5}+\frac{2}{5}$

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

3.a) $\frac{12}{7}$ **b)** $\frac{5}{12}$ **c)** $\frac{20}{15}$ or $\frac{4}{3}$

d) 9 **e)** $\frac{14}{5}$ **f)** $\frac{9}{2}$

4.a) $\frac{12}{5}$ **b)** $\frac{35}{10}$ or $\frac{7}{2}$ **c)** 5

d) $\frac{5}{2}$ **e)** 7 **f)** 6

5. 16 h

6.a) **i)** $\frac{12}{10}$ or $\frac{6}{5}$ **ii)** $\frac{12}{10}$ or $\frac{6}{5}$

b) The whole number in one question is the numerator in the other question.
For example: $2\times\frac{3}{12}=\frac{6}{12}=\frac{1}{2}$; $3\times\frac{2}{12}=\frac{6}{12}=\frac{1}{2}$

7. $\frac{9}{4}$ cups

8. b) For example: A set of 5 objects divided in half.

9. It will take Jacob and Henry $3\frac{3}{4}$ h to fill all the shelves.

Technology: Fractions to Decimals, page 144

1.a) Terminating decimals: $\frac{1}{4}, \frac{1}{5}, \frac{1}{8}, \frac{1}{10}, \frac{1}{16}, \frac{1}{20}$

Repeating decimals: $\frac{1}{3}, \frac{1}{6}, \frac{1}{7}, \frac{1}{9}, \frac{1}{11}, \frac{1}{12}, \frac{1}{13}, \frac{1}{14}, \frac{1}{15}, \frac{1}{17}, \frac{1}{18}, \frac{1}{19}$

b) The decimal for $\frac{2}{6}$ is two times the decimal for $\frac{1}{6}$, and so on.

2. $0.\overline{1}$; $0.0\overline{1}$; $0.\overline{001}$

3.a) $0.\overline{3}$; 0.3333333… > 0.3 **b)** $\frac{1}{9}$; 0.1111111… > 0.11

4.7 Multiplying Decimals, page 147

1.a) 1.7 × 1.5 = 2.55 **b)** 2.3 × 1.3 = 2.99

2.a) 3.9 **b)** 3.92 **c)** 4.32

3.a) 0.92 **b)** 1.14 **c)** 0.56

4.a) 86.4 **b)** 86.4 **c)** 86.4

5.a) 15.54 **b)** 2.67 **c)** 0.54

6. 76 km

7. 161.65 m^2

8.a) i) 11.34 ii) 2.94 iii) 0.40

b) The number of decimal places in the product is equal to the sum of the decimal places in the numbers that are multiplied.

9. For example: 0.1×3.6; 0.2×1.8; 0.3×1.2

10.a) 2.52 b) 7.46 c) 35.22

11. The area is 9.18 m^2.

12.a) i) 25.44 ii) 2.88 iii) 0.24

b) The number of decima1places in the product is equal to the sum of the decimal places in the numbers that are multiplied.

13. When you multiply 2 decimals with tenths, you get a decimal with hundredths, and so on.

4.8 Dividing Decimals, page 151

1.a) 18 b) 1.9 c) 21 d) 2.5 e) 3

2.a) 1.7 b) 31.5 c) 17.4 d) 12

3.a) 29 b) 3.2 c) $17.1\overline{6}$

4.a) 18.2 b) 23.4 c) 3.2

5.a) 66.3 b) 6.4 c) 11.3

6.a) 18.25 b) 1.5 c) 115.4

7. For example: $0.024 \div 0.2$; $0.036 \div 0.3$; $0.048 \div 0.4$

8.a) No b) Yes, 0.5 m more

9. 21.5 m

10.a) 338.57 b) 0.33857 c) 3.3857 d) 33.857

11. 0.125 g yeast, 2.5 g salt, 2 kg flour, 85 g cardamom, 1.875 L milk, 7.5 g butter, 0.4 kg sugar

12. 6.25 days

4.9 Order of Operations with Decimals, page 155

1.a) 31.4 b) 3 c) 6.2

2.a) 13.6 b) 8.1 c) 8.7 d) 146.6 e) 43.3 f) 1499.75

3.a) 32.75 b) 168.885 c) 42.2 d) 19.991 73 e) 41.3 f) 62.56

4.a) 10.7 b) 69.4 c) 30.68 d) 5

5.a) 242.2 b) 667.5

6. The mean time is 15.6 min.

7. 105.2

Unit 4 Unit Review, page 158

1.a) $\frac{2}{5}$ b) $\frac{1}{2}$ c) equal d) $\frac{7}{2}$

2.a) $\frac{5}{6}$ b) 1 c) $\frac{3}{4}$ d) $\frac{7}{10}$

3. For example: $\frac{3}{8}+\frac{2}{8}=\frac{5}{8}$; $\frac{1}{2}+\frac{1}{8}=\frac{5}{8}$; $\frac{1}{4}+\frac{6}{16}=\frac{5}{8}$

4.a) $\frac{3}{2}$ b) $\frac{5}{4}$ c) $\frac{7}{5}$ d) $\frac{5}{4}$

5.a) $\frac{7}{10}$ b) $\frac{3}{10}$

6.a) $\frac{11}{15}$ b) $\frac{7}{8}$ c) $\frac{29}{30}$ d) $\frac{17}{20}$

7.a) $\frac{37}{30}$ or $1\frac{7}{30}$ b) $\frac{13}{20}$ c) $\frac{17}{15}$ or $1\frac{2}{15}$ d) $\frac{25}{24}$ or $1\frac{1}{24}$

8.a) $8\frac{2}{3}$ b) $3\frac{7}{12}$ c) $5\frac{1}{2}$ d) $7\frac{13}{20}$

9.a) $\frac{43}{24}$ or $1\frac{19}{24}$ b) $\frac{97}{30}$ or $3\frac{7}{30}$ c) $\frac{83}{40}$ or $2\frac{3}{40}$

10.a) $\frac{1}{6}$ b) $\frac{3}{10}$ c) $\frac{5}{8}$ d) $\frac{1}{2}$

11. For example: $\frac{3}{4}-\frac{1}{2}=\frac{1}{4}$; $\frac{1}{2}-\frac{1}{4}=\frac{1}{4}$; $\frac{6}{8}-\frac{1}{2}=\frac{1}{4}$

12.a) Ali b) $\frac{1}{12}$

13.a) $\frac{1}{2}$ b) $\frac{3}{2}$ or $1\frac{1}{2}$ c) $\frac{27}{20}$ or $1\frac{7}{20}$ d) $\frac{19}{12}$ or $1\frac{7}{12}$

14.a) $1\frac{5}{8}$ b) $2\frac{2}{15}$ c) $6\frac{1}{6}$ d) $\frac{11}{20}$

15.a) $\frac{7}{4}$ b) 3 c) $\frac{21}{5}$ or $4\frac{1}{5}$ d) 4

16.a) Sasha has $\frac{1}{2}$ of the tomatoes left.

b) Sasha has 8 tomatoes left.

17. Orit has 8 hours left in her day.

18. 5.32 m^2

19.a) 7 bottles b) 0.3 L

20.a) Delia earns $112.50 in a week. b) $56.25

21. 13.6 km

22.a) 7 b) 50.4 c) 3.5

23.a) 13.26 b) 9.8

Unit 4 Practice Test, page 161

1.a) $\frac{13}{8}$ or $1\frac{5}{8}$ b) $\frac{9}{10}$ c) $\frac{1}{4}$ d) $\frac{29}{18}$ or $1\frac{11}{18}$

2.a) For example: $\frac{1}{5}+\frac{2}{5}=\frac{3}{5}$; $\frac{1}{10}+\frac{1}{2}=\frac{3}{5}$; $\frac{1}{3}+\frac{4}{15}=\frac{3}{5}$

b) For example: $\frac{4}{5}-\frac{3}{5}=\frac{1}{5}$; $\frac{7}{10}-\frac{1}{2}=\frac{1}{5}$; $\frac{4}{3}-\frac{17}{15}=\frac{1}{5}$

3.a) $4\frac{7}{40}$ b) $6\frac{11}{12}$

4. All the jobs will take $7\frac{3}{4}$ h to complete. Including lunch and travel time, she'll need more than 8 h.

5.a) i) $\frac{9}{2}$ ii) $\frac{14}{3}$ iii) 7

b) i) 4.5 ii) $4.\overline{6}$ iii) 7.0

c) 4.5, $4.\overline{6}$, 7.0

6.a) 7 bags of fertilizer b) $108.50

7. 102.875

Unit 4 Unit Problem: Publishing a Book, page 162

1. $3\frac{7}{8}$ pages

4. 4; there will be room for one $\frac{1}{8}$-page advertisement.

6. $2810

7.a) $3.88 b) $5.54 c) 388 books

Cumulative Review, Units 1–4, page 164

1. 40

2.a) 1 m by 29 m, 2 m by 28 m, 3 m by 27 m, … 29 m by 1 m

b) 15 m by 15 m; a square has the greatest area.

3. For example:

a) $41 = 6^2 + 5$; $43 = 6^2 + 7$; $47 = 6^2 + 11$; $49 = 6^2 + 13$

b) $49 = 7^2$; $49 = 6^2 + 13$

4.a) 9, 4, 1; start at 7^2, reduce the base by 1 each time.

b) 63, 127, 255; start at 3, double it and add 1 each time.

c) 7776, 46 656, 279 936; start at 6, multiply by 6 each time.

5.a) 1:2 **b)** 1:2 **c)** 1:15

6.a) Carla; by comparing equivalent ratios, Carla has the most hits: 45:60

b) Irina has the fewest hits: 36:60

7.a) 12 **b)** 9:15 or 3:5

8.a) Back view; letter **b)** Side view; picnic table

c) Front view; microwave oven

9.a) 28 cm^2 **b)** 119.5 cm^2 **c)** 0.54 m^2

11.a) $\frac{15}{8}$ or $1\frac{7}{8}$ **b)** $\frac{11}{12}$ **c)** $\frac{9}{10}$ **d)** $\frac{1}{2}$

12.a) Riley; $\frac{1}{10}$ more **b)** $\frac{3}{10}$

13.a) $\frac{20}{8}$ or $2\frac{1}{2}$ **b)** 3 **c)** $\frac{9}{10}$ **d)** $\frac{25}{4}$ or $6\frac{1}{4}$

14.a) 7.35 **b)** 0.96

15. 3.5 m

16.a) 8.45 **b)** 6.16 **c)** 8.6 **d)** 0.7

The answers are different for parts c and d because the order of operations is different.

Unit 5 Data Management, page 166

Skills You'll Need, page 168

1.a) Mean: 5.125; median: 5; mode: 5, 9

b) Mean: $28.\overline{4}$; median: 24; mode: 21

c) Mean: 14.5; median: 15; mode: 16

d) Mean: 73; median: 74; mode: 76, 81

5.1 Collecting Data, page 170

1.a) Secondary data **b)** Primary data

c) Secondary data

2.a) Secondary data **b)** Primary data

c) Secondary data **d)** Primary data

3. For example: If the president of a company wants you to buy her product, she might use biased data to show that her company's product is better.

4.a) For example: "The school gets very hot in the summer. Should there be more air conditioners?"

b) "Should the school buy more air conditioners?"

5.a) Biased. For example: "Should children eat candy?"

b) Biased. For example: "Which do you think is more fun, snowboarding or skiing?"

6. For example: "What is your favourite style of shoe? What make of shoes do you prefer?"
The survey results would let the person know what makes and styles of shoes to stock.

7.a) For example: Watching television

b) For example: "What is your favourite pastime?"

d) For example: My prediction was incorrect. The favourite pastime is playing sports.

5.2 Recording Data, page 176

1.a) 8; 6; 5; 5; 10; 6 **b)** 40

c) Most popular: Toronto Maple Leafs; least popular: Montreal Canadiens and Ottawa Senators

3.a) For example: "What do you mainly use the Internet for?"

b) 360

c) The number of icons would increase; the number of icons would decrease.

e) For example: Yes; a bar graph is easier to read.

f) For example: "What do people use the Internet for the most?" Answer: Research.

4.a) There are two pieces of information for each category.

b) The female population is slightly less than the male population.

c) For example: PEI

d) The data are too small for the scale on the graph.

e) For example: No; the range is too large.

6.a) For example: "How do you spend your money each week?"

7.a) 0–2; 3–5; 6–8; 9–11; 12–14; 15–17; 18–20

b) Frequency: 11; 15; 15; 9; 2; 3; 4

5.3 Stem-and-Leaf Plots, page 182

1.a) The plot shows the hours worked by part-time staff at a video store in one month.

b) 33 **c)** 91 h; 139 h **d)** 48 h

e) 122 h **f)** 137 h

2.b) 54 kg; 28 kg **c)** 26 kg

d) 37 kg **e)** 35 kg

3. For example: Data that are arranged in intervals could not be shown in a stem-and-leaf plot.

5.a) For example: I cannot tell from the data alone; I would have to calculate the mean, median, and/or mode.

b) For example: With a stem-and-leaf plot, I could show that the median and mode are less than 50 g. The manufacturer's claim is not true.

Unit 5 Mid-Unit Review, page 184

1.a) Yes

b) For example: "Do we need a new hockey arena?"

