Answers

Unit 1 Patterns and Relations, page 4

1.1 Patterns in Division, page 8

1. Divisible by 2: parts a, c, and f
Divisible by 5: parts b, d, and f

2. Answers may vary. For example: a number with 0 in ones place is divisible by 2 and by 5. So, it is divisible by 10.

3. Divisible by 4: parts a, b, d, e, and f
Divisible by 8: parts b and f
Divisible by 10: parts c and d

4. Maxine is right. Tony is wrong. A number is divisible by 8 if, when divided by 4, the quotient is even (divisible by 2).

5. Answers may vary. For example: Multiples of 1000 are divisible by 8: 3000, 5000, 8000

6.a) Divisible by 2: 28, 54, 224, 322, 382, 460, 1046, 1088, 1784, 3662
Divisible by 4: 28, 224, 460, 1088, 1784
Divisible by 8: 224, 1088, 1784

c) Answers may vary. For example: 3472, 7000, 9632, all divisible by 8

7. Answers may vary. For example:

a) 0, 4, 8

b) 0, 2, 4, 6, 8

c) 0, 1, 2, 3, 4, 5, 6, 7, 8, 9

8. 1852, 1788, 1992, and 2004 are divisible by 4. Yes, 1964 is divisible by 4, so it is a leap year.

1.2 More Patterns in Division, page 11

1. Divisible by 3: parts a, b, c, d, e, and f
Divisible by 9: parts a, b, e, and f

2. Answers may vary. For example: 3102, 5100, 2010

3. a, b, c, e, f

4.a) 1, 2, 3, 5, 6, 10, 15, 25, 30, 50, 75, 150

b) 1, 5, 19, 95

c) 1, 3, 9, 13, 39, 117

d) 1, 2, 4, 5, 8, 10, 16, 20, 40, 80

5.

	Divisible by 9	**Not divisible by 9**
Divisible by 4	144, 252, 468	68, 120, 128, 424
Not divisible by 4	153	235, 361

6. 240

7.a) Answers may vary. For example: 135

b) 1, 3, 5, 9, 15, 27, 45, 135

c) 990; 135

8.a) 2, 5, 8

b) 0, 3, 6, 9

c) 1, 4, 7

9.a) 2 cereal bars

b) 4 cereal bars

c) 24 cereal bars cannot be divided among 0 groups.

d) A whole number cannot be divided among 0 groups.

Unit 1 Reading and Writing in Math: Writing to Explain Your Thinking, page 15

1. 25

2. 22 times

3.a) 41 tiles

b) The 9th term has 37 tiles.

1.3 Algebraic Expressions, page 18

1.a) 3, x, 2 **b)** 5, n, 0

c) 1, w, 3 **d)** 2, p, 4

2. $7p + 9$

3.a) $n + 6$ **b)** $8n$

c) $n - 6$ **d)** $\frac{n}{4}$

4.a) **i)** \$20.00 **ii)** \$32.00

b) 4t

5.a) $2n + 3$ **b)** $2(n - 5)$ **c)** $\frac{n}{7} + 6$

d) $28 - n$ **e)** $n - 28$

6.a) **i)** $n + 4$

ii) $4 + n$

iii) $n - 4$

iv) $4 - n$

b) In parts i) and ii), the numerical coefficient, the variable, and the constant term are the same. So, the algebraic expressions are the same.
In parts iii) and iv), the numerical coefficients and the constant terms are different. So, the algebraic expressions are different.

7.a) 9 **b)** 12 **c)** 7 **d)** 2 **e)** 13 **f)** 12

8.a) 19 **b)** 3 **c)** 35 **d)** 18 **e)** 21 **f)** 4

9.a) $7 \times 8 + 9 \times 12$

b) $7x + 45$

c) 10 h

10.a) $n = 6$ **b)** $n = 4$ **c)** $n = 2$

d) $n = 3$ **e)** $n = 6$ **f)** $n = 40$

1.4 Relationships in Patterns, page 23

1.a) **i)** The term is twice the term number.
ii) $2n$
b) **i)** The term is 2 more than the term number.
ii) $n + 2$
c) **i)** The term is the term number multiplied by 8.
ii) $8n$
d) **i)** The term is 5 more than the term number.
ii) $n + 5$

2.a) $3n$ **b)** $n + 2$
c) $\frac{n}{2}$ **d)** $4n + 10$

3.a) $10n$
b) \$300.00

4.a) $4n$
b) 48 cm
c) Answers may vary. For example:
i) perimeter of an equilateral triangle with side length s
ii) perimeter of a regular octagon with side length t

5. Answers may vary. For example:
a) Karin's brother is 5 years older than she is.
b) Canoe rental is \$15 for the first hour plus \$2 per each additional hour.
c) There are 3 candies per person and one left over.

6.a) \$65.00; \$110.00
b) $9p + 20$
c) $18p + 20$
d) $9p + 40$
e) Answers may vary. For example:
The variable p represents any number.
So, I can replace p to find the value of the algebraic expression for any particular value of the variable.

7.a) $e + 8$
b) \$13.00
c) $e + 5$
d) \$10.00
e) \$3.00

8.a) $4n$
b) $n + 6$
c) $n - 1$

9.a) **i)** The term is double the term number plus one.
ii) $2n + 1$
b) **i)** The term is two less than three times the term number.
ii) $3n - 2$
c) **i)** The term is three less than four times the term number.
ii) $4n - 3$

1.5 Patterns and Relationships in Tables, page 27

1.a)

Input x	Output $2x$
1	2
2	4
3	6
4	8
5	10

The output is double the input.

b)

Input m	Output $10 - m$
1	9
2	8
3	7
4	6
5	5

The output is ten minus the input.

c)

Input p	Output $3x + 5$
1	8
2	11
3	14
4	17
5	20

The output is 5 more than 3 times the input.

2.a) $7n$
b) $3n + 1$
c) $2n - 1$

3. a)

Input n	Output $3n + 4$
1	7
2	10
3	13
4	16

b)

Input n	Output $4n + 3$
1	7
2	11
3	15
4	19

4.a) $3x + 2$
b) $6x - 5$
c) $5x + 3$

5.a) The pattern rule for the input is: Start at 5. Add 10 each time. The pattern rule for the output is: Start at 1. Add 2 each time. When the Input number increases by 10, the Output number increases by 2.

b)

Input x	Output
65	13
75	15
85	17

c) $\frac{x}{5}$ is related to x

Unit 1 Mid-Unit Review, page 29

1. Divisible by 4: parts a, c, d, and e
Divisible by 8: parts c and d

2. Divisible by 3: 54, 123, 3756
Divisible by 5: 85
Divisible by 3 and 5: 735, 1740, 6195

3.a) 1, 5, 17, 85
b) 1, 2, 4, 8, 17, 34, 68, 136
c) 1, 2, 3, 5, 6, 9, 10, 15, 18, 27, 30, 45, 54, 90, 135, 270

4.a) $n + 7$
b) $11n$
c) $\frac{n}{6}$
d) $4n - 3$
e) $2 + 5n$

5.a) **i)** 15
ii) 16
b) **i)** 48
ii) 1
c) **i)** 6
ii) 8
d) **i)** 22
ii) 18

6.a) **i)** The term is the term number multiplied by 6.
ii) $6n$
b) **i)** The term is 4 more than the term number.
ii) $n + 4$

7.a) $12 + 2t$
b) \$32.00; \$52.00
c) $12 + 4t$

8.a) $4x + 3$
b) $8x - 3$

1.6 Graphing Relations, page 33

1.a) Output: 4, 8, 12, 16, 20
b) Output: 4, 5, 6, 7, 8
c) Output: 10, 14, 18, 22, 26

3.a) Output: 8, 20, 32, 44, 56
b) One square represents 4 units.
c) The graph shows a linear relation: When the Input number increases by 2, the Output number increases by 12.

4.a) 10
b) 5
c) 24
d) Answers may vary. For example: At a bowling alley, shoe rental is \$8 and lane rental is \$2/h.