2.c) For example: "What type of movie was the least popular?" Answer: Foreign.

d) For example: We know the type of movie rented the most and the least in one day. We know the total number of movies rented in one day.

4.b) 65 **c)** 2 **d)** 9 **e)** 75 **f)** 75

5.4 Line Graphs, page 191

1. a) For example: It shows Nathan's height from age 8 to age 16.

b) i) 125 cm **ii)** 150 cm **iii)** 180 cm

c) During year 12 to 13; during year 15 to 16. The steepest part of the graph shows when Nathan grew the most. The least steep part of the graph shows when Nathan grew the least.

d) For example: 185 cm **e)** For example: 185 cm

2. a) The table shows the average monthly rainfall in Vancouver and Ottawa.

c) For example: Vancouver: The graph shows a downward trend from January to July, then an upward trend from July to December.
Ottawa: The graph shows an upward trend from January to August, then a downward trend from August to December.

d) April and September. For example: At some point during these months, Ottawa and Vancouver had approximately the same rainfall.

e) Vancouver: 104.4 cm; Ottawa: 70.2 cm

4. a) It depends on the speed of the car and the wetness of the pavement.

c) For example: Because the data change over time.

d) They are both upward trends.

e) About 45 m **f)** About 45 km/h

g) For example: "A car takes 44 m to stop on wet pavement. How fast was it travelling?" The line graph fills in the information left out of the table.

5. a) i: Yearly sales. For example: The data change over time. You can also predict future sales.

c) For example: The graph generally shows an upward trend, so, annual sales have increased over time.

d) A bar graph would be suitable for part ii.

e) For example: Most of the shoes sold are sizes 7, 8, and 9. 2003 was the year the store sold the most shoes, and 1997 was the year the store sold the fewest shoes.

5.5 Applications of Mean, Median, and Mode, page 200

1. a) Mean ≐ 119.8 s; median = 119 s; mode = 118 s

b) For example: The mode best describes Ira's race time, because it is the time he gets most often.

c) 5 s

2. a) Math: Mean = 74.6; median = 75; no mode;
Spelling: Mean = 77.3; median = 81; mode = 81;
History: Mean = 74.4; median = 74; mode = 74

b) For example: The mean is the average of Caitlin's marks in each subject. The median gives the middle mark. The mode is the mark she gets most often in each subject.

c) All measures of central tendency show Spelling as Caitlin's best marks, and History as her worst marks.

3. a) Week 1: Mean = \$825; median = \$800; no mode
Week 2: Mean = \$825; median = \$775; no mode

b) Mean = \$825; median = \$787.5; mode = \$600

c) For example: The mean is the same for parts a and b. There is no mode in part a, only in part b.

d) For example: The median; half the tips are less than the median, and half the tips are greater than the median.

4. a) Median = 120 s; mode = 118 s **b)** 122 s

5. For example: 18, 24, 25, 26, 27; there are many different sets. The five numbers must have a sum of 120, and the middle number must be 25.

6. a) Part i; mean ≐ 395.3 g

b) Yes. For example: This shipment is acceptable because the mean mass is greater than 395 g.

7. a) Mean = 34, median = 33.5, mode = 30

b) i) When each number is increased by 10, the mean, median, and mode increase by 10.

ii) When each number is doubled, the mean, median, and mode are doubled.

5.6 Evaluating Data Analysis, page 204

1. For example: The graph on the right is misleading because the vertical scale starts at 100 instead of 0.

2. a) For example: The graph on the left, because the upward trend is steeper.

b) For example: The graph on the right, because the scale makes the profits seem smaller.

c) For example: \$126 million; I assumed that the upward trend would continue.

3. For example: In order to bias the results in someone's favour. A misleading graph can be drawn by not using a proper scale.

4. a) For example: Manufacturer A's trucks are much more dependable than B, C, and D.

b) B: 97.5; C: 96.5; D: 95.5

c) For example: No. The range of the data is only 3. There is only a 1% difference between adjacent manufacturers.

5. a) For example: The bars are low and close to the same size, so the expenses look low.

b) For example: The scale does not start at 0, and the difference in heights of the bars increases, so it looks like expenses are getting higher.

Unit 5 Unit Review, page 208

1. For example:

a) "What is your favourite summer activity?"

b) "In the summer, people like to swim to cool down. What is your favourite summer activity?"

2.a) The data show the average weekly earnings in 2001, for various jobs.

c) For example: A bar graph is easy to read, and we can compare earnings for different jobs. A circle graph could not be used because we're not looking at percents or parts of a whole. A line graph could not be used because the data are not measured over time.

d) Mining; Health Care; these jobs are represented by the tallest and shortest bars.

e) For example: Multiply the data by 52 to get average annual earnings. Then, divide the average annual earnings by 12 to get average monthly earnings.

f) For example: Mean.

3.a) 17; 10; 9; 4; 20 **b)** 60

c) Metro PD, because it is the least favourite.

d) Reality Shock, because it has the most viewers.

4.b) For example: The median and the mode. The boxes with the greatest and least mass, and the range of the data.

c) For example: No, the shipment will not be approved if the mean is used, since the mean mass of a box of raisins is less than 100 g.

d) 99.9 g **e)** 100.3 g

f) Yes; the mode is higher than 100 g. No; the median is less than 100 g.

5.b) For example: Calgary: Upward trend from February to June, downward trend from June to November. Charlottetown: Downward trend from January to April, and from May to July; upward trend from July to November.

c) No. Charlottetown gets more rain than Calgary year round; the 2 cities never get the same amount of rain in a given month.

d) Calgary: 40 cm; Charlottetown: 106 cm

e) Calgary: 2.05 cm; Charlottetown: 8.6 cm

f) For example: Charlottetown gets the most rain in November and the least rain in July. Calgary gets the most rain in June and the least rain in February.

6.a) Mode; the storeowner needs to know which size sweater sells the most.

b) Mean; this is the highest of the 3 values, and will get Robbie the most money.

c) Median; if Tina's score is greater than the median, she is in the top half of her class.

7.a) Mean **b)** Mode

Unit 5 Practice Test, page 211

1.a) For example: Primary data are data I collect. Secondary data come from another source.

b) **i)** Secondary data **ii)** Primary data

2.b) 1:30, or 90 s **c)** 2:54.5, or 2 min 54.5 s

d) Yes; 2:39, 2:47, 3:07, 3:11, 3:25

3.a) 94 **b)** 86 **c)** 85

4.a) For example: I used a bar graph because the data are not measured over time.

b) For example: The scale would change to allow for the greater number. Another bar would be added to the graph.

d) For example: The graph from part a, because it is easier to read.

Unit 6 Measuring Perimeter and Area, page 214

Skills You'll Need, page 216

1.a) $P = 30$ cm, $A = 36$ cm^2

b) $P = 26$ m, $A = 40$ m^2

c) $P = 18$ cm, $A = 20.25$ cm^2

d) $P = 8.4$ cm, $A = 3.6$ cm^2

6.1 Area of a Parallelogram, page 219

1.a) $b = 12$ cm, $h = 4$ cm **b)** $b = 10$ cm, $h = 12$ cm

c) $b = 8.0$ cm, $h = 4.4$ cm **d)** $b = 4.0$ cm, $h = 8.8$ cm

2.a) 48 cm^2 **b)** 120 cm^2 **c)** 35.2 cm^2 **d)** 35.2 cm^2

3.b) **i)** 15 cm^2 **ii)** 24.5 cm^2

The areas are the same, but the parallelograms have different shapes.

5.a) 24 cm^2 **b)** 12 cm **c)** 8 cm

d) For example: 1 cm by 48 cm, 2 cm by 24 cm, 3 cm by 16 cm, 4 cm by 12 cm, 6 cm by 8 cm, 8 cm by 6 cm, 12 cm by 4 cm, 16 cm by 3 cm, 24 cm by 2 cm, 48 cm by 1 cm

6.a) 5 cm **b)** 14 cm **c)** 7 cm

7.a) For example: 8 **b)** For example: 12

c) For example: 4

8. No. For example: The area of A is equal to the area of B.

9.a) The two triangles are congruent.

b) 60 cm^2

c) 30 cm^2; the area of each triangle is one-half the area of the parallelogram.

10.a) 95.04 m^2 **b)** 132 m^2

c) For example: Subtract the area of the patio from the sum of the areas of the patio and gardens.
Area of the gardens = 36.96 m^2

6.2 Area of a Triangle, page 222

1.a) $b = 7$ m, $h = 3$ m **b)** $b = 3$ cm, $h = 5$ cm
c) $b = 6$ m, $h = 8$ m **d)** $b = 4$ cm, $h = 7$ cm
2.a) 10.5 m^2 **b)** 7.5 cm^2 **c)** 24 m^2 **d)** 14 cm^2
3.b) i) 6 cm^2 **ii)** 24.375 cm^2
The areas are the same for the 3 different triangles in parts i and ii.
5.b) i) For example: By doubling the height or the base, the area of the triangle doubles.
ii) For example: By halving the height or the base, the area of the triangle is halved.
6.b) 12 cm^2
For example: All the triangles have different side lengths.
7.a) 10 cm **b)** 8 cm **c)** 3 cm
8. For example: I double the area, then divide by the base.
9.a) 8.55 m^2 **b)** 2 cans
10.a) 92.98 m^2 **b)** 33 sheets; \$823.35

Unit 6 Mid-Unit Review, page 225

1.a) $P = 15$ m, $A = 12.5$ m^2 **b)** $P = 13.6$ m, $A = 11.56$ m^2
2.a) 7 cm^2 **b)** 9.2 cm^2 **c)** 3 cm^2
3.a) 2700 cm^2 **b)** For example: $b = 60$ cm, $h = 90$ cm
c) For example: $b = 30$ cm, $h = 45$ cm
4.a) 12 cm^2 **b)** 3.5 cm^2 **c)** 2.2 m^2
5. \$1265.63, or \$1375 if the contractor rounds to the next square metre of concrete.

6.3 Area and Perimeter of a Trapezoid, page 228

1.a) 15 cm^2 **b)** 12 cm^2 **c)** 16 cm^2
2.a) 65 cm^2 **b)** 38 cm^2
3.a) 5 cm^2 **b)** $A \doteq 58.6$ cm^2
4.a) $A = 156$ cm^2, $P = 54$ cm **b)** $A = 816$ m^2, $P = 124$ m
5.a) i) 33.6 cm^2 **ii)** 66 m^2
b) i) No; there is not enough information.
ii) Yes; $P = 36$ m
6.a) Flowers: $A = 5.2$ m^2; vegetables: $A = 3.965$ m^2; herbs: $A = 2.535$ m^2
b) $A = 11.7$ m^2; find the sum of the three areas in part a, or find the area of the rectangle.
8.a) For example: Divide the area of the parallelogram by 2 to find the area of each trapezoid.
9.a) 510 cm^2 **d)** Larger
10. For example:
Area of a trapezoid = $\frac{1}{2}$ (*base 1* + *base 2*) × *h*

6.4 Measuring Irregular Figures, page 236

1. 24 m^2
2.a) 31 m^2 **b)** 27 m^2
3.a) Answers vary. **b)** $A = 42.56$ m^2, $P = 37.6$ m
4.b) $A = 2200$ m^2, $P = 220$ m
c) For example: Count the squares on the grid and multiply by 100 to get the area; count the sides of the squares and multiply by 10 to get the perimeter.
5.b) 135 m^2
c) No. For example: The areas of the garden and the backyard never change, so you are always subtracting the same numbers.
6.b) All the perimeters are the same; $P = 26$ m
c) For example: You cannot make an L-shaped pool with area 30 m^2 and arm width 5 m. You end up with a rectangle.

Unit 6 Unit Review, page 240

1.a) 6.8 cm^2 **b)** 2.94 cm^2 **c)** 3.125 cm^2 **d)** 5.98 cm^2
2.a) 186 cm^2 **b)** 1125 cm^2
3.a) 64 cm **b)** 145 cm
4. For example: The height of the trapezoid is about 10 cm.
5.a) $P = 37.2$ cm, $A = 52.28$ cm^2
b) $P = 48$ m, $A = 155.52$ m^2
6.a) 1105.5 m^2 **b)** \$10 756.50

Unit 6 Practice Test, page 241

1.a) $A = 63$ cm^2, $P = 34$ cm **b)** $A = 9$ cm^2, $P = 25.5$ cm
c) $A = 8.1$ cm^2, $P = 13.9$ cm
d) $A = 27$ cm^2, $P = 26$ cm
2.a) Area is doubled. **b)** Area is halved.
c) Area stays the same.
4.a) 25.5 cm^2 **b)** 36 cm

Unit 7 Geometry, page 244

Skills You'll Need, page 246

3. Yes.
4. No. An equilateral triangle always has three equal angles of 60°. A right triangle has one angle of 90°.
7.a) On the vertical axis **b)** On the horizontal axis

7.1 Classifying Figures, page 252

1.a) For example: A polygon has sides that intersect only at the vertices. The sides of this figure don't only intersect at the vertices.
b) For example: A polygon is a closed figure. This is not a closed figure.
2.a) i) No. Not all the angles are equal.
ii) Yes. All the sides and all the angles are equal.
iii) No. Not all the sides are equal.
b) i) All of the polygons in part a have line symmetry.

ii) Figures ii and iii in part a have rotational symmetry.