5.a) $3n + 5$

c)

Number of Go-Cart Rides	Total Cost (\$)
0	5
1	8
2	11
3	14
4	17
5	20

d) **i)** \$23.00 **ii)** 8 rides

6.a) ii **b)** iii **c)** i

7.a) $75 - 5s$

b)

Week	Amount Owing
2	65
4	55
6	45
8	35
10	25

c) The graph goes down to the right. When the number of weeks increases by 2, the amount owing decreases by \$10.00.

d) **i)** \$10.00
ii) After 15 weeks

8.a) Answers will vary. For example: Maya is paid a flat rate of \$6 plus \$5 for each item she sells.

b)

Input n	Output $5n + 6$
0	6
1	11
2	16
3	21
4	26
5	31
6	36

c) The graph goes up to the right. When the Input number increases by 1, the Output number increases by 5.

d) Questions may vary. For example: What is the output when the input is 8? (*46*) What is the input when the output is 41? (*7*)

1.7 Reading and Writing Equations, page 36

1.a) $n + 8 = 12$
b) $n - 8 = 12$

2.a) Twelve more than a number is 19.
b) Three times a number is 18.
c) Twelve minus a number is 5.
d) A number divided by 2 is 6.

3.a) $6p = 258$

b) $\frac{s}{2} = 21$

c) $6h = 36$

4. $4s = 156$

5. $p = 6 \times 9$

6.a) C

b) D

c) A

d) B

7. $\frac{n}{4} + 10 = 14$

8.a) **i)** $5s = 295$

ii) $7h = 28$

iii) $2x + 20 = 44$

iv) $n + 7 = 20$

b) Answers may vary. For example:
The equation in part iii is the most difficult because it involves more operations.

c) Answers may vary. For example: One-third the number of books on my shelf is 6.

1.8 Solving Equations Using Algebra Tiles, page 41

1.a) $x = 7$

b) $x = 8$

c) $x = 4$

d) $x = 8$

e) $x = 6$

f) $x = 3$

2.a) $x + 7 = 12$

b) $x = 5$

3. Answers may vary. For example:

a) 6 and 13, 1, x

b) 4 and 12, 1, x

c) 11 and 7, 1, x

d) 16, 2, x

e) 18, 3, x

f) 12, 4, x

4.a) $3x = 12$

b) $x = 4$

5.a) $4x = 20$

b) $x = 5$

6.a) $13 + x = 20$

b) $x = 7$

7.a) $3x + 4 = 16$

b) $x = 4$

8.a) $4x + 2 = 18$

b) $x = 4$

9.a) $3x + 5 = 20$

b) $x = 5$

10. Answers may vary. For example:

a) $3x + 2 = 14$

b) Two more than three times a number is 14.

c) $x = 4$

d) Tina had \$14. She bought boxes of cookies at \$3 per box. How many boxes did she buy if she was left with \$2?

Unit 1 Unit Review, page 44

1. 1, 2, 3, 5, 6, 9, 10, 15, 18, 30, 45, 90

2. Parts a, b, c, d, e, f, h

3. 252 and 432

4.a) Yes. There are numbers divisible by 6 and by 9.

b) Divisible by 6: 330, 858
Divisible by 9: 639, 2295
Divisible by 6 and 9: 5598, 12 006
Divisible by neither 6 nor 9: 10 217, 187

5.a) **i)** $n - 5$

ii) 3

b) **i)** $n + 10$

ii) 18

c) **i)** $3n$

ii) 24

d) **i)** $3n + 6$

ii) 30

6.a) $4n$

b) $n + 3$

c) $\frac{n}{4}$

7.a)

Input n	Output $n + 13$
1	14
2	15
3	16
4	17
5	18

b)

Input n	Output $5n + 1$
1	6
2	11
3	16
4	21
5	26

c)

Input n	Output $6n - 3$
1	3
2	9
3	15
4	21
5	27

8.a) $n + 11$

b) $5n - 3$

9.a) iv

b) i

c) v

10. Answers may vary. For example:

a) i) The cost is \$4 plus \$2/h.

ii)

Input m	Output $4 + 2m$
1	6
2	8
3	10
4	12
5	14

iv) The graph goes up to the right.
When the Input number increases by 1, the Output number increases by 2.

v) Questions may vary. For example:
What is the input when the output is 18? (*7*)
What is the output when the input is 6? (*16*)

b) i) Anna owes her mother \$15. She pays her \$2/week.

ii)

Input d	Output $15 - 2d$
0	15
1	13
2	11
3	9
4	7

iv) The graph goes down to the right.
When the Input number increases by 1, the Output number decreases by 2.

v) What is the input when the output is 3? (*6*)
What is the output when the input is 7? (*1*)

11.a) $2c + 6$

b)

c	Amount Paid (\$)
0	6
5	16
10	26
15	36

c) The graph goes up to the right.
When the number of children supervised increases by 5, the amount paid increases by \$10.00.

d) i) \$56.00

ii) 20 children

12. Answers will vary. For example:
May is payed \$24 per day, plus \$2 for each dress she sells.

13.a) $3n = 15$

b) $3n - 4 = 20$

14. $8n = 48$

15.a) i) $3x = 36$

ii) $x = 12$

b) i) $x + 7 = 18$

ii) $x = 11$

c) i) $3x = 24$

ii) $x = 8$

d) i) $x + 8 = 21$

ii) $x = 13$

16.a) $4x + 5 = 21$

b) $x = 4$

Unit 1 Practice Test, page 47

1.a) 0, 2, 4, 6, 8

b) 2, 5, 8

c) 2, 6

d) 0, 5

e) 2, 8

f) 6

g) 8

h) 0

2. For $n = 1$, $2 + 3n$ equals $2n + 3$.
For $n = 5$, $2n + 3$ equals $3n - 2$.

3.a) $25 + 2v$

b) \$45.00; \$75.00

c) $25 + 3v$; Jamal would pay \$55.00; that is, \$10.00 more.

4.a) i) $x + 5 = 22$

ii) $2x = 14$

iii) $3x + 4 = 19$

b) i) $x = 17$

ii) $x = 7$

iii) $x = 5$

Unit 2 Integers, page 50

2.1 Representing Integers, page 54

1.a) +1 **b)** +3 **c)** 0 **d)** –1 **e)** –3 **f)** –2

2. Answers may vary. For example:

a) 6 red tiles, or 7 red tiles and 1 yellow tile

b) 7 yellow tiles, or 8 yellow tiles and 1 red tile

c) 6 yellow tiles, or 8 yellow tiles and 2 red tiles

d) 2 red tiles, or 6 red tiles and 4 yellow tiles

e) 9 yellow tiles, or 10 yellow tiles and 1 red tile

f) 4 red tiles, or 5 red tiles and 1 yellow tile

g) 1 yellow tile and 1 red tile, or 3 yellow tiles and 3 red tiles

h) 10 yellow tiles, or 13 yellow tiles and 3 red tiles

3.a)

Number of Yellow Tiles	Number of Red Tiles	Integer Modelled
0	6	–6
1	5	–4
2	4	–2
3	3	0
4	2	+2
5	1	+4
6	0	+6

4.a) I chose +3. I need 3 yellow tiles to model it.

b) I add a zero pair each time. I can model +3 in many ways.

c)

Number of Yellow Tiles	Number of Red Tiles	Integer Modelled
3	0	+3
4	1	+3
5	2	+3
6	3	+3

There are always 3 more yellow tiles than red tiles. As the number of yellow tiles increases, the number of red tiles increases by the same amount.

d) For a negative integer, such as –23, there will always be 23 more red tiles than yellow tiles. For a positive integer, such as +41, there will be 41 more yellow tiles than red tiles.

5.a) 8 **b)** 98

6.a) +9 **b)** –5 **c)** +11 **d)** –9 **e)** –7

7.a) +100; –20

b) +6; –4

c) +12; –8

2.2 Adding Integers with Tiles, page 58

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) +1 **b)** –1 **c)** 0

3.a) 0 **b)** 0 **c)** 0

The number of red tiles equals the number of yellow tiles each time.

4.a) +5 **b)** +1 **c)** –5

5.a) (+4) + (+3) = +7

b) (–7) + (+5) = –2

c) (–4) + (–5) = –9

d) (+8) + (–1) = +7

e) (–10) + (–6) = –16

f) (+4) + (–13) = –9

6.a) (–3) + (+4) = +1

b) (+5) + (–3) = +2

c) (+15) + (–7) = +8

d) (–3) + (+8) = +5

e) (+12) + (–5) = +7

8.a) (+3) **b)** (–1) **c)** (–2)

d) (+2) **e)** (–1) **f)** (+6)

9.a) –4

b) No, the sum remains the same.

c) Each integer has been replaced by its opposite. The sum is also replaced by its opposite.

10.a) +6 **b)** +4 **c)** –5 **d)** +2

11. a)

+3	–4	+1
–2	0	+2
–1	+4	–3

b)

–1	–6	+1
0	–2	–4
–5	+2	–3

12.a) –8, –12, –16, –20 …

Add –4 each time to get the next term.

b) 0, +3, +6, +9 …

Add +3 each time to get the next term.

2.3 Adding Integers on a Number Line, page 62

1.a) +4 **b)** +2 **c)** –2 **d)** –4

e) –7 **f)** +1 **g)** –1 **h)** +7

2.a) +6 **b)** +2 **c)** –6 **d)** –6

e) –13 **f)** –5 **g)** –3 **h)** +12

3. a), b) The answers are the same.

c) The order in which you add integers does not matter.

4.a) –2 **b)** –3 **c)** +4

5.a) +5; The temperature rose 5°C.

b) +4; Adrian gained $4.

c) +1; The stock was up $1.

6.a) **i)** –2

ii) +5

iii) –6

iv) +8

b) **i)** (+2) + (–2) = 0

ii) (–5) + (+5) = 0

iii) (+6) + (–6) = 0

iv) (–8) + (+8) = 0

c) The sum of two opposite integers is 0.

7. a), b) i) (–5) + (–10) = –15

You take 15 steps backward.

ii) (–5) + (+8) = +3;

You deposit $3.

iii) (–8) + (+6) = –2;

The diver descends 2 m.

iv) (+4) + (–7) = –3;
The snowmobile driver rides 3 km west.

v) (+6) + (–10) = –4;
The person loses 4 kg.

8.a) i) (–4) + (+7) = +3

ii) (+8) + (–3) = +5

b) Answers may vary. For example:

i) The temperature dropped 4°C overnight and rose 7°C during the day.

ii) Sarah has $8 and spends $3.

9.a) Always true

b) Never true

c) Always true

d) Sometimes true

10.a) +1 **b)** –5 **c)** –6 **d)** 0

11. +6°C

Unit 2 Mid-Unit Review, page 65

1. Answers may vary. For example:

a) 5 red tiles, or 6 red tiles and 1 yellow tile

b) 1 red tile and 1 yellow tile, or 4 red tiles and 4 yellow tiles

c) 8 yellow tiles, or 9 yellow tiles and 1 red tile

d) 3 red tiles and 2 yellow tiles, or 1 red tile

e) 3 yellow tiles, or 4 yellow tiles and 1 red tile

f) 7 red tiles, or 9 red tiles and 2 yellow tiles

2. 11

3.a) +5 **b)** –2 **c)** 0

4.a) +3 **b)** –5 **c)** –4 **d)** +9 **e)** –12 **f)** +12

5.a) +5 **b)** –6 **c)** –2 **d)** +1 **e)** 0 **f)** +7

6.a) –1

b) Answers may vary. For example:
+2 and –3; +3 and –4; +5 and –6; +6 and –7

7.a) (+50) + (–20) = +30;
Puja had $30.

b) (+5) + (–10) = –5;
The temperature was –5°C.

c) (+124 000) + (–4000) = +120 000;
The population was 120 000.

d) (+12 000) + (–1200) = +10 800;
The plane was cruising at 10 800 m.

8.a) i) (–2) + (+6) = +4

ii) (+4) + (–6) = –2

b) Answers may vary. For example:

i) The temperature was –2°C and it rose 6°C.

ii) Karin walked 4 steps forward and 6 steps backward.

9.a) (+1) + (+2) + (+3) + (+4) = +10

b) (–1) + (0) + (+1) = 0 or
(–2) + (–1) + (0) + (+1) + (+2) = 0

c) (–1) + (0) + (+1) + (+2) = +2

d) (+3) + (+4) = +7

e) (–3) + (–2) + (–1) + (0) + (+1) + (+2) + (+3) + (+4) = +4

f) (–7) + (–6) + (–5) + (–4) + (–3) + (–2) + (–1) + (0) + (+1) + (+2) + (+3) + (+4) + (+5) + (+6) + (+7) + (+8) = +8

2.4 Subtracting Integers with Tiles, page 69

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

7.a) i) +2 and –2

ii) –1 and +1

iii) +7 and –7

b) When the order in which we subtract two integers is reversed, the answer is the opposite integer.

8. –7

9. I can write as many questions as I want. For example:

a) (–4) – (–6) = +2
(+7) – (+5) = +2
(+1) – (–1) = +2

b) (–5) – (–2) = –3
(–4) – (+7) = –3
(–1) – (+2) = –3

c) (–3) – (–8) = +5
(+7) – (+2) = +5
(+2) – (–3) = +5

d) (–8) – (–2) = –6
(+3) – (+9) = –6
(–3) – (+3) = –6

10.a) Part i; +4 is greater than –4.

b) Part i; +1 is greater than –1.

11.a) +2 and –3

b) Answers will vary. For example:
Find two integers with a sum of +3 and a difference of +9. Answer: +6 and –3

12.a) (+1) **b)** (+4) **c)** (+5)

13.a) +2 **b)** 0 **c)** 0 **d)** +1 **e)** –3 **f)** 0

14.a) The sum of the numbers in each row, column, and diagonal is –9, so the square is still magic.

–4	+1	–6
–5	–3	–1
0	–7	–2

b) The sum of the numbers in each row, column, and diagonal is +6, so the square is still magic.

+1	+6	–1
0	+2	+4
+5	–2	+3

2.5 Subtracting Integers on a Number Line, page 73

1.a) +1 **b)** +7 **c)** –3 **d)** –7 **e)** +4 **f)** +4

2.a) –1, –7, +3, +7, –4, –4

b) The answers in part a are the opposites of those in question 1. When the order of the integers is reversed, the difference changes to its opposite.

3.a) +5 **b)** +10 **c)** –14
d) –15 **e)** –8 **f)** 0

4.a) (+6) + (–4) = +2
b) (–5) + (–4) = –9
c) (–2) + (+3) = +1
d) (+4) + (+2) = +6
e) (+1) + (–1) = 0
f) (+1) + (+1) = +2

5.a) +12°C or –12°C
b) +7°C or –7°C
c) +13°C or –13°C

6.a) +8 or –8
b) +5 or –5
c) +9 or –9

7.a) **i)** (+13) – (–4) = +17; +17°C
ii) (–10) – (–22) = +12; +12°C
iii) (+12) – (–3) = +15; +15°C
iv) (+13) – (+7) = +6; +6°C
b) Calgary

8.a) –17
b) +17; the answers in parts a and b are opposite integers.
c) Each integer was replaced with its opposite. The differences are opposite integers: +17 and –17

9. Answers may vary. For example:
(–6) – (–10) = +4
(+6) – (+2) = +4
(–1) – (–5) = +4

10.a) (+6) – (+5) = +1
(+5) – (+5) = 0
(+4) – (+5) = –1
(+3) – (+5) = –2
(+2) – (+5) = –3
b) (+7) – (+4) = +3
(+7) – (+3) = +4
(+7) – (+2) = +5
(+7) – (+1) = +6
(+7) – (0) = +7
(+7) – (–1) = +8
(+7) – (–2) = +9
(+7) – (–3) = +10
c) (+8) – (+7) = +1
(+7) – (+7) = 0
(+6) – (+7) = –1
(+5) – (+7) = –2
(+4) – (+7) = –3
(+3) – (+7) = –4
(+2) – (+7) = –5
(+1) – (+7) = –6
0 – (+7) = –7
(–1) – (+7) = –8
(–2) – (+7) = –9
(–3) – (+7) = –10

11.a) –6, –10, –14, –18;
Start at +6. Subtract +4 each time.
b) +3, +5, +7, +9;
Start at –3. Subtract –2 each time.
c) +26, +33, +40, +47;
Start at +5. Subtract –7 each time.
d) –2, –3, –4, –5;
Start at +1. Subtract +1 each time.