3. For example:
  a) Parallelogram b) Isosceles triangle
  c) Concave polygon
  d) Obtuse triangles, scalene triangles

4. a) Concave polygon b) Concave polygon
  c) Regular polygon
  In every figure, all the sides are equal. Only figure c has equal angles.

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

7. For example: A: Parallelogram, convex polygon, quadrilateral; B: trapezoid, convex polygon, quadrilateral; C: quadrilateral, convex polygon; D: rectangle, parallelogram; E: kite, quadrilateral

9. b) For example: Many different figures. Quadrilaterals, trapezoids, parallelograms, concave polygons, convex polygons, obtuse triangles

10. a) For example: Rectangle, parallelogram, trapezoid, kite, quadrilateral
  b) For example: All the quadrilaterals in part a are possible.

7.2 Congruent Figures, page 257

1. △ABC ≅ △DFE; A D 50°; AB = DF = 4 cm;
  B F 40°

2. Yes. Quadrilateral ABCD and quadrilateral LKNM have 4 pairs of corresponding sides equal, and 4 pairs of corresponding angles equal.

3. For example:
  a) △ABC ≅ △ADC; they have 3 pairs of corresponding sides equal.
  b) △PQR ≅ △RSP; they have 2 pairs of corresponding sides equal, and 1 pair of corresponding angles equal, between these sides.
  c) △HEF ≅ △FGH; they have 3 pairs of corresponding sides equal.
  d) △JKL ≅ △LMJ; they have 2 pairs of corresponding sides equal, and 1 pair of corresponding angles equal, between these sides.

4. For example:
  b) i) one side length, one angle, height
    ii) length and width iii) length of one side
  c) For example: Congruent parallelograms have corresponding sides equal and corresponding angles equal. Congruent rectangles have equal bases and equal heights. Congruent squares have equal sides.

5. b) For example: We need to know the angle between the 2 sides, or the length of the third side.

6. For example:
  a) The corresponding angles are not equal.
  b) All the corresponding angles are equal, and all the corresponding sides are equal.
  c) The quadrilaterals in part a have different angles than the quadrilaterals in part b.

7. For example: The salesperson needed to know the shape of the quadrilateral.

8. a) No; they can have different side lengths.
  b) Yes; when 2 angles and the side between these angles are known, only 1 triangle can be drawn.

9. a) No

Unit 7 Mid-Unit Review, page 260

1. a) △DEF and △GHJ b) △ABC c) △DEF
  d) △GHJ e) △ABC

2. a) For example: Corresponding sides are equal, and corresponding angles are equal. The hexagons are concave because one angle is greater than 180° in each hexagon.
  b) For example: The hexagons are convex because all the angles are less than 180°. The hexagons are congruent because corresponding sides are equal and corresponding angles are equal.

3. b) For example: Corresponding angles are equal and corresponding sides are equal.
  c) For example: Corresponding angles are not equal, and two corresponding sides are not equal.

4. a) For example: Quadrilaterals ABCD and JKLM are not congruent. They do not have equal corresponding sides or angles.
  b) EFGH ≅ QPNR; all corresponding sides and all corresponding angles are equal.

7.3 Transformations, page 264

1. For example:
  a) Figure A is translated 3 units right and 3 units up
  b) Rotate Figure A one-half turn about its turn centre (where Figure A and Figure C touch).
  c) Figure B is reflected in a vertical line 1 unit to the right (between Figure B and Figure E).
  d) Figure D is translated 4 units left and 2 units up.
  e) Rotate Figure D one-half turn about its turn centre (where Figure D and Figure C touch).

2. For example:
  a) Rotate Figure B one-quarter turn counterclockwise about the point where Figures A and B meet.
  b) Translate Figure C 2 units up.

c) Rotate Figure D one-quarter turn counterclockwise about the point where the vertices of Figure D and Figure C meet.

d) Rotate Figure A one-half turn about the midpoint of the base of Figure A.

4. For example: Rotate Figure A one-quarter turn counterclockwise about point (5, 6) to get Figure D. Reflect Figure A through a diagonal line going through points (5, 6) and (8, 9) to get Figure B.

5.a) Figures A and B do not represent a transformation, and Figures E and F do not represent a transformation.

b) Figure D is the image of Figure C after a rotation of one-quarter turn clockwise about the point (7, 2).

7. For example: Translate Figure B 2 units left. Reflect Figure B in a diagonal line that runs through the point where Figure A and Figure B meet.

7.4 Tiling Patterns, page 268

1. For example: No, it does not tile the plane. It leaves gaps that are squares.

2. For example: Yes.

3. For example: It does not tile the plane. It leaves gaps that are squares.

4. For example: Escher started with a regular hexagon. At each vertex 3 hexagons meet, and the sum of the angles is 360°.

5. For example: Parts of the edges will not be covered by a full tile. Tiles will have to be cut to fit.

6. For example: Because squares and rectangles tile a larger square or rectangle, which is often the shape of a floor.

7.a) For example: Pentagons that tile the plane meet at vertices where the sum of the angles is 360°.

8. For example: There are no gaps between the octagons that tile the plane.

9. For example: Honeycombs are hexagons.

Reading and Writing in Math: Choosing a Strategy, page 278

1. 80 km

2. 50

3. Cannot draw d and f. For example: Quadrilaterals can have a maximum of 4 lines of symmetry, and triangles are the only polygons that can have 3.

5.a) For example: Top row: $\frac{1}{6}$; middle row: 1, $\frac{5}{6}$;
bottom row: $\frac{1}{3}, \frac{2}{3}, \frac{1}{2}$

b) For example: Top row: 1; middle row: $\frac{1}{6}, \frac{1}{3}$;
bottom row: $\frac{5}{6}, \frac{1}{2}, \frac{2}{3}$

6. $\frac{3}{4}$

7. For example:

a) $\frac{\text{HI K}}{\text{G J}}$; the letters that have curves are on the bottom.

b) 100, 200, 500, 1000, 2000; this represents currency in cents: penny, nickel, dime, quarter, loonie, toonie, \$5 bill, \$10 bill, \$20 bill.

c) E, N, T, E, T; the letters represent the first letter of each number: one, two, three, four, and so on.

8.a) Back face of the prism: Brown, light blue, dark green, red, purple, white

c) Dark green, orange, light blue, brown, dark blue, light green

9.a) Monday July 15, Wednesday July 24, Saturday July 27

b) Tuesday July 16, Friday July 19

Unit 7 Unit Review, page 282

1. For example:

a) Six-sided figure with one angle greater than 180°

b) Five-sided figure, with all angles less than 180°

c) Four-sided figure, with one angle greater than 180°

d) A figure that is not closed, or a circle

e) All sides are equal, all angles are equal.

2. For example:

a) Six-sided figure; convex polygon. 1 pair of 60° angles, 2 pairs of 150° angles.

b) A regular polygon. All sides are equal, all angles are equal, 60°.

c) Five-sided concave polygon. One angle is 240°. Three angles are less than 90°.

d) Five-sided convex polygon. Three angles are 120°, 2 angles are 90°.

3.a) No; not all pairs of corresponding sides are congruent.

b) Yes; all three pairs of corresponding sides are congruent.

4.a) One-quarter turn clockwise about point C.

b) Reflect Figure ABCD in a horizontal line through (0,11).

c) A translation 2 units right and 5 units down.

Unit 7 Practice Test, page 283

1.a) ABCD ≅ JKMH; corresponding pairs of angles and corresponding sides are equal.

b) □EFG and □PQN are not congruent; corresponding sides are not equal.

c) □EFG or □PQN **d)** ABCD or JKMH

2. For example: No. The side lengths could be different.

3. For example: Two squares.

Unit 8 Working with Percents, page 288

Skills You'll Need, page 290

1.a) 0.75 **b)** 0.4 **c)** 0.6 **d)** 0.68
2.a) 0.625 **b)** 0.1875 **c)** 0.375 **d)** 0.4375
4. 6%

8.1 Relating Fractions, Decimals, and Percents, page 294

1.a) 15%; $\frac{15}{100}$, 0.15 **b)** 40%; $\frac{40}{100}$, 0.40
c) 80%; $\frac{80}{100}$, 0.80
2.a) 25% **b)** 30% **c)** 140% **d)** 75%
3.a) 0.2, 20% **b)** 0.06, 6% **c)** 0.16, 16%
d) 1.15, 115% **e)** 1.4, 140%
4. Janet; 82% is greater than $\frac{8}{10}$, or 80%
5. For example: Yes; the 5 triangles can be arranged into different figures.
7. The green section is 15%.
8. For example: Giving 100% is like giving one whole. Giving 110% is giving more than one whole.
9.a) 25% **b)** 50% **c)** 6% **d)** 10%

8.2 Estimating and Calculating Percents, page 299

1. For example:
a) 25% **b)** 33% **c)** 60% **d)** 90%
2.a) 5 **b)** 4 **c)** 9 **d)** 30
e) 7.5 **f)** 3.3 **g)** 4.5 **h)** 1.8
3.a) 2.5 **b)** 2 **c)** 4.5 **d)** 15
e) 3.75 **f)** 1.65 **g)** 2.25 **h)** 0.9
4.a) 7.5 **b)** 6 **c)** 13.5 **d)** 45
e) 11.25 **f)** 4.95 **g)** 6.75 **h)** 2.7
5.a) 3 cm **b)** 1.2 cm **c)** 2.4 cm **d)** 18 cm
6. For example: Method 1: Find 15% of $65.
Method 2: Find 10% of $65, then halve the amount to get 5% of $65, and add the two amounts to get 15% of $65.
The cost of the shoes is $74.75.
7. For example:
a) 75 **b)** 12 **c)** 90 **d)** 53
e) 40 **f)** 53 **g)** 4 **h)** 4
8. For example: No. 10% of 160 is 16, so 20% of 160 is 32. This would be a closer estimate.
9.a) $\frac{219}{341}$ **b)** Approximately 64%
10.a) $\frac{21}{66}$ or $\frac{7}{22}$ **b)** Approximately 35%
c) Approximately 65%
12.a) Approximately 800 000 km^2
b) Approximately 9 170 000 km^2
13. Approximately 2 300 000 km^2
14.a) $\frac{4.5}{12}$ or $\frac{3}{8}$ **b)** 37.5%
15. Approximately 81%

8.3 Multiplying to Find Percents, page 304

1.a) 2.73 **b)** 9.68 **c)** 0.306 **d)** 97.44
2.a) 6.48 **b)** 16.08 **c)** 27.44 **d)** 75.04
3.a) $15.00 **b)** $44.99 **c)** $18.00
d) $41.99 **e)** $47.99 **f)** $53.99
4.a) $45.00 **b)** $42.00 **c)** $36.00
5.a) $46.58 **b)** $25.30
6.a) **i)** 1.046 **ii)** 10.46 **iii)** 104.6
Keep moving the decimal point one place to the right.
7. For example: You get the same answer: $3.75
8. 16.7%

Unit 8 Mid-Unit Review, page 305

1.a) 0.8, 80% **b)** 0.12, 12%
c) 2.36, 236% **d)** 0.35, 35%
2.a) 1.35, 135% **b)** 0.56, 56%
c) 1.875, 187.5% **d)** 0.4375, 43.75%
4. For example:
a) 50% **b)** 33%
5.a) $\frac{32}{66}$ or $\frac{16}{33}$ **b)** Approximately 50%
c) $3.11 **d)** Approximately 40%
6.a) 2.8 **b)** 6.6 **c)** 3.5 **d)** 18
7.a) 16.8 **b)** 39.6 **c)** 21 **d)** 108
8. For example:
a) 80% **b)** 70% **c)** 200% **d)** 210% **e)** 10%
9. For example:
a) 14 **b)** 30 **c)** 150 **d)** 133
10.a) **i)** $0.05 **ii)** $0.30 **iii)** $1.30 **iv)** $0.20
11. $68.43
12. For example: You get the same answer: $34.00

8.4 Drawing Circle Graphs, page 309

1.a) 112 500 **b)** 62 500 **c)** 25 000
2.a) **i)** Yes; it adds up to 100%.
ii) No; it adds up to more than 100%.
b) **ii)** A bar graph.
3.a) Blue, 22%; brown, 48%; green, 18%; grey, 12%
4.a) 92
b) MAJIC99, 22%; EASY2, 23%; ROCK1, 30%; HITS2, 25%
6. Approximate area: Australia, 61 million km^2; Antarctica, 98 million km^2; Europe, 86 million km^2; South America, 147 million km^2; Asia, 367 million km^2; Africa, 244 million km^2

8.5 Dividing to Find Percents, page 312

1.a) 2.5 m **b)** 5 m
2.a) 0.12 kg **b)** 12 kg

3.a) 0.3 cm **b)** 30 cm

4. 480 families

5. 12 games

6. 240 pages

7.a) 9 pieces **b)** Approximately 56%

8. 400 students

9.a) \$60.38 **b)** No.