12.a) +1 **b)** +1 **c)** –4 **d)** +2 **e)** +12 **f)** –11

Unit 2 Unit Review, page 79

1.a) 5 **b)** 17 **c)** 37 **d)** 0

2.a) +8 **b)** –5 **c)** +12 **d)** –7 **e)** –9

3.a) –3 **b)** +1 **c)** –1 **d)** 0

4.a) (–6) + (+4) = –2
b) (–25) + (+13) = –12
c) (+15) + (–23) = –8
d) (–250) + (+80) = –170

5. Answers may vary. For example:
a) (–5) + (0) = –5;
(–3) + (–2) = –5;
(–1) + (–4) = –5;
(+1) + (–6) = –5

b) (+4) + (0) = +4;
(+2) + (–2) = +4;
(–2) + (+6) = +4;
(–4) + (+8) = +4

6. (–10) + (+17) = +7;
The new temperature is +7°C.

7.a) **i)** (–4) + (+5) = +1
ii) (+2) + (–4) = –2

b) Answers may vary. For example:
i) Sasha takes 4 steps backward and 5 steps forward.
ii) The temperature is +2°C and then drops 4°C.

8.a) +2 **b)** –1 **c)** –5 **d)** +2

9.a) +2 **b)** +2 **c)** –10 **d)** –2

10. The difference of two positive integers is positive if the first integer is greater than the second integer. The difference of two positive integers is negative if the first integer is less than the second integer.

11.a) +9°C **b)** 0°C **c)** –6°C **d)** –7°C

12.a) +3 **b)** +6 **c)** +4 **d)** –5
e) –4 **f)** –5 **g)** –2 **h)** +5

13.a) +5 **b)** –10 **c)** +1 **d)** 0 **e)** +6 **f)** –1

14.a) +12°C or –12°C
b) –150 m or +150 m

15.a) –9 m or +9 m
b) +14 m or –14 m

16.a) +12 kg or –12 kg
b) –1 kg or +1 kg

17.a) +1 **b)** –2 **c)** +3 h or –3 h

18. Answers may vary. For example:
a) (+10) – (+4) = +6
(+8) – (+2) = +6
(+6) – (0) = +6
(+4) – (–2) = +6
(+2) – (–4) = +6
b) (–5) – (–2) = –3
(–1) – (+2) = –3
(+3) – (+6) = –3
(0) – (+3) = –3
(–3) – (0) = –3

Unit 2 Practice Test, page 81

1.a) –3 **b)** –10 **c)** –10
d) +6 **e)** –4 **f)** +23

2.a) +8 **b)** –15 **c)** –11
d) +7 **e)** +2 **f)** +4

3.a) The sum of two integers is zero when the integers are opposites.

b) The sum of two integers is negative when both integers are negative; or when one integer is positive and the other is negative, and the negative integer has a longer arrow on the number line.

c) The sum of two integers is positive when both integers are positive; or when one integer is positive and the other is negative, and the positive integer has a longer arrow on the number line.

4.a) 6 different scores

b) (+10) + (+10) = +20
(+10) + (+5) = +15
(+10) + (–2) = +8
(+5) + (+5) = +10
(+5) + (–2) = +3
(–2) + (–2) = –4

5. +373°C or –373°C

6. There are 4 possible answers: +7, +13, –1, and +5.
For 4 integers in a row, the addition and/or subtraction signs can be arranged as shown:
+ + +; + + –; + – +; + – –; – + +; – + –; – – +; – – –

Unit 2 Unit Problem: What Time Is It?, page 82

1.a) 0:00 a.m.
b) 5:00 a.m.
c) 9:00 a.m.
d) 6:00 a.m.

2. 10:00 a.m. the next day

3. Atsuko needs to fly out at 3:00 p.m. Tokyo time.
Paula needs to fly out at 7:00 a.m. Sydney time.

Unit 3 Fractions, Decimals, and Percents, page 84

3.1 Fractions to Decimals, page 88

1.a) **i)** $0.\overline{6}$
ii) 0.75
iii) 0.8
iv) $0.\overline{83}$
v) $0.\overline{857\,142}$

b) **i)** repeating
ii) terminating
iii) terminating
iv) repeating
v) repeating

2.a) $\frac{9}{10}$

b) $\frac{26}{100} = \frac{13}{50}$

c) $\frac{45}{100} = \frac{9}{20}$

d) $\frac{1}{100}$

e) $\frac{125}{1000} = \frac{1}{8}$

3. a) **i)** $0.\overline{037}$

ii) $0.\overline{074}$

iii) $0.\overline{1}$

b) As the numerator of the fraction increases by 1, the corresponding decimal increases by $0.\overline{037}$ each time.

c) **i)** $0.\overline{148}$

ii) $0.\overline{185}$

iii) $0.\overline{296}$

4.a) $\frac{4}{10}$, 0.4

b) $\frac{25}{100}$, 0.25

c) $\frac{52}{100}$, 0.52

d) $\frac{38}{100}$, 0.38

e) $\frac{74}{1000}$, 0.074

5.a) $\frac{2}{3}$ **b)** $\frac{5}{9}$ **c)** $\frac{41}{99}$ **d)** $\frac{16}{99}$

6. a) $0.\overline{571\,428}$ **b)** $0.\overline{4}$

c) $0.\overline{54}$ **d)** $0.\overline{538\,461}$

7. 0.294 117 647; Use long division.

8. 0.2

a) 0.8 **b)** 1.4 **c)** 1.8 **d)** 2.2

9.a) **i)** $0.\overline{001}$

ii) $0.\overline{002}$

iii) $0.\overline{054}$

iv) $0.\overline{113}$

b) The numerator of the fraction becomes the repeating digits in the decimal. If the numerator is a two-digit number, the first repeating digit is 0.

c) **i)** $\frac{4}{999}$

ii) $\frac{89}{999}$

iii) $\frac{201}{999}$

iv) $\frac{326}{999}$

10.a) iii **b)** i **c)** iv **d)** ii

11.a) 1.0, 2.0, 1.5, $1.\overline{6}$, 1.6, 1.625; The decimals are greater than or equal to 1 and less than or equal to 2.

b) $1.\overline{615\,384}$, $1.\overline{619\,047}$, 1.617 647…, $1.\overline{618}$

12.a) $1.\overline{142\,857}$; Six digits repeat.

b) $0.\overline{285\,714}$, $0.\overline{428\,571}$, $0.\overline{571\,428}$, $0.\overline{714\,285}$, $0.\overline{857\,142}$; The tenth digit increases from least to greatest; the other digits follow in a clockwise direction around the circle.

13.a) **i)** 0.875; terminating

ii) $0.2\overline{7}$; repeating

iii) 0.3; terminating

iv) $0.\overline{296}$; repeating

v) 0.16; terminating

b) **i)** $2 \times 2 \times 2$

ii) $2 \times 3 \times 3$

iii) 2×5

iv) $3 \times 3 \times 3$

v) 5×5

c) When the prime factors of the denominator are 2 and 5 only, the corresponding decimal is terminating. When the denominator has any other prime factors, the fraction can be written as a repeating decimal.

d) **i)** No

ii) Yes

iii) No

iv) Yes

3.2 Comparing and Ordering Fractions and Decimals, page 94

1. Answers may vary.

For example: $\frac{1}{7}$, $\frac{4}{7}$, $\frac{8}{7}$, $\frac{18}{7}$, $\frac{24}{7}$

2. From greatest to least: $\frac{11}{3}$, $2\frac{5}{6}$, $2\frac{1}{2}$

3.a) 1, $\frac{7}{6}$, $1\frac{2}{9}$, $\frac{15}{12}$

b) $\frac{7}{6}$, $1\frac{3}{4}$, 2, $\frac{7}{3}$

c) $\frac{15}{10}$, $\frac{7}{4}$, 2, $\frac{11}{5}$

d) $2\frac{1}{3}$, $\frac{10}{4}$, 3, $\frac{9}{2}$

4.a) $3\frac{1}{2}$, $\frac{13}{4}$, $3\frac{1}{8}$; 3.5, 3.25, 3.125

b) $1\frac{1}{12}$, $\frac{5}{6}$, $\frac{9}{12}$, $\frac{2}{3}$; $1.08\overline{3}$, $0.8\overline{3}$, 0.75, $0.\overline{6}$

c) $\frac{3}{2}$, $1\frac{2}{5}$, $\frac{4}{3}$; 1.5, 1.4, $1.\overline{3}$

5.a) 1, 1.25, 1.6, $\frac{7}{4}$, $1\frac{4}{5}$

b) 1.875, 2, $\frac{5}{2}$, $2\frac{5}{8}$, $2\frac{3}{4}$

6.a) $\frac{17}{5}$, $3\frac{1}{4}$, 3.2, $\frac{21}{7}$, 2.8, 2

7. Answers may vary. For example:

a) $\frac{27}{16}$ **b)** 2.25

8. Answers may vary. For example:

a) $\frac{11}{14}$ **b)** $1\frac{1}{2}$ **c)** 1.35 **d)** 0.55

9.a) $\frac{11}{4}$; $2\frac{1}{2} = \frac{10}{4}$ which is less than $\frac{11}{4}$.

b) $3\frac{2}{5}$; $\frac{2}{5}$ is close to $\frac{1}{2}$, so $3\frac{2}{5}$ is closer to $3\frac{1}{2}$.