11.a) Yes; the shoes cost \$23.00, so \$40.00 is enough.

b) \$17.00

12. 200 marbles

Reading and Writing in Math: Choosing a Strategy, page 314

1. For example: 8 × 9 × 10; 1 × 2 × 3 × 4 × 5 × 6

2.a) 12:21, 1:01, 1:11, 1:21, 1:31, 1:41, 1:51, 2:02, 2:12, 2:22, 2:32, 2:42, 2:52, 3:03, 3:13, 3:23, 3:33, 3:43, 3:53, 4:04, 4:14, 4:24, 4:34, 4:44, 4:54, 5:05, 5:15, 5:25, 5:35, 5:45, 5:55, 6:06, 6:16, 6:26, 6:36, 6:46, 6:56, 7:07, 7:17, 7:27, 7:37, 7:47, 7:57, 8:08, 8:18, 8:28, 8:38, 8:48, 8:58, 9:09, 9:19, 9:29, 9:39, 9:49, 9:59, 10:01, 11:11

b) 2 minutes (between 9:59 and 10:01)

3. 1; 36; 81; 100; 121; 144; 169; 196; 225; 324

4. For example: About 4 h, if I walk 5 km/h.

5. About 231.5 h

6.a) 8 **b)** 24 **c)** 24 **d)** 8

8. 8 sets

9. $\frac{1}{4}$

10.a) Mean, \$6000 **b)** Mode, \$4000

11. 38 m by 92 m

Unit 8 Unit Review, page 316

1.a) 0.4, 40% **b)** 2.8, 280% **c)** 0.56, 56%

d) 0.7, 70% **e)** 1.125, 112.5% **f)** 1.7, 170%

2. For example:

a) 18%, $\frac{9}{50}$ **b)** 30%, $\frac{3}{10}$

c) 0.8, $\frac{4}{5}$ **d)** 0.375, 37.5%

4. For example:

a) 100 **b)** 36 **c)** 12 **d)** 41

e) 62 **f)** 59 **g)** 9 **h)** 4

5. Approximately \$34.50

6. 28 students

7.a) \$90.00 **b)** \$84.00 **c)** \$72.00

d) \$60.00 **e)** \$48.00 **f)** \$66.00

8.a) \$736.00 **b)** \$220.80

9.a) Lake Huron

b) For example: It has the greatest surface area.

c) 26 840 km^2

10.b) For example: I know that the greatest primary energy resource in Canada in 2001 was oil, and the least was nuclear. I know that hydro-electricity generated the most electricity in 2001, and oil and natural gas generated the least.

11.a) Canada, 44%; USSR, 8%; U.S., 16%; Europe, 32%

b) The U.S. section of the circle graph would change to 12%; the USSR section of the circle graph would change to 12%.

12. 175 cm

13. 400 students

Unit 8 Practice Test, page 319

1. For example: One item may cost a different amount than the other; or one item may be a different size than another.

2.a) 16 cm

b) The original strip is 20 cm long.

3.a) 240 **b)** 24 **c)** 2.4

4.a) \$56.25 **b)** \$64.69

5.b) No. For example: I only need to know the percents to draw the graph (as long as they add up to 100%).

6. 20 dogs

Cumulative Review, Units 1–8, page 322

2.a) **i)** 6 **ii)** 9 **iii)** 12 **iv)** 15

b) For example: 5 tea bags. You need $4\frac{1}{2}$ tea bags, but you can't break a tea bag in half.

3.a) 8640 cm^3

b) For example: 60 cm by 36 cm by 32 cm

c) 60 cm by 36 cm by 32 cm; this box has the smaller surface area.

4.a) 8.64

b) For example: Many different pairs of factors are possible. 0.1 × 86.4, 0.2 × 43.2, 0.3 × 28.8, and so on.

5.b) 10 under par; 2 at par; 7 over par

c) 26

d) Mean ≐ 34, median = 35, mode = 33

6.a) For example: There is an upward trend from left to right.

b) For example: Yes. The graph shows that students who read 1.5 hours or more per week do better than students who read less than 1.5 hours per week.

7.a) 9.36 cm^2 **b)** 4.68 cm^2

8. $A = 30.72\ cm^2$, $P = 24$ cm

9. $A = 33\ cm^2$, $P = 28$ cm

10. For example: Corresponding side lengths and corresponding angles are equal.

11.a) 3.8 cm **b)** 125°

13.a) \$71.99 **b)** \$82.79

14. For example: The operations are the same, since order does not matter in multiplication, and both have a product of $21.

Unit 9 Integers, page 324

Skills You'll Need, page 326

1. a) 110 **b)** 40 **c)** 131 **d)** 47

2. a) First row: 8, 1, 6; second row: 3, 5, 7; third row: 4, 9, 2. The magic sum is 15.

b) First row: 17, 10, 15; second row: 12, 14, 16; third row: 13, 18, 11. The magic sum is 42.

9.1 What Is an Integer?, page 328

2. a) –3 **b)** +1 **c)** +8000 **d)** –10

3. a) –35°C **b)** +28 000 m **c)** –35 m **d)** +$500

4. For example:

a) The temperature in Hamilton increased 4°C.

b) George owes Stan $5.00.

c) Maya walked 120 steps forward.

d) The shipwreck is 8500 m below sea level.

5. For example: To describe the weather: A high of +7°C and a low of –2°C.
To describe altitude in relation to sea level: +400 m above sea level, –3000 m below sea level.

6. a) Positive integers: Births, Immigration
For example: These numbers represent an increase in population.
Negative integers: Deaths, Emigration
For example: These numbers represent a decrease in population.

b) Births: –545 000; deaths: +364 000; immigration: +512 000; emigration: –10 000

c) For example: Births are an increase in population (above or to the right of 0 on the number line). Deaths are a decrease in population (below or to the left of 0 on the number line).

d) For example: Immigration is an increase in population (above or to the right of 0 on the number line). Emigration is a decrease in population (below or to the left of 0 on the number line).

7. a) **i)** +$2 **ii)** –$3 **c)** –$1 **d)** +$5

b) For example: The final price is $3 less than the initial price.

c) For example: The final price is $5 more than the initial price.

d) For example: A negative integer represents a decrease in price; a positive integer represents an increase in price.

9.2 Comparing and Ordering Integers, page 332

1. a) Missing integers: –3, –1, +3

b) Missing integers: –8, –6, –4, –2, 0

2. a) +1, +5, +13 **b)** –5, –4, –3 **c)** –2, +3, +4

3. a) +8, +4, +1 **b)** –3, –5, –7 **c)** +4, 0, –4

4. a) –5, –2, +2, +4, +5 **b)** –12, –10, –8, 0, +10

c) –41, –39, –25, –15, +41 **d)** –2, –1, +1, +2, +3

5. a) +14, +3, –10, –25, –30 **b)** +2, +1, 0, –1, –2

c) +27, +6, –4, –11, –29 **d)** +10, +8, –7, –9, –11

6. b) –64, –61, –58, –54, –53, –47
For example: I wrote the temperatures on the thermometer in order from bottom to top.

7. a) +5 < +10 **b)** –5 > –10 **c)** –6 < 0

d) –5 < –4 **e)** +100 > –101 **f)** –80 < –40

8. a) **i)** +4, +8, +9 **ii)** 0 **iii)** –8 **iv)** –8, –5, 0

b) For example: Which integers are less than –4?
Answer: –5, –8

9. Warmest: Charlottetown, Prince Edward Island, because –21°C is the greatest integer. Coldest: Sydney, Nova Scotia, because –23°C is the least integer.

10. a) **i)** 0 **ii)** –2 **iii)** –3
iv) +2 **v)** –1 **vi)** –5

b) For example: The distance between –5 and +1 is 6 units; half of 6 units is 3 units; 3 units to the right of –5 is –2. The distance between –5 and –1 is 4 units; half of 4 units is 2 units; 2 units to the right of –5 is –3.

c) For example: –3 is halfway between –8 and +2.

11. –46°C

12. a) –5, –3, –1, +1, +3, +5, +7
Start at –5. Add 2 to get the next term.

b) +7, +4, +1, –2, –5, –8, –11
Start at +7. Subtract 3 to get the next term.

c) –20, –18, –16, –14, –12, –10, –8
Start at –20. Add 2 to get the next term.

d) –5, –10, –15, –20, –25, –30, –35
Start at –5. Subtract 5 to get the next term.

9.3 Representing Integers, page 335

1. a) +1 **b)** +3 **c)** 0 **d)** –1 **e)** –3 **f)** –2

4. a) For example: +3

b) For example: 3 yellow tiles, 0 red tiles; 4 yellow tiles, 1 red tile; and so on. Many answers are possible.

c) For example: There are always 3 more yellow tiles than red tiles.

d) For example: To model +30: Start with 30 yellow tiles and 0 red tiles. Increase each number of yellow and red tiles by 1.

5. a) 8 red tiles; (+10) + (–8) = +2

b) 98 red tiles; (+100) + (–98) = +2

9.4 Adding Integers with Tiles, page 339

1.a) (+4) + (–2) = +2 **b)** (+2) + (–3) = –1
c) (–4) + (–2) = –6 **d)** (+6) + (–3) = +3
e) (+1) + (–4) = –3 **f)** (+3) + (+2) = +5

2.a) (+3) + (–2) = +1 **b)** (+3) + (–4) = –1
c) (–2) + (+2) = 0

3.a) 0 **b)** 0 **c)** 0

4.a) +5 **b)** +1 **c)** –5 **d)** 0 **e)** –7 **f)** +3

5.a) +7 **b)** –2 **c)** –9 **d)** +7 **e)** –16 **f)** –9

6.a) (–3) + (+4) = +1 **b)** (+5) + (–3) = +2

7. For example: (–5) + (–3) = –8; (–7) + (+2) = –5; (–4) + (+8) = +4

8.a) +6 **b)** +4 **c)** –5 **d)** +2 **e)** –5 **f)** –10

9.a) (+5) + (+3) = +8 **b)** (–1) + (–3) = –4
c) (+3) + (–2) = +1 **d)** (–5) + (+2) = –3
e) (+2) + (–1) = +1 **f)** (+6) + (–6) = 0

10.a) –4
b) No; the sum is still –4. For example: Order does not matter when adding; the integers have not changed sign.
c) (–3) + (+7) = +4, (+3) + (–7) = –4; the integers have changed sign.

11.a) First row: +3, –4, +1; second row: –2, 0, +2; third row: –1, +4, –3. The magic sum is 0.
b) First row: –1, –6, +1; second row: 0, –2, –4; third row: –5, +2, –3. The magic sum is –6.

12.a) +7 **b)** –1 **c)** –1

13. For example: First row: –3; second row: –4, –5; third row: –2, –6, –1. The vertices are consecutive numbers and the middle integers are consecutive.

9.5 Adding Integers, page 343

1.a) +4 **b)** +2 **c)** –2 **d)** –4

2.a) +6 **b)** +2 **c)** –6 **d)** –6

3.a) +6; +2; –6; –6 **b)** The answers are the same.
c) For example: Order does not matter when adding integers.

4.a) –1°C **b)** –2°C **c)** +3°C

5.a) +5°C **b)** Gain **c)** +$1

6.a) +15 **b)** +6 **c)** –15 **d)** +3 **e)** –15 **f)** –6

7.a) +40 **b)** +10 **c)** –40 **d)** +3 **e)** –3 **f)** –80

8.a) For example: Opposite integers are the same distance from 0, so their sum equals 0.
b) For example: To add positive integers, move to the right on a number line. The numbers to the right of 0 are always positive, so the sum is always positive.
c) For example: To add negative integers, move to the left on a number line. The numbers to the left of 0 are always negative, so the sum is always negative.
d) For example: If the greater integer in the sum is negative, the answer is negative. If the greater integer in the sum is positive, the answer is positive.

9.a) +1 **b)** –5 **c)** –6 **d)** 0 **e)** +7 **f)** –23

10. 28°C; (+23) + (–7) + (+12) = +28

11. (+24) + (–7) + (+12) + (–10) = +19; Susanna has $19 left.

12.a) (+10) + (+15) = +25 **b)** (–10) + (–15) = –25
c) (+20) + (–5) = +15 **d)** (–20) + (+5) = –15
e) (+35) + (–18) = +17 **f)** (–35) + (+18) = –17

Unit 9 Mid-Unit Review, page 345

2.a) –12 **b)** +3 **c)** +10 **d)** –2 **e)** +25 **f)** +1500

3.a) –4, –3, –2, +1, +4 **b)** –50, –17, 0, +18, +50

5.a) +3 **b)** –5 **c)** –4 **d)** +9 **e)** –12 **f)** +12

6.a) +5 **b)** –6 **c)** –2 **d)** +1 **e)** 0 **f)** +7

7.a) +3 **b)** +6 **c)** –4 **d)** +5

8.a) +3 **b)** –8 **c)** –1 **d)** –7

9.a) $40 **b)** –3°C **c)** 120 000

10.a) –1
b) For example: (+7) + (–8), (–6) + (+5), (–10) + (+9)

9.6 Subtracting Integers with Tiles, page 349

1.a) +3 **b)** 0 **c)** –3 **d)** +2 **e)** –7 **f)** 0

2.a) +3 **b)** –5 **c)** +7 **d)** –1 **e)** +2 **f)** –9

3.a) –3 **b)** +5 **c)** –7 **d)** +1 **e)** –2 **f)** +9

4.a) +11 **b)** –10 **c)** –14 **d)** +14 **e)** –9 **f)** –12

5.a) –1 **b)** –8 **c)** –7 **d)** +7 **e)** +10 **f)** +11

6. For example: (–5) – (–8) = +3; (+6) – (–4) = +10; (–9) – (+3) = –12

7.a) **i)** +2 and –2 **ii)** –1 and +1
b) For example: The answers are opposite integers. Order matters when you subtract.