10.a) $6\frac{2}{20}$ should be the second number in the set:

$\frac{29}{5}$, $6\frac{2}{20}$, $6\frac{2}{10}$, 6.25

b) $\frac{3}{2}$ should be the first number in the set:

$\frac{3}{2}$, $1\frac{7}{16}$, $1\frac{3}{8}$, 1.2, $\frac{3}{4}$

11.a) From least to greatest: $\frac{11}{6}$, 1.875, $\frac{9}{4}$

b) Corey sold the most pizzas; Amrita sold the fewest pizzas.

c) Use equivalent fractions.

d) $\frac{11}{6}$, 1.875, $2\frac{1}{5}$, $\frac{9}{4}$

3.3 Adding and Subtracting Decimals, page 98

1.a) $2 - 0 = 2$

b) $71 + 6 = 77$

c) $125 + 37 = 162$

d) $9 - 1 = 8$

2. 0.067 km

3.a) $819.24

b) $248.26

4. a) 12.7 kg

b) No; 12.7 is greater than 10.5.

c) 2.2 kg

5. Use front-end estimation: 49; 51.485

6.a) Robb family: $428.79; Chan family: $336.18

b) $92.61

7. Answers may vary.
For example: 216.478 and 65.181

8. Answers may vary.
For example: 0.312 and 5.476

9.a) The student did not line up the digits of like value.

b) 4.437

10. Answers may vary.
For example: 1.256 and 2.044

11.a) Start at 2.09. Add 0.04 each time.

b) Start at 5.635. Subtract 0.25 each time.

3.4 Multiplying Decimals, page 102

1.a) $1.7 \times 1.5 = 2.55$

b) $2.3 \times 1.3 = 2.99$

2.a) 3.9

b) 0.92

c) 0.56

3. Answers may vary. For example: I chose part a from question 2. I used 2 flats: $2 \times 1 = 2$;
16 rods: $16 \times 0.1 = 1.6$;
30 small cubes: $30 \times 0.01 = 0.3$.
The area of the plot is: $2 + 1.6 + 0.3 = 3.9$

4.a) 15.54 **b)** 2.67 **c)** 0.54

5. 161.65; I estimated 150, so the answer is reasonable.

6.a) 83.6; 836; 8360; 83 600; Multiply by multiples of 10. The digits in the product move one place to the left each time. Or, the decimal point moves one place to the right.

b) 0.836; 0.0836; 0.008 36; 0.000 836; Multiply by multiples of 0.1. The digits in the product move one place to the right each time. Or, the decimal point moves one place to the left.

7. 9.18 m^2

8.a) 12.922 2

b) 174.315 96

c) 1.333 072

9.a) 936.66 km

b) 852.24 km

10.a) $2.43 **b)** $12.50 **c)** $0.62

11. Answers may vary.
For example: 1.2 and 0.3 or 0.2 and 1.8

12.a) 216

b) **i)** 21.6
ii) 2.16
iii) 2.16
iv) 0.0216

13.a) **i)** 11.34
ii) 0.0962
iii) 8.448
iv) 1.1106

b) The number of decimal places in the product is the sum of the number of decimal places in the question.

c) 9.1; Yes, the rule applies, but the product must be written as 9.10. The calculator does not show the product this way.

3.5 Dividing Decimals, page 106

1.a) 8 **b)** 4 **c)** 4.5 **d)** 5.5

2.a) 12.45; 1.245; 0.1245; 0.012 45; Divide by multiples of 10. The digits in the quotient move one place to the right each time. Or, the decimal point moves one place to the left.

b) 1245; 12 450; 124 500; 1 245 000; Divide by multiples of 0.1. The digits in the quotient move one place to the left each time. Or, the decimal point moves one place to the right.

3. All division statements are equivalent.

4.a) 11.9 **b)** 976.5 **c)** 39.15

5.a) 2.5 **b)** 3.2 **c)** 1.6 **d)** 2.4

6.a) 3.5 **b)** 1.5 **c)** 7.1 **d)** 24.1

7. 87

8. 27.9 m

9.a) About $3

b) $3.35

c) About 3 kg

10.a) About 12 pieces; Assumptions may vary.

b) No, he needs 14 pieces and he has material for 12.

c) If Alex cannot use the 0.28-m piece left after he cut twelve 0.8-m pieces, he needs 1.6 m of fabric. If he can use it, he only needs 1.32 m of fabric.

d) Yes; Alex would only need $0.7 \text{ m} \times 14 = 9.8 \text{ m}$ of fabric.

11. Answers may vary.
For example: 0.312 and 2.6

12. $9.25; The result should be written to the nearest hundredth.

13. 237 is greater than 10 times 7 and less than 100 times 7, so the quotient should be between 10 and 100: $237 \div 7 = 33.857$

a) 338.57 **b)** 33.857 **c)** 3.3857 **d)** 33.857

3.6 Order of Operations with Decimals, page 109

1.a) 6.5 **b)** 6.2 **c)** 14 **d)** 1498

2.a) 58 **b)** 211 **c)** 12

3.a) 4.4

b) 2.2

4.a) 345.68 **b)** 18.038

c) 163 **d)** 116.54

5.a) Aida

b) Ioana: $12 \times (4.8 \div 0.3 - 3.64 \times 3.5) = 39.12$
Norman: $(12 \times 4.8 \div 0.3 - 3.64) \times 3.5 = 659.26$

6. 41.21

7. Answers may vary. For example:
$0.1 + 0.2 + 0.3 + 0.4 = 1$,
$(0.6 \times 0.5 + 0.7) \times 0.2 \div 0.1 = 2$,
$(0.8 + 0.7) \times 0.6 \div 0.3 = 3$,
$0.6 \div 0.2 + 0.1 + 0.9 = 4$,
$0.9 \div 0.3 + 0.4 \div 0.2 = 5$

Unit 3 Mid-Unit Review, page 110

1.a) **i)** $0.0\overline{3}$

ii) $0.0\overline{6}$

iii) $0.0\overline{9}$

b) Start at $0.0\overline{3}$. Add $0.0\overline{3}$ each time.

c) **i)** $\frac{5}{33}$

ii) $\frac{12}{33}$

2.a) 0.125; terminating

b) 0.6; terminating

c) $0.\overline{6}$; repeating

d) $0.\overline{538\,461}$; repeating

3.a) $\frac{1}{5}$ **b)** $\frac{8}{9}$ **c)** $\frac{1}{200}$ **d)** $\frac{23}{99}$

4. From least to greatest:

a) $\frac{11}{6}$, 2, $2\frac{1}{4}$, $\frac{8}{3}$ **b)** $1\frac{3}{4}$, $\frac{23}{8}$, 3.5

c) 1, $\frac{13}{10}$, $1\frac{3}{5}$, 1.75, $\frac{9}{5}$

5. Answers may vary. For example:

a) 1.5 **b)** 2.4 **c)** 1.5

6.a) 25.72 **b)** 137.521 **c)** 17.1

7.a) 3.585 kg **b)** 9.25 kg

8.a) 7.44 **b)** 4.706 **c)** 58.95

9. 9.94 km^2

10. The division statements are equivalent.

11.a) 16.26 **b)** 50.5 **c)** 18.431

3.7 Relating Fractions, Decimals, and Percents, page 112

1.a) $\frac{3}{20}$, 15%, 0.15

b) $\frac{2}{5}$, 40%, 0.4

c) $\frac{4}{5}$, 80%, 0.8

2.a) $\frac{1}{50}$, 0.02

b) $\frac{9}{100}$, 0.09

c) $\frac{7}{25}$, 0.28

d) $\frac{19}{20}$, 0.95

3.a) 0.2, 20%
b) 0.06, 6%
c) 0.16, 16%
d) 0.65, 65%
e) 0.8, 80%

4. Janet; 82% is greater than 80%.

5. 15%

6.a) 25% **b)** 50% **c)** 6% **d)** 10%

3.8 Solving Percent Problems, page 115

1.a) 3 **b)** 10 **c)** 6.48 **d)** 75.04

2.a) $45.00 **b)** $42.00 **c)** $36.00

3. a) $40.50 **b)** $22.00 **c)** $35.00

4. a) $3.63 **b)** $11.30 **c)** $3.27

5.a) i) $7.74
ii) $136.74
b) i) $1.50
ii) $26.49
c) i) $2.58
ii) $45.55

6. About 192 bands

7.a) Answers may vary. For example: Some items will be 60% off, others will be reduced by less. Or, the sale prices will be at least 40% the original price.
b) Scarves and hats
c) Sweaters: About $20.00 ($14.99 off sale price), ski jackets: $60.00 ($52.49 off sale price), leather gloves: $28.00 ($10.49 off sale price)