8. For example: –7; the integers are the same but in a different order, so the answer should be the opposite integer.

9. Many answers are possible. For example:
a) (–3) – (–5) **b)** (+6) – (+9)
c) (+7) – (+2) **d)** (–4) – (+2)

10.a) Yes, because each row, column, and diagonal equal the same number (–9).
b) Yes, because each row, column, and diagonal equal the same number (0).
c) For example: First row: –5, 0, –7; second row: –6, –4, –2; third row: –1, –8, –3

11.a) +2 and –3

b) For example: Find 2 integers with a sum of –7 and a difference of +3. –2, –5

12. a) +2 **b)** 0 **c)** 0 **d)** +1 **e)** –3 **f)** 0

13. a) (+4) – (+1) = +3 **b)** (+3) – (+4) = –1

c) (+5) – (+1) = +4

14. a) i; because + 4 > –4 **b)** i; because +1 > –1

9.7 Subtracting Integers, page 354

1. a) (+6) + (–4) **b)** (–5) + (–4) **c)** (–2) + (+3)

d) (+4) + (+2) **e)** (+1) + (–1) **f)** (+1) + (+1)

2. a) +1 **b)** +7 **c)** –3 **d)** –7 **e)** +4 **f)** +4

3. a) –1; –7; +3; +7; –4; –4

b) For example: The answers are opposite integers. Order matters when subtracting.

4. a) +5 **b)** +10 **c)** –14 **d)** –15 **e)** –8 **f)** 0

5. a) –8°C **b)** +5°C **c)** –7 m **d)** –2

6. a) +17°C **b)** +12°C **c)** +15°C **d)** +6°C

7. a) –3 **b)** +10 **c)** –10

8. a) –17 **b)** +17; it is the opposite integer.

c) For example: (+6) – (–11) = (+6) + (+11) = +17; the sum of two positive integers is a positive integer. (–6) – (+11) = (–6) + (–11) = –17; the sum of two negative integers is a negative integer.

9. a) –7.5°C **b)** 44°C **c)** –28°C

10. a) +1 **b)** +1 **c)** –4 **d)** +2 **e)** +12 **f)** –11

11. For example: (+9) – (+5) = +4; (–3) – (–7) = +4; (+2) – (–2) = +4

Reading and Writing in Math: Choosing a Strategy, page 356

1. 152

2. a) 187 **b)** 11

3. a) $7.95 **b)** $22.95

4. 12

5. a) Mr. Anders: $\frac{1}{4}$; his assistant: $\frac{1}{6}$

b) $\frac{5}{12}$ **c)** 2 hrs 24 min

6. For example: 6, 13, 14, 16, 16; 9, 10, 14, 16, 16

7. 1 cm by 1 cm by 36 cm; 2 cm by 2 cm by 9 cm; 3 cm by 3 cm by 4 cm; 6 cm by 6 cm by 1 cm

8. For example: 4 ways, using line symmetry and rotational symmetry.

9. 59%

10. There are many solutions. For example: 22 + 23, 14 + 15 + 16, 7 + 8 + 9 + 10 + 11, and so on.

11. a) 8 × 125; one answer

b) 1 × 8 × 125; 2 × 4 × 125; 8 × 5 × 25

12. 22 times

Unit 9 Unit Review, page 360

2. a) –2 **b)** –250 m **c)** +32°C **d)** –$125 **e)** +$3

3. –55, –54, –3, +150, +200

4. a) +2 **b)** –1 **c)** –5 **d)** 2

5. a) +2 **b)** +2 **c)** –10 **d)** –2

6. No. For example: If the first integer is greater than the second, then the difference is positive. If the first integer is less than the second, then the difference is negative.

7. (–5°C) + (+12°C) + (–9°C) = –2°C

8. a) +3 **b)** +6 **c)** +4 **d)** –5

e) –4 **f)** –5 **g)** –2

9. a) +12°C **b)** –150 m **c)** +3

10. a) +2 **b)** –3 **c)** +40 **d)** –160

11. a) For example: (–3) + (–3); (–9) + (+3); (–7) + (+1); (+6) + (–12); (–6) + 0

b) For example: (+5) – (+8); (+2) – (+5); (–2) – (+1); (–5) – (–2); (–11) – (–8)

Unit 9 Practice Test, page 361

1. a) +1 **b)** –2 **c)** –12 **d)** –14

2. –14, –12, –2, +1

3. a) –3 **b)** –10 **c)** –10 **d)** +6 **e)** –4 **f)** +23

4. For example:

a) When the integers are the same, but with opposite signs: (+3) + (–3) = 0

b) When both integers are negative: (–7) + (–8) = –15

c) When both integers are positive: (+9) + (+11) = +20

5. a) 10 **b)** 30, 25, 20, 18, 15, 13, 8, 6, 1, –6

6. +373°C

Unit 9 Unit Problem: What Time Is It?, page 362

1. a) 1:00 a.m. **b)** 6:00 a.m. **c)** 10:00 a.m. **d)** 7:00 p.m.

2. 10:00 a.m.

3. Atsuko leaves at 3:00 p.m. and Paula leaves at 7:00 a.m.

Unit 10 Patterning and Algebra, page 364

Skills You'll Need, page 366

1. a) 37 **b)** 45 **c)** 29 **d)** 7 **e)** 17

f) 9 **g)** 5 **h)** 2 **i)** 14

2. a) **i)** 16 **ii)** 22 **iii)** 90

iv) 23 **v)** 29 **vi)** 17

b) For example: The answer depends on the order in which we carry out the operations.

3. A(2, 3); B(5, 5); C(4, 0); D(0, 1)

5. a) $16 **b)** 3 h **c)** $4/h

10.1 Number Patterns, page 371

1.a) For example: The first term is a triangle, the second term is a square, and the third term is a pentagon. These three terms repeat.

b) Square, pentagon, triangle

c) 29th term: square; 49th term: triangle

2.a) For example: Three circles are arranged in an "L" shape. A circle is added to the vertical arm and the horizontal arm each time.

b) 18th term: 19 circles along the vertical arm, 19 circles along the horizontal arm; 38th term: 39 circles along the vertical arm, 39 circles along the horizontal arm

3.a) i) Each term in the pattern is a multiple of 3. The 1st term is the 2nd multiple of 3. The 2nd term is the 3rd multiple of 3.

ii) 18, 21, 24

iii) The 40th term is the 41st multiple of 3: $3 \times 41 = 123$

b) i) Start at 6. Add 4 each time. **ii)** 22, 26, 30

iii) The 40th term is $6 + 4 \times 39 = 162$

c) i) Start at 6. Add 5 each time. **ii)** 26, 31, 36

iii) The 40th term is $6 + 5 \times 39 = 201$

4. 6, 12, 18, 24, 30, …
Part a increases by 3, part b increases by 4, part c increases by 5. The next pattern increases by 6.

5.a) i) Start at 2. Multiply by 2 each time.

ii) 32, 64, 128 **iii)** 1 048 576

b) i) Start at 3. Multiply by 2 each time.

ii) 48, 96, 192 **iii)** 1 572 864

6. For example: In both patterns, start by adding 3, then keep adding consecutive odd numbers each time. The starting number for each pattern is different.

a) i) 37, 50, 65 **ii)** 401

b) i) 35, 48, 63 **ii)** 399

7.a) For example: Start with 1 row of 3 squares. The length and width of the rectangle increases by 2 units each time.

c) 17th term: 33×35; 37th term: 73×75

8. For example: 12, 16, 20, 24, 28, 32; start at 12. Add 4 each time. Next 4 terms: 36, 40, 44, 48
2, 12, 22, 32; start at 2. Add 10 each time.
Next 4 terms: 42, 52 62, 72

9.a) For example: A "U" shape made of squares. Start with 5 squares. Add 3 each time.

b) 32 **c)** 30; 36 **d)** 66 **e)** 35

f) No; 27 does not fit the pattern.

10. For example: 11, 13, 16, 20, 25; 16, 17, 20, 25, 32

10.2 Graphing Patterns, page 375

1.a) Output: 3; 6; 9; 12; 15 **b)** Output: 3; 4; 5; 6; 7

c) Output: 5; 8; 11; 14; 17 **d)** Output: 9; 12; 15; 18; 21

2.a) Output: 10; 8; 6; 4; 2 **b)** Output: 97; 77; 57; 37; 17

c) Output: 7; 5; 3; 1; –1

3.a) Input: 2; 4; 6; 8; Output: 3; 7; 11; 15

b) When the Input increases by 2, the Output increases by 4.

c) Input: 10; 12; 14; Output: 19; 23; 27
Increase the Input by 2 and the Output by 4.

4.a) Money collected: \$15; \$30; \$45; \$60; \$75; \$90

c) i) For example: Find the number of pins in the left column, and find the money collected along the same row in the right column.

ii) For example: Find the number of pins along the horizontal axis. Move vertically until you reach a point on the graph. Then move left to read the money collected on the vertical axis.

5.a) i) Start at 6. Add 2 each time.

ii) Add 4 to the Input number.

iii) Input: 12; 14; 16; Output: 16; 18; 20

b) i) Start at 6. Add 6 each time.

ii) Multiply the Input number by 3.

iii) Input: 12; 14; 16; Output: 36; 42; 48

c) i) Start at 6. Add 4 each time.

ii) Multiply the Input number by 2, then add 2.

iii) Input: 12; 14; 16; Output: 26; 30; 34

6.a) Number of students: 5; 10; 15; 20; 25; 30
Number of sandwiches: 13; 23; 33; 43; 53; 63

b) Number of students: 5; 10; 15; 20; 25; 30
Number of drinks: 10; 15; 20; 25; 30; 35

c) For example: For the graph in part a: To get from one point to the next, move 5 squares right and 10 squares up. Moving 5 squares right is the same as adding 5 to the Input number to get the next Input number. Moving 10 squares up is the same as adding 10 to the Output number to get the next Output number, and so on.

7.b) Figure Number: 1; 2; 3; 4; 5
Blue Squares: 1; 4; 9; 16; 25

d) For example: The dots appear to lie along a curve. The dots for other graphs appear to lie along a line.

e) For example: If you use the table, the number of blue squares is the figure number squared.

10.3 Variables in Expressions, page 380

1.a) $n + 6$ **b)** $8n$ **c)** $n - 6$ **d)** $\frac{n}{4}$

2.a) \$20 **b)** \$32 **c)** \$$4t$

3.a) 48 cm^2 **b)** 50 cm^2 **c)** $l \times w$ cm^2

4.a) 10 km **b)** 25 km **c)** $5t$ km

5. For example:

a) Eight more than a number

b) A number multiplied by six
c) A number divided by five
d) A number decreased by eleven
e) Twenty-seven decreased by a number
f) A number squared

6.a) $2n + 3$ **b)** $(n - 5) \times 2$ **c)** $17 - \frac{n}{2}$
d) $\frac{n}{7} + 6$ **e)** $28 - n$ **f)** $n - 28$

7. For example:
a) **i)** Subtract three from forty, then multiply by a number.
ii) A number is multiplied by three and then subtracted from forty.
b) They have the same numbers and use the same variable, but the order of operations is different.

8.a) **i)** $n + 3$ **ii)** $3 + n$ **iii)** $n - 3$ **iv)** $3 - n$
b) For example: All expressions all involve a number and three, but the order and the operations are different.

9. For example:
a) Six times a number, then add five
b) One-quarter of three less than a number
c) Twelve added to one-quarter of a number
d) Three times the difference of a number and three
e) One-fifth of a number subtracted from thirty-two
f) Thirty-two subtracted from one-fifth of a number

10.a) **i)** $9n - 4$ **ii)** $4n + 9$ **iii)** $n + 9 - 4$ **iv)** $n \div 4 + 9$
b) For example: The sum of nine times a number and four: $9n + 4$; five less than a number: $n + 4 - 9$

11. The cost of a pizza with e extra toppings is \$8.00 + \$1e

Unit 10 Mid-Unit Review, page 382

1.a) **i)** Start at 5. Add 3 each time.
ii) 17, 20, 23 **iii)** 32
b) **i)** Start at 14. Add 11 each time.
ii) 58, 69, 80 **iii)** 113
c) **i)** The cubes of whole numbers.
ii) 125, 216, 343 **iii)** 1000
d) **i)** Start at 1. Multiply by 2, then add 1 each time.
ii) 63, 127, 255 **iii)** 1023

2.a) For example: Start with a rectangle with width 1 unit and length 2 units. The width and length increase by 1 unit each time.
b) 5×6; 6×7 **c)** 2, 6, 12, 20, 30
d) 19×20; area = 380
e) The 10th rectangle: 10×11

3.a) Output: 3; 7; 11; 15; 19; 23
b) For example: To get from one point to the next, move 1 square right and 4 squares up. Moving 1 square right is the same as adding 1 to the Input number to get the next Input number. Moving 4 squares up is the same as adding 4 to the Output number to get the next Output number.