8.a) $199.99 – $199.99 × 0.25 = $149.99
b) $199.99 × 0.75 = $149.99
c) Yes

Unit 3 Unit Review, page 121

1.a) 0.6; terminating
b) $0.8\overline{3}$; repeating
c) 0.375; terminating
d) 0.15; terminating

2.a) $\frac{11}{20}$ **b)** $1\frac{1}{3}$ **c)** $\frac{4}{5}$ **d)** $\frac{7}{99}$

3.a) From least to greatest:
$\frac{3}{6}, \frac{5}{8}, 1\frac{1}{16}, 1.1, \frac{5}{4}$

4. For example:
a) 2.25; From least to greatest:
$2.25, 2\frac{1}{3}, \frac{17}{6}, 2\frac{11}{12}$
b) $1\frac{3}{15}$; From least to greatest:
$\frac{3}{5}, \frac{9}{10}, \frac{21}{20}, 1.1, 1\frac{3}{15}$

5. Answers will vary.
For example: 1.78 and 1.63

6. 0.72 s

7.a) $118.58
b) $59.29

8. $1.56

9. i) a, b, c
ii) d, e, f; part d: 4.1875; part e: 5.2; part f : 24.2

10. 6.25 m

11.a) 43.79
b) 5.855

12.a) i) 10.68
ii) 10.92
iii) 9.48
iv) 11.56
b) When the position of the brackets changes, the order of operations changes.

13.a) $\frac{4}{5}$, 0.8

b) $\frac{3}{25}$, 0.12

c) $\frac{1}{50}$, 0.02

d) $\frac{63}{100}$, 0.63

14.a) 0.56, 56%
b) 0.95, 95%
c) 0.14, 14%
d) 0.2, 20%

15. 28 students

16.a) $33.15 **b)** $21.75 **c)** $31.50

17.a) $34.19 **b)** $31.79 **c)** $2.40

18. $6.55

Unit 3 Practice Test, page 123

1.a) $\frac{1}{250}$ **b)** $\frac{16}{25}$ **c)** $\frac{1}{3}$
d) 0.255 **e)** 0.75

2.a) $90.00
b) No. The equipment costs $107.80.
c) $17.80

3. Yes

4.a) 34.74 **b)** 15.67

5. 26 cats

6.a) \$58.50 **b)** \$19.50 **c)** \$3.51 **d)** \$62.01

Cumulative Review Units 1–3, page 126

1. Divisible by 4: 320, 488, 2660
Divisible by 6: 762, 4926
Divisible by 4 and by 6: 264, 504
Not divisible by 4 or by 6: 1293

2.a) 5 strawberries **b)** 8 strawberries
c) I cannot divide 40 strawberries among 0 people.

3.a) $\frac{n}{12}$
b) $n + 11$
c) $n - 8$

4.a) When the Input number increases by 1, the Output number increases by 2.

b)

Input x	Output
1	4
2	6
3	8
4	10
5	12
6	14

c) $2x + 2$; The table shows how $2x + 2$ relates to x.

5.a) 3, s, 2
b) 7, p
c) 1, c, 8
d) 11, w, 9

6.a) $5 + 3c$

b)

Additional Half Hours	Cost (\$)
0	5
1	8
2	11
3	14
4	17

c) The graph goes up to the right.
When the number of additional half hours increases by 1, the cost increases by \$3.

d) **i)** \$23.00
ii) 8 additional half hours

7.a) $x = 5$
b) $x = 2$

8.a) 11 red tiles
b) 3 ways: 3 red tiles, or 4 red tiles and 1 yellow tile, or 5 red tiles and 2 yellow tiles

9.a) 0
b) –2
c) –12
d) +2

10.a) **i)** +10, –5
ii) +25, –10
iii) –9, +12
b) **i)** (+10) + (–5) = +5; I deposit \$5.
ii) (+25) + (–10) = +15;
The balloon rises 15 m.
iii) (–9) + (+12) = +3;
I ride the elevator up 3 floors.

11.a) 115 m or –115 m
b) –75 m or 75 m

12.a) –4
b) –6
c) +10
d) –6

13.a) **i)** $0.\overline{03}$
ii) $0.\overline{06}$
iii) $0.\overline{09}$
b) As the numerator of the fraction increases by 1, the corresponding decimal increases by $0.\overline{03}$ each time.
c) **i)** $\frac{5}{33}$
ii) $\frac{8}{33}$
iii) $\frac{10}{33}$

14.a) From greatest to least:
$5\frac{1}{3}, 5.3, \frac{21}{4}, 4.9, \frac{24}{5}$

15. 1.873 m

16.a) 7.82
b) 3.96
c) 15.17
d) 4.93

17.a) 21 bottles
b) 0.375 L

18.a) **i)** \$7.80
ii) \$137.79
b) **i)** \$1.08
ii) \$19.06

Unit 4 Circles and Area, page 128

4.1 Investigating Circles, page 131

1.a) 12 cm
b) 16 cm

2.a) 14 cm
b) 8 cm

3.a) 1.9 cm
b) 15 cm

4. 0.6 m
5.c) 360°
d) The sum of the angles at the centre is 360°.
6. 15 glasses; Assumptions may vary. For example: All glasses are cylindrical and they can touch.
7. Answers may vary. For example:
15 cm, 7.5 cm; 2.5 cm, 1.25 cm; 9.6 cm, 4.8 cm; 8.8 cm, 4.4 cm; 1.5 cm, 0.75 cm; 1.8 cm, 0.9 cm; 2.6 cm, 1.3 cm
8. Answers may vary. For example:
Fix one end of a measuring tape on the circumference. Walk around the circle with the measuring tape at ground level, until you reach the maximum distance across the circle, which is the diameter. The centre of the circle is the midpoint of the diameter.

4.2 Circumference of a Circle, page 136

1.a) About 31.42 cm **b)** About 43.98 cm
c) About 47.12 cm
2.a) About 7.64 cm; about 3.82 cm
b) About 0.76 m; about 0.38 m
c) About 12.73 cm; about 6.37 cm
3. Less than; π is greater than 3.
4.a) About 7.5 m
b) About $33.98, assuming the edging does not have to be bought in whole metres
5.a) The circumference doubles.
b) The circumference triples.
6. About 71.6 cm
7. No, because π never terminates or repeats. So, the circumference will never be a whole number.
8.a) A dotted line with the marks equally spaced apart
b) About 289 cm, or 2.89 m
c) About 346 times
9.a) About 40 075 cm
b) There would be a gap of about 160 m under the ring. You would be able to crawl, walk, and drive a school bus under the ring.