4.a) Start at 8. Add 3 each time.
b) Multiply the Input number by 3, then add 5.
c) Input: 7; 8; 9; Output: 26; 29; 32
d) For example: To get from one point to the next, move 1 square right and 3 squares up. Moving 1 square right is the same as adding 1 to the Input number to get the next Input number. Moving 3 squares up is the same as adding 3 to the Output number to get the next Output number.

5.a) $n + 11$ **b)** $n - 4$ **c)** $\frac{n}{3}$
d) $9n$ **e)** $5n + 2$ **f)** $2n + 17$

6. For example:
a) The sum of a number and three
b) A number subtracted from twenty-one
c) Nine times a number
d) One-quarter of a number

10.4 Evaluating Algebraic Expressions, page 385

1.a) 9 **b)** 12 **c)** 7 **d)** 2 **e)** 13 **f)** 12
2.a) 19 **b)** 3 **c)** 6 **d)** 18 **e)** 21 **f)** 4

3. For example:
a) A number decreased by one; 2
b) The sum of five times a number and two; 17
c) The sum of one-third of a number and five; 6
d) One added to a number; 4
e) Two times the sum of a number and nine; 24
f) One-half of the sum of a number and seven; 5

4.a) Output = two times each Input number: 2; 4; 6; 8; 10
b) Output = ten minus the Input number: 9; 8; 7; 6; 5
c) Output = the sum of three times the Input number and four: 7; 10; 13; 16; 19

5.a) In dollars: $7 \times 9 + 9 \times 12$ **b)** In dollars: $7x + 9 \times 5$
c) 10 h

6.a) \$65; \$110 **b)** $9p + 20$
c) $18p + 20$ **d)** $9p + 40$
e) For example: The algebraic expressions for the different charges can be easily written, and p is the first letter in "people".

7.a) 6 **b)** 4 **c)** 2 **d)** 3 **e)** 6 **f)** 32

8.a) Output = $3x$ **b)** Output = $3x - 2$
c) Output = $x - 3$

9. For example: $p = 4$, $q = 1$
There are many different ways to do this. The value of p has to be one more than three times the value of q.

10.5 Reading and Writing Equations, page 389

1.a) $n + 8 = 12$ **b)** $3n = 12$ **c)** $n - 8 = 12$

2. For example:

a) The sum of twelve and a number is nineteen.

b) Three times a number is eighteen.

c) Twelve decreased by a number is five.

d) One-half of a number is six.

3.a) $2n + 5 = 35$ **b)** $8 + \frac{n}{2} = 24$ **c)** $3n - 6 = 11$

4. For example:

a) Seven subtracted from five times a number is thirty-seven.

b) Four added to one-third of a number is nine.

c) Seventeen decreased by two times a number is three.

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

6. $\frac{n}{4} + 10 = 14$

7.a) $b + 7 = 20$ **b)** $5n = 295$

c) $2w + 30 = 38$ **d)** $2x + 20 = 44$

10.6 Solving Equations, page 393

1.a) $x = 9$ **b)** $y = 0$ **c)** $z = 5$ **d)** $c = 3$

2.a) $x = 7$ **b)** $n = 0$ **c)** $z = 4$ **d)** $k = 2$

3.a) $n = 45 - 10$ **b)** $n = 35$

4.a) $x = 11$ **b)** $k = 8$ **c)** $y = 8$ **d)** $z = 18$

5.a) $n = 28$ **b)** $z = 11$ **c)** $y = 9$ **d)** $x = 28$

6.a) $4s = 156$ **b)** $s = 39$ cm

7.a) $p = 6 \times 9$ **b)** $p = 54$ cm

8. For example:

a) The length of a rectangle is 12 cm and the perimeter is 30 cm. What is the width of the rectangle?

b) $24 + 2w = 30$ **c)** $w = 3$ cm

9.a) For example: $10 + 24x = 130$ **b)** $x = 5$

10.a) $n = 9$ **b)** $n = 12$ **c)** $n = 15$

d) $n = 81$ **e)** $n = 48$ **f)** $n = 18$

11. For example:

a) Sheila bought two tickets, and got $1 off. She paid a total of $5. What is the regular price of a ticket? $x = 3$

b) The perimeter of a square is 24 cm. What is the side length? $y = 6$

c) When a group of people is divided into 38 equal groups, there are 57 groups. How many people are there in total? $z = 2166$

d) Eli has 5 groups of comic books. When he buys 5 more comics, he has 30 in all. How many comics are in each group? $x = 5$

e) When 25 bananas are divided equally amongst some friends, each friend gets 5 bananas. How many friends are there? $y = 5$

f) Four cards are removed from a deck of 52 cards. Each of the 4 players are dealt the rest of the cards. How many cards do they each get? $x = 12$

Reading and Writing in Math: Choosing a Strategy, page 396

1. 5040

2.a) 10, 9, 12

b) Start at 1. Add 3 for the next term, then take away 1 for the next.

c) 21; 52

For example: Each odd term is equal to the term number; each even term is equal to the term number plus 2.

3.a) Term 1: 4 Blue, 1 Red; Term 2: 8 Blue, 4 Red; Term 3: 12 Blue, 9 Red

b) 20th term: 400 red tiles **c)** 100th term: 400 blue tiles

d) 30th term: a total of 1020 red and blue tiles

e) 144 red tiles; the number of blue tiles is the term number times 4; the number of red tiles is the term number squared.

4. Can: 12 g; red ball: 5 g; green ball: 2 g

5. Irfan: $25; Marisha: $35

6. For example:

a) The mass of garbage generally increases with the number of people in a household.

b) A household produces a lot of garbage, and doesn't recycle; the household produces heavier garbage; this week, the household threw out a really heavy item.

c) The people may have been away on vacation for part of the week; they didn't throw out any heavy items; they recycle and use a composter.

7.a) Total cost of trip: $60; $70; $80; $90; $100; $110; $120; $130; $140; $150

b) **i)** $170 **ii)** $200 **iii)** $250

c) **i)** $20 **ii)** $15 **iii)** $13.33

8.a) $25 **b)** $29

c) For example: We're paying for the cost of the trip. Carrying 2 packages instead of 1 doesn't make much difference.

9.a) 111 or 482

b) For example: The digits are either all even or all odd.

Unit 10 Unit Review, page 398

1.a) **i)** Start at 5. Add 7 each time.

ii) 33, 40, 47 **iii)** 138; 20th term = $5 + 19 \times 7$

b) **i)** The pattern is consecutive powers of 3.

ii) 243, 729, 2187

iii) 3 486 784 401; 20th term = 3^{20}

c) **i)** Start at 96. Subtract 3 each time.
ii) 84, 81, 78 **iii)** 39; 20th term = 96 – 19 × 3
d) **i)** Start at 10. Add 11 each time.
ii) 54, 65, 76 **iii)** 219; 20th term: 10 + 19 × 11
e) **i)** Start at 9. Add 4 each time.
ii) 25, 29, 33 **iii)** 85; 20th term: 9 + 19 × 4

2.a) \$20.48 **b)** \$40.95

3.a) Start at 2. Double the number, then add 1 each time.
b) 95, 191, 383 **c)** For example: 5, 16, 49, 148

4.a) For example: Start with a purple square in the middle and a green square on all four sides. A purple square is added to the middle, and a green square is added to the top and bottom rows each time.
c) 12th figure: 12 purple squares in the middle, 1 green square on each end, 12 green squares on the top, 12 green squares on the bottom.
22nd figure: 22 purple squares in the middle, 1 green square on each end, 22 green squares on the top, 22 green squares on the bottom.

5.a) Output: 7; 9; 11; 13; 15 **b)** Output: 8; 12; 16; 20; 24
c) Output: 1; 3; 5; 7; 9 **d)** Output: 2; 3; 4; 5; 6
e) Output: 5; 6; 7; 8; 9 **f)** Output: 5; 9; 13; 17; 21

6.a) Input: 2; 4; 6; 8; 10; Output: 16; 14; 12; 10; 8
b) Input: Start at 2. Add 2 each time.
Output: Start at 16. Subtract 2 each time.
c) Input: 12; 14; 16; Output: 6; 4; 2
Add 2 to the Input each time; subtract 2 from the Output each time.
d) The Output will become negative.

7.a) Input: Start at 5. Increase by 10 each time.
Output: Start at 1. Increase by 2 each time.
b) Input: 65; 75; 85; Output: 13; 15; 17

8.a) $n + 20$ **b)** $n - 1$ **c)** $n + 10$ **d)** $13n$

9. For example:
a) Four more than a number
b) A number subtracted from 25
c) One-fifth of a number
d) Five decreased by two times a number

10.a) 11 **b)** 27 **c)** 5 **d)** 1.5 **e)** 34 **f)** 0

11.a) 8 **b)** 2 **c)** 4 **d)** 6

12.a) \$210; \$490 **b)** \$70r **c)** $\frac{d}{70}$

13. For example:
a) The sum of a number and three is seventeen.
b) Three times a number is 24.
c) A number divided by four is five.
d) Three times a number, decreased by four, is 20.
e) Seven plus four times a number is 35.

14. For example:
a) The sum of the pennies in my pocket and five is 21. How many pennies are in my pocket?
b) If you buy 5 tickets to a play, you get a \$2 discount. You then pay a total of \$28. How much are the tickets at regular price?

15.a) $6n = 258$ **b)** $6w = 36$ **c)** $\frac{n}{2} = 6$

16. For example:
a) A number plus 2 is 23.
b) Four decreased by a number is 12.
c) Five times a number is 35.
d) One-ninth of a number is 5.

17. $3l = 24$

18.a) $n = 4$ **b)** $n = 3$ **c)** $n = 3$
d) $n = 243$ **e)** $n = 51$ **f)** $n = 3$

19.a) $n = 5$ **b)** $n = 10$ **c)** $n = 7$ **d)** $n = 425$

20.a) $n = 250 - 98$ **b)** $n = 152$

21.a) $b = 2w$, $w = 74$ **b)** $b = 148$

Unit 10 Practice Test, page 401

1.a) Output: 2; 7; 12; 17; 22
c) Input: 6; 7; 8; Output: 27; 32; 37
d) Output = 47 × 5 – 3 **e)** Add 3, divide by 5
f) Yes, because the Input number goes up by 1 each time.
g) No, because the Output number ends in a 2 or a 7.

2.a) Choice 1
b) For example: The pattern is a power of 2.
c) After 19 days

3. For example: Yes; $n = 0$, $n = 1$

4.a) 19 **b)** 7 **c)** 2 **d)** 19

Unit 10 Unit Problem: Fund Raising, page 402

Part 1

Time (h): 1; 2; 3; 4; 5; Distance (km): 15; 30; 45; 60; 75
Distance = 15t. In 7 h, distance = 15 × 7 = 105 km
$15t = 135$, $t = 9$ h

Part 2

Time (h): 1; 2; 3; 4; 5; Distance (km): 20; 40; 60; 80; 100
Distance = 20t. In 7 h, distance = 20 × 7 = 140 km
$20t = 135$, $t = 6.75$ h

Part 3

For example: Both of the graphs increase over time; they are linear. Liam's is steeper and goes up by 20.

Part 4

Distance (km): 10; 20; 30; 40; 50
Money raised by Ingrid (\$): 250; 500; 750; 1000; 1250
Money raised by Liam (\$): 200; 400; 600; 800; 1000
Ingrid raises \$25d; Liam raises \$20d
To raise equal amounts of money, Ingrid cycles 40 km, and Liam cycles 50 km.

Unit 11 Probability, page 404

Skills You'll Need, page 406

1.a) 10% **b)** 1% **c)** 24% **d)** 5%
2.a) 0.7, 70% **b)** 0.6, 60% **c)** 0.36, 36% **d)** 0.75, 75%
3.a) 0.175, 17.5% **b)** 0.375, 37.5%
c) 0.8125, 81.25% **d)** 0.255, 25.5%

11.1 Listing Outcomes, page 409

1.a) Red, green, yellow **b)** 1, 2, 3, 4, 5, 6
2.a) Red, yellow, green **b)** Boy, girl
c) 0, 1, 2
d) Hearts, diamonds, clubs, spades
3. Saturday, all day, adult; Saturday, all day, child; Saturday, all day, senior; Saturday, half day, adult; Saturday, half day, child; Saturday, half day, senior; Sunday, all day, adult; Sunday, all day, child; Sunday, all day, senior; Sunday, half day, adult; Sunday, half day, child; Sunday, half day, senior
4. Eggs, toast, milk; eggs, toast, juice; eggs, pancakes, milk; eggs, pancakes, juice; eggs, cereal, milk; eggs, cereal, juice; fruit, toast, milk; fruit, toast, juice; fruit, pancakes, milk; fruit, pancakes, juice; fruit, cereal, milk; fruit, cereal, juice
5.a) Black, red; black, beige; black, white; black, yellow; grey, red; grey, beige; grey, white; grey, yellow; navy, red; navy, beige; navy, white; navy, yellow
b) 6 **c)** 6 **d)** 0
6.a) 12 **b)** 30 **c)** 24 **d)** 18
7.b) 11 **c)** 5 **d)** 4 **e)** 2
f) It occurs the most often.
g) For example: The table is easier to read. The tree diagram doesn't show the sums.
8.a) 24 **b)** 256

11.2 Experimental Probability, page 413

1. Yang Hsi: 0.448; Aki: 0.488; David: 0.426; Yuk Yee: 0.306; Eli: 0.367; Aponi: 0.357; Leah: 0.478; Devadas: 0.378
2.a) 0.175; 0.825 **b)** 0.029; 0.971
3.a) Top up, top down, on its side
b) For example: No, the shape of the cup makes it more likely to land on its side.
c) Top up: 0.27; top down: 0.32; side: 0.41
5. 6 ways; 1 red, 0 yellow; 2 red, 0 yellow; 3 red, 0 yellow; 2 red, 1 yellow; 3 red, 1 yellow; 3 red, 2 yellow
6.c) For example: The sum of the relative frequencies should be 1.
7.b) For example: The more times you do the experiment, the closer the experimental probability is to the calculated probability.