Unit 4 Mid-Unit Review, page 138

2. Answers may vary, but diameters should be less than 20 cm and greater than 10 cm.
3.a) 3.9 cm **b)** 4.1 cm **c)** 5 cm **d)** 12.5 cm
4. No, two circles with the same radius are the same (congruent).
5.a) About 37.70 cm **b)** About 50.27 cm
6.a) **i)** About 207.35 cm
ii) About 232.48 cm
iii) About 188.50 cm
b) The tire has the greatest circumference; it has the greatest diameter, too.
7. About 24.38 m
8.a) About 40.7 cm
b) About 18.0 cm
c) About 7.2 cm
9. About 78.54 cm

4.3 Area of a Parallelogram, page 139

1.iii) **a)** 20 cm^2
b) 9 cm^2
c) 30 cm^2
2.a) 312 cm^2
b) 195 mm^2
c) 384 cm^2
3.b) The 3 parallelograms have equal areas: 21 cm^2
4. Yes; Parallelograms with the same base and height have equal areas.
5.b) 10 cm^2
6.a) 5 m **b)** 3 mm **c)** 6 cm
7. Answers may vary. For example:
a) $b = 5$ cm, $h = 2$ cm
b) $b = 6$ cm, $h = 3$ cm
c) $b = 7$ cm, $h = 4$ cm
8. The area of the parallelogram is 16 cm^2. The student may have used the side length, 5 cm, as the height of the parallelogram.
9. No, the areas of Shape A and Shape B are equal.
10.a) 95.04 m^2
b) 132 m^2
c) 36.96 m^2; 18.45 m^2 each

4.4 Area of a Triangle, page 145

2.a) 21 cm^2 **b)** 12.5 cm^2 **c)** 12 cm^2
d) 12 cm^2 **e)** 10 cm^2 **f)** 8 cm^2
3.b) In a right triangle, two heights coincide with the sides.
4.a) 21 cm^2
c) Each parallelogram has area 42 cm^2.
5.a) 4 cm **b)** 16 m **c)** 32 mm
6.b) All triangles in part a have the same area: 6 cm^2
7.a) $b = 4$ cm, $h = 7$ cm or $b = 2$ cm, $h = 14$ cm
b) $b = 10$ cm, $h = 2$ cm or $b = 4$ cm, $h = 5$ cm
c) $b = 4$ cm, $h = 4$ cm or $b = 2$ cm, $h = 8$ cm
8.a) **i)** The area doubles.
ii) The area is 4 times as great.
iii) The area is 9 times as great.
b) I can triple the base or the height of the triangle.

9.a) 11.7 m^2

b) About 3 cans of paint

10.a) 17 triangles: 12 small, 4 medium, 1 large

b) 1 small triangle is $\frac{1}{4}$ of a medium triangle and $\frac{1}{16}$ of the large triangle.

1 medium triangle is $\frac{1}{4}$ of the large triangle and 4 times as great as a small triangle.

The large triangle is 4 times as great as a medium triangle and 16 times as great as a small triangle.

c) 12 parallelograms: 9 small, 3 medium

d) 27.6 cm^2 **e)** 6.9 cm^2

f) 1.725 cm^2

g) Small: 3.45 cm^2; medium: 13.8 cm^2

11.a) 92.98 m^2

b) At least 33 sheets of plywood

4.5 Area of a Circle, page 151

1.a) About 12.57 cm^2

b) About 153.94 cm^2

c) About 153.94 cm^2

d) About 706.86 cm^2

2.a) About 28.27 cm^2

b) About 113.10 cm^2

c) About 254.47 cm^2

d) About 452.39 cm^2

3.a) The area is 4 times as great.

b) The area is 9 times as great.

c) The area is 16 times as great.

4.a) The area of the circle is approximately halfway between the area of the smaller square and the area of the larger square: About 75 cm^2

b) About 78.54 cm^2

c) Answers may vary.

5.a) About 104 cm^2

b) About 16 cm^2

6.a) About 0.0707 m^2

b) About 1.0603 m^2; about 3.3929 m^2; about 5.6549 m^2

7.a) About 113.10 cm^2

b) About 19.63 cm^2

c) About 34.58 cm^2

8. Two large pizzas are the better deal.

4.6 Interpreting Circle Graphs, page 158

1.a) Traditional dance lessons

b) Powwow drum classes; traditional dance lessons

c) Stick games: 175 students;
Powwow drum classes: 200 students;
traditional dance lessons: 125 students

2.a) 0 to 12 years and 13 to 19 years

b) **i)** 112 500 viewers
ii) 62 500 viewers
iii) 25 000 viewers

3.a) 161 t

b) 805 t

4.a) French: \$550; History: \$1050;
Science: \$750; Biography: \$550;
Geography: \$450; Fiction: \$900;
Reference: \$750

b) The total amount of money spent on each type of book should be \$5000.

5.a) 10%

b) Saskatchewan, Manitoba, Alberta, British Columbia

c) Saskatchewan: 968 300 people;
about 968 000 people
Manitoba: 1 161 960 people;
about 1 162 000 people
Alberta: 3 292 220 people;
about 3 292 000 people
British Columbia: 4 260 520 people;
about 4 261 000 people

6.a) 25 students

b) Autumn: $\frac{7}{2}$; 28%; winter: $\frac{3}{25}$; 12%; spring: $\frac{5}{25}$; 20%; summer: $\frac{10}{25}$; 40%

c) All percents in part b should add up to 100.

7.a) Morning Snack Mix: sunflower seeds 30 g, almonds 54 g, raisins 25.5 g, peanuts 40.5 g
Super Snack Mix: raisins 19.5 g, banana chips 34.5 g, cranberries 25.5 g, papaya chunks 40.5 g, pineapple chunks 30 g

b) Morning Snack Mix: 51 g of raisins
Super Snack Mix: 39 g of raisins
I assumed the percents of the ingredients in both snack mixes remain the same.

4.7 Drawing Circle Graphs, page 163

1.a) 50 students

b) Blue: $\frac{12}{50} = \frac{6}{25}$; brown: $\frac{24}{50} = \frac{12}{25}$; green: $\frac{8}{50} = \frac{4}{25}$; grey: $\frac{6}{50} = \frac{3}{25}$

c) Blue: 24%; brown: 48%; green: 16%; grey: 12%

2.a) 92 people

b) MAJIC99: $\frac{88}{400} = \frac{11}{50}$, 22%;

EASY2: $\frac{92}{400} = \frac{23}{100}$, 23%;

ROCK1: $\frac{120}{400} = \frac{3}{10}$, 30%;

HITS2: $\frac{100}{400} = \frac{1}{4}$, 25%

3.a) 40 000 000 U.S. residents

b) $\frac{1\,200\,000}{40\,000\,000} = \frac{12}{400} = \frac{3}{100}$

c) 10%

4.a) Yes, each number of students can be written as a fraction of the whole.

b) No, data cannot be written as a fraction of the whole.

5. Asia: about 367 million km^2
Africa: about 244 million km^2
South America: about 147 million km^2
Antarctica: about 98 million km^2
Europe: about 86 million km^2
Australia: about 61 million km^2

Unit 4 Unit Review, page 168

1. Answers may vary. For example: Use a pencil, a string, and a pin.

2.a) 6 cm **b)** 10 cm **c)** 3.5 cm

3.a) 30 cm **b)** 44 cm **c)** 8.4 cm

4. About 34.85 m

5.a) About 75.40 m **b)** 14 m **c)** About 87.96 m

6.a) About 94.25 mm **b)** About 131.95 mm

c) Mel's dial; it has the greater radius.

7. Answers may vary. For example: 6 cm and 4 cm; 4 cm and 6 cm; 8 cm and 3 cm; 3 cm and 8 cm; 2 cm and 12 cm; 12 cm and 2 cm; 1 cm and 24 cm; 24 cm and 1 cm

8.a) 3.84 m^2

b) **i)** 0.96 m^2 **ii)** 13.44 m^2

9.a) Answers may vary. For example: $b = 1$ cm, $h = 24$ cm; $b = 2$ cm, $h = 12$ cm; $b = 3$ cm, $h = 8$ cm; $b = 4$ cm, $h = 6$ cm; $b = 6$ cm, $h = 4$ cm; $b = 8$ cm, $h = 3$ cm; $b = 12$ cm, $h = 2$ cm; $b = 24$ cm, $h = 1$ cm

b) The area of the parallelograms in question 7 is double the area of the triangles in part a.

10. $1265.63

11.a) About 201.06 m^2 **b)** About 50.27 m

12.a) The circumference is halved.

b) The area is one-quarter of what it was.

13. About 637.94 cm^2

14. I calculated the area of each shape:
about 55.42 cm^2, 54 cm^2, 56 cm^2
The shape in part c will require the most paint.