Unit 11 Mid-Unit Review, page 415

1. Easy, 1 player; easy, 2 players; intermediate, 1 player; intermediate, 2 players; challenging, 1 player; challenging, 2 players
2. Egg roll, chicken, milk; egg roll, chicken, juice; egg roll, chicken, pop; egg roll, chop suey, milk; egg roll, chop suey, juice; egg roll, chop suey, pop; egg roll, broccoli beef, milk; egg roll, broccoli beef, juice; egg roll, broccoli beef, pop; soup, chicken, milk; soup, chicken, juice; soup, chicken, pop; soup, chop suey, milk; soup, chop suey, juice; soup, chop suey, pop; soup, broccoli beef, milk; soup, broccoli beef, juice; soup, broccoli beef, pop; fried rice, chicken, milk; fried rice, chicken, juice; fried rice, chicken, pop; fried rice, chop suey, milk; fried rice, chop suey, juice; fried rice, chop suey, pop; fried rice, broccoli beef, milk; fried rice, broccoli beef, juice; fried rice, broccoli beef, pop
3.a) 0.033 **b)** 0.552 **c)** 0.663
4. 0.333
5.a) 1, 2, 3, 4, 5, 6 **b)** Yes, they each occur once.
d) For example: Yes.
e) For example: The more times the number cube is rolled, the closer the results are likely to be the calculated probability.
6. Part b; adding green counters increases the probability of picking green.

11.3 Theoretical Probability, page 418

1.a) About 0.26 **b)** About 0.22
2.a) 0.5 **b)** 0.5 **c)** 0.125 **d)** 0.875
3.a) False; it could happen, but it is unlikely.
b) False; you will not always get exactly this outcome.
c) True; the more you toss a coin, the more likely this outcome will occur.
4.a) True; *Win* covers $\frac{1}{3}$ of the spinner.
b) False; 100 is not divisible by 3, so an equal number of times is not possible.
c) False; this outcome will not always occur. The experimental results may be different from the theoretical results.
5.a) 0.004 **b)** 0.04 **c)** 0.9
6.a) For example: I divided 360 by each denominator to find the angle in degrees for each sector of the spinner.
b) Red: 50; yellow, 100; blue: 33; green; 17
c) For example: The probability of landing on each other colour would increase, because the sum of the fractions must equal 1 whole. If one decreases, one or more of the others increases.

11.4 Applications of Probability, page 422

1.a) 8 **b)** 0.125 **c)** 0.125

d) They are the same; if all the winners are female, none of the winners can be male, which is the answer to part c.

2.a) 25% **b)** 75%

3.a) **i)** 37.5% **ii)** 37.5% **iii)** 50% **iv)** 12.5%

b) For example: "At least" includes 2 tails and 3 tails. If these words were left out, 3 tails would not be included, and the probability of getting tails would be lower.

c) For example: "Exactly" means 3 heads are not included. If this word was left out, this could mean 2 heads or 3 heads, and the probability would change.

4. For example: People are not likely to win, so the carnival owners can afford to be generous with the prize.

5.a) 37.5% **b)** 93.75% **c)** 12.5%

6.a) $\frac{1}{6}$

b) For example: There would be 18 different combinations. Each combination would have a probability of $\frac{1}{18}$.

7. For example: Best combination is Spinner A for pink, then Spinner B for yellow, or Spinner B for yellow, then Spinner A for pink.

Reading and Writing in Math: Choosing a Strategy, page 424

1. $6.97

2. For example: It depends on the number of hours worked. If he works less than 22 h, $96 per week is a better deal. If he works 22 h or more, $4.50/h is better.

3.a) 81 cm^2 **b)** 216 cm^3

4. For example: $\frac{1}{32}$

6. a and b are the same; the final price is $73.59 in both cases.

7. $18

9. 136

10.a) 6 **b)** 0.25

11.a) 0.125 **b)** About 0.396

Unit 11 Unit Review, page 427

1.a) Banana, carrots, yogurt; banana, carrots, cheese; banana, celery, yogurt; banana, celery, cheese; banana, cucumber, yogurt; banana, cucumber, cheese; orange, carrots, yogurt; orange, carrots, cheese; orange, celery, yogurt; orange, celery, cheese; orange, cucumber, yogurt; orange, cucumber, cheese; apple, carrots, yogurt; apple, carrots, cheese; apple, celery, yogurt; apple, celery, cheese; apple, cucumber, yogurt; apple, cucumber, cheese

b) 3 **c)** 14 **d)** 12

2.a) HHHH, HHHT, HHTH, HTHH, THHH, HHTT, HTHT, HTTH, THHT, THTH, TTHH, HTTT, THTT, TTHT, TTTH, TTTT

b) 4 **c)** 6 **d)** 5

3.a) 0.9 **b)** 13 500

4.a) 0.487 **b)** 0.513 **c)** 0.715

d) 0.167 **e)** 0.395

5.a) False; it is very unlikely, but it could happen.

b) True; it is very unlikely.

c) False; this outcome will not always occur in practice.

d) True; with a greater number of trials, the experimental and theoretical probabilities are likely to be close.

6.a) Yes; the circle is divided into 10 equal parts.

b) 0.1 **c)** 0.4 **d)** 0.5

7.a) 0.5 **b)** 0.25 **c)** 0.8 **d)** 0.45

8.a) 7 times **b)** 33 times **c)** 59 times **d)** 46 times

9.a) **i)** 25% **ii)** 0%

b) **i)** 37.5% **ii)** 87.5%

10. About 33%

Unit 11 Practice Test, page 429

1. Saturday, matinee, adult; Saturday, matinee, child; Saturday, matinee, senior; Saturday, evening, adult; Saturday, evening, child; Saturday, evening, senior; Sunday, matinee, adult; Sunday, matinee, child; Sunday, matinee, senior; Sunday, evening, adult; Sunday, evening, child; Sunday, evening, senior

2.a) 10 times; it is likely to appear once every 6 rolls.

b) 30 times; one-half the numbers are even.

c) 30 times; one-half the numbers are greater than 3.

d) 0 times; 9 is not a number on the cube.

3.a) 0.3 **b)** 0.353

c) For example: 27, if her batting average stays at 0.3.

4. Equally likely; for example: The probabilities are the same.

5. About 8 times

Cumulative Review, Units 1–11, page 434

1.a) 6, 12, 18, 24, 30 **b)** 9, 18, 27, 36, 45

c) 12, 24, 36, 48, 60

2.a) 1, 2, 3, 4, 6, 9, 12, 18, 36

b) 1, 3, 19, 57 **c)** 1, 3, 5, 15, 25, 75

3. Quilt B

4.a) $SA = 6c^2$ **b)** $SA = 2lw + 2lh + 2wh$

c) For example: Substitute c for l, w, and h.

5.a) $1\frac{5}{12}$ **b)** $5\frac{14}{15}$ **c)** $1\frac{7}{10}$

d) $1\frac{4}{5}$ **e)** $\frac{45}{8}$ or $5\frac{5}{8}$ **f)** $\frac{26}{10}$ or $2\frac{3}{5}$

6. a) 3.8 **b)** 3.4 **c)** 3.9 **d)** 3.7

7. a) For example: The cafeteria staff may change the menu based on students' favourite foods.

b) For example: If many customers would like Sunday appointments, the salon might stay open on Sundays.

8. a) 122 s **b)** 119.5 s **c)** 118

d) For example: The median. **e)** 19s

f) 120 s, or any time above 120 s **g)** 113 s

9. a) For example: It shows the average attendance at the Blue Jays' games in Toronto from 1991 to 2003.

b) For example: The mean.

d) For example: The data show a downward trend as time goes on. Attendance was high around the years the Jays won the World Series.

f) For example: The graph in part i minimizes the downward trend. The graph in part ii makes the downward trend seem larger.

10. a) 30 cm^2 **b)** 10.125 cm^2

c) 36.01 m^2 **d)** 8.64 cm^2

11. a) 24 cm

b) Cannot find; missing side length

c) 30 m **d)** 14.4 cm

13. $50.00

14. a) 630 **b)** 600 **c)** 60

15. –8, –6, –5, –1, 0, +2, +5

16. a) –4 **b)** –6 **c)** +10 **d)** –6

17. a) 7 m **b)** 3 m

18. +7°C

19. For example:

a) Two decreased by three times a number

b) Three times a number minus two

c) Thirty-five decreased by a number

d) The sum of a number and 35

e) Two times the sum of a number and two

f) The sum of one-fifth of a number and ten

20. a) $\frac{n}{12}$ **b)** $\frac{n}{12}$ **c)** $5n + 11$

21. a) Money collected ($): 30; 60; 90; 120; 150; 180

c) For example: When the number of cars increases by 5, the cost increases by $30.

d) **i)** Find the row with that value in it.

ii) Find the number of cars along the horizontal axis, and read the cost along the vertical axis.

e) $162; 3 ways. The table, the graph, or by multiplying.

22. a) $x = 6$ **b)** $x = 45$ **c)** $x = 5$ **d)** $x = 9$

23. a) $3p = 852.00$ **b)** $p = \$284.00$

24. a) HHH, HHT, HTH, HTT, THH, THT, TTH, TTT

b) 3 heads: $\frac{1}{8}$; 2 heads, 1 tail: $\frac{3}{8}$; 1 head, 2 tails: $\frac{3}{8}$; 3 tails: $\frac{1}{8}$

e) For example: The more times I conduct the experiment, the closer the relative frequency is likely to be to the calculated probability.

25. a) 5 **b)** 10

c) 20 (or 25, if you include Y as a vowel)

d) 0

26. 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16

Extra Practice

Unit 1, page 438

1. $146

2. 732 799 km^2

3. 52

4. $9801

5. a) For example: Assuming the average Canadian lives 80 years, about 2400 km/year, and about 46 km/week.

6. a) 1, 2, 3, 6, 12, 18, 36 **b)** 1, 2, 4, 7, 8, 14, 28, 56

c) 1, 2, 4, 6, 8, 12, 16, 24, 48, 96

7. a) 12, 24, 36, 48, 60, 72, 84, 96, 108, 120

b) 15, 30, 45, 60, 75, 90, 105, 120, 135, 150

c) 20, 40, 60, 80, 100, 120, 140, 160, 180, 200

8. a) 6 **b)** 3 **c)** 25 **d)** 12

9. a) 49 **b)** 289 **c)** 729 **d)** 1369

10. a) 72 **b)** 120 **c)** 180 **d)** 168

11. a) 9 **b)** 12 **c)** 15 **d)** 20

12. a) 196 cm^2 **b)** 56 cm

13. a) 30 m **b)** 120 m

14. 52 cm

15. 1350 cm^3

16. a) 4^5 **b)** 12^4

17. a) **i)** 50 **ii)** 510 **iii)** 5110

b) 51 110

Unit 2, page 439

1. a) For example: 6 red squares, 7 blue squares

b) For example: 2 triangles, 7 circles

2. a) 2:1 **b)** 7:4 **c)** 5:3 **d)** 1:4

3. For example:

a) 10:14, 15:21, 20:28 **b)** 18:5, 72:20, 108:30

c) 18:8, 27:12, 36:16 **d)** 8:11, 16:22, 64:88

4. a) Figure B **b)** Figure C **c)** Figure A

5. a) 3:1 **b)** 13:5

c) Arlene will be 16 years old. Her brother will be 8 years old.

6. a) Bucket B contains more triangles. Bucket A contains more squares.

b) 7:16

7. a) 20 sticks **b)** 7:4

8. a) 63:10 **b)** 70 girls

9. 48 and 40; 42 and 35

10. a) Coriander, 1:2; cumin, 3:10; peppercorns, 1:5

b) 500 g of coriander, 300 g of cumin, and 200 g of peppercorns

Unit 3, page 440

1.b) For example: Two different objects.

6.a) $A = 45$ cm^2; $P = 32.2$ cm **b)** $A = 31.36$ m^2; $P = 22.4$ m

7.a) $SA = 188$ cm^2 **b)** $V = 168$ cm^3

c) $SA = 19.44$ cm^2 **d)** $V = 5.832$ cm^3

8.a) 2000 cm^2

b) For example: 2488 cm^2, if there is 1 cm extra on each side.

9. 88 m^2

Unit 4, page 441

1.a) $\frac{3}{2}$ **b)** $\frac{4}{9}$ **c)** $\frac{2}{3}$ **d)** 2

2.a) 1 whole circle, and $\frac{2}{3}$ of another circle.

b) 1 whole circle, and $\frac{2}{5}$ of another circle.

c) 3 whole circles, and $\frac{1}{2}$ of another circle.

d) 3 whole circles, and $\frac{2}{3}$ of another circle.

3.a) $0.9\overline{4}$ **b)** 3.25 **c)** 0.6 **d)** $2.\overline{3}$

4.a) $\frac{13}{6}$ or $2\frac{1}{6}$ **b)** $\frac{9}{8}$ or $1\frac{1}{8}$ **c)** $\frac{8}{10}$ or $\frac{4}{5}$ **d)** $\frac{21}{12}$ or $1\frac{3}{4}$

5.a) $2\frac{13}{15}$ **b)** $3\frac{13}{15}$ **c)** $\frac{13}{15}$ **d)** $1\frac{13}{15}$

6.a) $\frac{3}{8}$ **b)** $\frac{8}{12}$ or $\frac{2}{3}$ **c)** $\frac{3}{8}$ **d)** $\frac{7}{6}$ or $1\frac{1}{6}$

7.a) $\frac{23}{40}$ **b)** $\frac{17}{12}$ or $1\frac{5}{12}$ **c)** $\frac{23}{15}$ or $1\frac{8}{15}$ **d)** $\frac{31}{24}$ or $1\frac{7}{24}$

8.a) $\frac{5}{12}$ **b)** $\frac{11}{30}$ **c)** $\frac{1}{10}$ **d)** $\frac{3}{40}$

9.a) $\frac{23}{12}$ or $1\frac{11}{12}$ **b)** $\frac{32}{10}$ or $3\frac{1}{5}$ **c)** $\frac{29}{18}$ or $1\frac{11}{18}$ **d)** $\frac{74}{30}$ or $2\frac{14}{30}$

10.a) $\frac{3}{5} \times 5$ **b)** $\frac{7}{4} \times 3$

11.a) 3 **b)** $\frac{21}{4}$

12.a) $\frac{5}{4}$ **b)** $\frac{11}{2}$ **c)** 14 **d)** $\frac{3}{4}$

13.a) 7.82 **b)** 3.96 **c)** 15.17 **d)** 4.93

14.a) 2.5 **b)** 3.5 **c)** 2.8 **d)** 1.5

15. 56.16 m^2

16. 1.5 m

17.a) \$14.14 **b)** \$5.86

18.a) 3.78 **b)** 11.1

Unit 5, page 442

1.a) 26°C; 24°C **b)** About 11°C

c) From January to May; from February to June

d) i) For example: What is the greatest average high temperature shown on the graph?

ii) For example: What is the lowest temperature between June and September?

2.a) The data are not measured over time.

b) About 170 000 km^2 **c)** About 169 000 km^2

e) About 320 000 km^2, round each area to the nearest ten thousand: 80 000 + 40 000 + 200 000 = 320 000 km^2.

3.a) 140 cm **c)** There is no mode.

d) 143.2 cm

4. For example: 5, 6, 6, 6, 7, 7, 7, 8; many shoe sizes are possible, as long as the mean of the 4th and 5th terms equals the median, $6\frac{1}{2}$.

5.b) 1 min 30 s

c) The stem for 2 minutes. For example: Most swimmers took between 2 and 3 minutes to complete the race.

d) 2:48 **e)** 2:25, 2:43, 2:54, 3:09, 3:10

Unit 6, page 443

1.b) 46.75 cm^2

2. For example: $b = 6$ cm, $h = 4$ cm; $b = 8$ cm, $h = 3$ cm; $b = 5$ cm, $h = 4.8$ cm

3. 64.41 cm^2

4. 3.84 m^2

5.a) 0.96 m^2

b) 13.44 m^2; add the areas of the two triangles and the areas of the three parallelograms.

6.b) 16.875 cm^2

7.a) For example: $b = 6$ cm, $h = 4$ cm; $b = 8$ cm, $h = 3$ cm; $b = 5$ cm, $h = 4.8$ cm

b) For example: They have the same base and height; each triangle is one-half the area of each parallelogram.

8. 5.59 cm^2

9.a) 14.4 cm^2

b) For example: Find the area of the trapezoid; find the area of the square and subtract the area of the two triangles.

c) About 16 cm

d) No; the lengths of all the sides of the trapezoid are not known.

10. $P = 16$ m; $A = 9.72$ m^2

Unit 7, page 444

1. For example: A and D: Hexagonal concave polygons, 4 right angles, one angle greater than 180°.
B and C: Pentagonal concave irregular polygons, 2 right angles, 2 angles less than 90°, 1 angle greater than 180°.
E and F: Quadrilateral convex irregular polygons, no parallel sides.

2. Figures A and D, E and F, B and C; the figures have the same size and shape.

3. Figure D is the image of Figure A, after a reflection in a diagonal between the 2 figures.
Figure C is the image of Figure B after a rotation of a $\frac{1}{4}$-turn clockwise about a point that is 2 points below the vertex where the 2 figures meet. Figure F is the image of Figure E after a translation of 3 units right and 2 units down.

4.a) Figures B, C, E, F tile the plane.

7. The equilateral triangle, the rhombus, and the acute isosceles triangle.

Unit 8, page 445

1.a) About 15% **b)** About 75%
b) About 80% **d)** About 25%
2.a) 75%, 0.75 **b)** 150%, 1.50
c) 60%, 0.60 **d)** 15%, 0.15
3.a) \$20 **b)** \$0.85 **c)** \$6.00 **d)** \$1.87
e) \$5.50 **f)** \$14.00 **g)** \$0.05 **h)** \$1.50
4.a) \$2.00 **b)** \$12.00 **c)** \$14.00 **d)** \$24.00
e) \$150.00 **f)** \$45.00 **g)** \$4.00 **h)** \$50.00
5. About 80%
6.a) Sales tax: \$52.50; total cost: \$402.49
b) Sales tax: \$2.70; total cost: \$20.68
7. 180 students
8. 8530 m
9.a) The News **b)** Movies and Cartoons
c) About $\frac{1}{4}$ **d)** About 250 days

Unit 9, page 446

1.a) +5 cm **b)** –89°C **c)** –400 m **d)** +8156 m
2.a) –9 s **b)** +\$25 **c)** –50°C
3. –1
4.a) $-3 < +5$ **b)** $-2 > -4$ **c)** $+1 > 0$ **d)** $+8 > -10$
5. –15, –2, –1, 0, +1, +4, +5
6.a) +17 **b)** –12 **c)** –13 **d)** +2
7.a) +15 **b)** –11 **c)** –14 **d)** –6
e) –1 **f)** –21 **g)** +10 **h)** –13
8.a) –21 **b)** +3 **c)** +20 **d)** –3
e) +19 **f)** +21 **g)** –8 **h)** +21
9.a) +6; (+4) + (+2) = +6 **b)** +1; (–2) + (+3) = +1
c) –5; (–3) + (–2) = –5 **d)** –1; (+5) + (–6) = –1
e) –19; (–23) + (+4) = –19 **f)** –22; (–19) + (–3) = –22
g) +11; (+13) + (–2) = +11 **h)** +22; (+9) + (+13) = +22
10.a) +2; (+5) – (+3) = +2 **b)** +7; (+3) – (–4) = +7
c) –8; (–5) – (+3) = –8 **d)** –3; (–7) – (–4) = –3
e) +25; (+13) – (–12) = +25 **f)** –54; (–22) – (+32) = –54
g) 0; (–23) – (–23) = 0 **h)** –17; (–7) – (+10) = –17
11.a) High temperature: –1°C, low temperature: –9°C
b) 8°C
12.a) +12 **b)** 0 **c)** 0 **d)** –12
e) 0 **f)** +12 **g)** –12 **h)** 0

Unit 10, page 447

1.a) i) Start at 2. Add 3 each time.
ii) 17, 20, 23 **iii)** 44
b) i) Start at 1. Alternate between adding 2 and adding 3 each time.
ii) 13, 16, 18 **iii)** 36
c) i) Start at 1. Add 2. Increase the number you add by 1 each time.
ii) 21, 28, 36 **iii)** 120
d) i) Start at 3. Add 3. Increase the number you add by 2 each time.
ii) 38, 51, 66 **iii)** 227
2.a) Output: 3; 7; 11; 15; 19 **b)** Output: 23; 27; 31
c) The Input number starts at 1 and increases by 1 each time. The Output number starts at 3, and increases by 4 each time.
e) For example: To get from one point to the next, move 1 square right and 4 squares up. Moving 1 square right is the same as adding 1 to the Input number to get the next Input number. Moving 4 squares up is the same as adding 4 to the Output number to get the next Output number.
3. For example:
a) A number plus two
b) Five decreased by a number
c) Three times a number **d)** A number divided by two
4.a) $2n + 4$ **b)** $2n - 4$ **c)** $\frac{n}{4}$ **d)** $4n - 2$
5.a) 7 **b)** 1 **c)** 5 **d)** 2 **e)** 2 **f)** 1
6.a) $n + 3 = 18$ **b)** $6 + n = 71$ **c)** $\frac{n}{5} = 14$ **d)** $4n = 64$
7. For example:
a) The product of 3 and a number is 9.
b) Fifteen divided by a number is 3.
c) A number decreased by 6 is 13.
d) The product of 24 and a number is 552.
8.a) For example: Let t represent the number of points Tung scored. $t = 14 + 8$; $t = 22$
b) For example: Let n represent the number of cards Nema has. $n = 4 \times 156$; $n = 624$
c) For example: Let a represent how far Adriel cycled, in kilometres. $a = 218 - 80$; $a = 138$
9.a) $n = 25$ **b)** $n = 35$ **c)** $n = 6$
d) $n = 150$ **e)** $n = 6$ **f)** $n = 4$
10.a) $x = 7$ **b)** $x = 10$ **c)** $x = 6$
d) $x = 14$ **e)** $x = 247$ **f)** $x = 23$

Unit 11, page 448

1.a) J□G, J□B, J□R, J□Y, J□G, J□B, J□R, J□Y, J□G, J□B, J□R, J□Y, J□G, J□B, J□R, J□Y, Q□G, Q□B, Q□R, Q□Y, Q□G, Q□B, Q□R, Q□Y, Q□G, Q□B, Q□R, Q□Y, Q□G, Q□B, Q□R, Q□Y, K□G, K□B, K□R, K□Y, K□G, K□B, K□R, K□Y, K□G, K□B, K□R, K□Y, K□G, K□B, K□R, K□Y
b) 4 **c)** 12
2.b) Outcome: Ace, 2, 3, 4, 5, 6, 7, 8, 9, 10, J, Q, K
c) Yes

3. a) 25 times **b)** 50 times **c)** 75 times

4. White; there are 7 candies left: 2R, 2G, 3W. The probability of it being white is $\frac{3}{7}$, and the probability of it being red or green is only $\frac{2}{7}$.

5. a) E **b)** $\frac{1}{50}$ **c)** J, K, Q, X, Z

d) J, K, Q, X, Z: $\frac{1}{100}$; B, C, F, H, M, P, V, W, Y: $\frac{1}{50}$; D, L, S, U: $\frac{1}{25}$; N, R, T: $\frac{3}{50}$; A, I: $\frac{9}{100}$

e) No; each letter is in the bag, so each letter has a probability of being picked.

Take It Further, page 449

1. 29, 31

2. $6 \times \left(\frac{6}{6} + 6\right)$

3. For example: 2 quarters, 3 dimes, 20 pennies

4. Move 9 from box 3 to box 1.

5. For example: $(7 + 0 - 3 + 6 - 5 + 4) \times (9 - 2 + 1 - 8) = 0$

6. 60 cards

7. 27, 29, 31, 33

8. For example: $1 - 2 + 3 - 4 + 5 + 6 - 7 + 8 + 90 = 100$

9. $\left(\frac{5}{5} \times 5\right) \times 5 + 5$

10. $33 - 3 + \frac{3}{3}$

11. 51

12. For example: $10 + 24 + 6 + 35 + 7 + 8 + 9 = 99$

13. 50

14. $\left(\frac{4}{4} + 4\right) \times \left(\frac{4}{4} + 4\right) \times 4$

15. 5050

16. 23 matches

17. Remove the 6 segments that make up the 2 inner triangles.

18. At the end of 13 days.

19. For example: 11 and 1.1, 3 and $\frac{3}{2}$, 4 and $\frac{4}{3}$

20. 32

21. $41 943.04

22. Fill the 5-L container, pour it into the 8-L container. Fill the 5-L container again, and pour it into the 8-L container until it’s full. There will be 2 L of water left in the 5-L container.

23. 35 potatoes

24. 36 posts

25. For example: $5 + (5 \times 5)$ or $(6 \times 6) - 6$

26. Move the top counter down. Move the 2 counters at each end of the bottom row to each end of the second row from the top.

27. On day 8

28. 60 kg