15.a) Laura received the most votes.

b) Jarrod: 140 votes; Laura: 280 votes; Jeff: 80 votes

16.a) Lake Huron

b) Lake Superior has the greatest surface area.

c) 26 840 km^2

17.a) Water: 62%, protein: 17%, fat: 15%, nitrogen: 3%, calcium: 2%, other: 1%

b) 37.2 kg

18.a) Manitoba: 10%, Saskatchewan: 10%, Quebec: 30%, Ontario: 50%

Unit 4 Practice Test, page 171

2.a) About 31.42 cm **b)** About 78.54 cm^2

3. 360°

4.a) 63 cm^2 **b)** 9 cm^2

5.a) Too many to count

b) No, because π never terminates or repeats. So, the area will never be a whole number.

6.b) No. The circle represents the whole and each percent can be written as a fraction of the whole.

Unit 5 Operations with Fractions, page 176

5.1 Using Models to Add Fractions, page 179

1.a) $\frac{2}{4} + \frac{1}{2} = 1$ **b)** $\frac{2}{3} + \frac{4}{6} = 1\frac{1}{3}$ **c)** $\frac{7}{10} + \frac{4}{5} = 1\frac{1}{2}$

2.a) $\frac{7}{8} + \frac{1}{2} = 1\frac{3}{8}$ **b)** $\frac{3}{10} + \frac{2}{5} = \frac{7}{10}$ **c)** $\frac{2}{3} + \frac{1}{2} = 1\frac{1}{6}$

d) $\frac{2}{3} + \frac{5}{6} = 1\frac{1}{2}$ **e)** $\frac{3}{6} + \frac{1}{12} = \frac{7}{12}$ **f)** $\frac{1}{4} + \frac{2}{8} = \frac{1}{2}$

g) $\frac{1}{3} + \frac{1}{2} = \frac{5}{6}$ **h)** $\frac{1}{2} + \frac{4}{10} = \frac{9}{10}$

3. $\frac{1}{2}$ h

4.a) **i)** $\frac{2}{5}$

ii) 1

iii) $\frac{7}{10}$

iv) $\frac{2}{3}$

b) Answers may vary. For example: Use fraction circles. Or, add numerators.

5.a) $\frac{3}{4}$; less **b)** $\frac{9}{5} = 1\frac{4}{5}$; greater

c) 1; equal **d)** $\frac{4}{10}=\frac{2}{5}$; less

6. Answers may vary. For example: $\frac{1}{6}$ and $\frac{2}{3}$

7.a) $\frac{1}{8};\frac{1}{4};\frac{3}{8}$

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

5.2 Using Other Models to Add Fractions, page 183

1.a) $\frac{2}{4},\frac{3}{6},\frac{4}{8}$ **b)** $\frac{2}{8}$ **c)** $\frac{4}{6},\frac{6}{9}$

2.a) $\frac{3}{4}+\frac{7}{8}=\frac{13}{8}$ **b)** $\frac{5}{6}+\frac{2}{3}=\frac{9}{6}$ **c)** $\frac{3}{2}+\frac{3}{4}=\frac{9}{4}$

3. Answers may vary. For example:

a) The greater denominator is a multiple of the lesser denominator. The greater denominator shows which number line to use to get the answer.

b) One denominator is a multiple of the other.

4.a) $\frac{7}{6}$ **b)** $\frac{11}{12}$ **c)** $\frac{7}{10}$ **d)** $\frac{1}{4}$

5.a) $\frac{5}{6}$ **b)** $\frac{19}{12}$ **c)** $\frac{11}{10}$ **d)** $\frac{13}{15}$

6. Answers may vary. For example:

a) The least common multiple of the denominators shows which number line to use to get the answer.

b) The denominators are not multiples, nor factors of each other.

c) Use a number line divided in fractions whose denominator is given by the least common multiple of the unrelated denominators.

7.a) $\frac{13}{21}$ **b)** $\frac{35}{36}$ **c)** $\frac{57}{40}$ **d)** $\frac{29}{35}$

8. $\frac{19}{12}$

9.a) There are 36 possible fractions:

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

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

Answers may vary.

For example: $\frac{3}{4}+\frac{5}{6}=\frac{19}{12}=1\frac{7}{12}$; $\frac{3}{4}+\frac{1}{2}=\frac{5}{4}=1\frac{1}{4}$

b) $\frac{4}{6}+\frac{2}{5}=\frac{16}{15}$

10. Answers may vary. For example:

$\frac{7}{10}+\frac{4}{5}=\frac{3}{2}$; $\frac{3}{4}+\frac{3}{4}=\frac{3}{2}$

11. Yes, $\frac{7}{4}<2$

12. 2 cups

5.3 Using Symbols to Add Fractions, page 188

1.a) Eighths **b)** Twenty-fourths

c) Ninths **d)** Fifteenths

2.a) 1 **b)** 8 **c)** 2 **d)** 20

3.a) $\frac{7}{9}$ **b)** $\frac{5}{6}$ **c)** $\frac{15}{8}=1\frac{7}{8}$ **d)** $\frac{11}{12}$

4.a) About 1; $\frac{11}{10}=1\frac{1}{10}$ **b)** About $\frac{1}{2};\frac{19}{24}$

c) About 2; $\frac{29}{18}=1\frac{11}{18}$ **d)** About $1\frac{1}{2}$; $\frac{37}{28}=1\frac{9}{28}$

e) About $\frac{1}{2};\frac{11}{15}$ **f)** About 1; $\frac{31}{30}=1\frac{1}{30}$

5. $\frac{3}{16}$

6. $\frac{3}{4}+\frac{4}{5}$ is greater.

7. Statement b is true: $\frac{3}{10}+\frac{1}{5}+\frac{1}{2}=1$

Statement a is false: $\frac{1}{10}+\frac{3}{5}+\frac{1}{2}=\frac{12}{10}=\frac{6}{5}>1$

8. About $\frac{29}{30}$

9. Sums in parts a, e, and f are correct.

10.a) $\frac{13}{8}=1\frac{5}{8}$ **b)** $\frac{43}{20}=2\frac{3}{20}$ **c)** $\frac{35}{18}=1\frac{17}{18}$

Unit 5 Mid-Unit Review, page 190

1. $\frac{3}{5}+\frac{3}{10}=\frac{9}{10}$

2. $\frac{11}{12}$ h

3.a) $\frac{1}{2}+\frac{5}{12}=\frac{11}{12}$ **b)** $\frac{2}{3}+\frac{3}{4}=\frac{17}{12}=1\frac{5}{12}$

4.a) $\frac{5}{8}$ **b)** $\frac{5}{6}$ **c)** $\frac{13}{12}=1\frac{1}{12}$ **d)** $\frac{9}{10}$

5. $\frac{3}{2}=1\frac{1}{2}$; Methods may vary. For example: Use Pattern Blocks. Or, use fraction circles. Or, use equivalent fractions.

6.a) $\frac{9}{8}=1\frac{1}{8}$ **b)** $\frac{14}{15}$ **c)** $\frac{3}{8}$ **d)** $\frac{17}{12}=1\frac{5}{12}$

7. No; $\frac{59}{60}<1$

8. a) i) $\frac{3}{4}$

ii) $\frac{1}{2}$

iii) $\frac{1}{4}$

iv) $\frac{1}{2}$

b) Puzzles and games

5.4 Using Models to Subtract Fractions, page 193

1. Answers may vary. For example:

a) $\frac{4}{8}$ and $\frac{5}{8}$ **b)** $\frac{3}{12}$ and $\frac{4}{12}$

c) $\frac{4}{6}$ and $\frac{1}{6}$ **d)** $\frac{6}{10}$ and $\frac{5}{10}$

2.a) $\frac{1}{3}$; Less than $\frac{1}{2}$ **b)** $\frac{3}{4}$; Greater than $\frac{1}{2}$

c) $\frac{1}{3}$; Less than $\frac{1}{2}$ **d)** $\frac{1}{6}$; Less than $\frac{1}{2}$

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

4.a) Subtract the numerators only.
The denominator remains the same.

b) Examples may vary.

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

c) $\frac{8}{10}-\frac{2}{5}=\frac{4}{10}=\frac{2}{5}$ **d)** $\frac{11}{12}-\frac{2}{3}=\frac{3}{12}$

6.a) $\frac{1}{8}$ **b)** $\frac{1}{5}$ **c)** $\frac{3}{8}$ **d)** $\frac{7}{12}$

7. $\frac{1}{6}$

8. $\frac{1}{4}$

9. No. Spencer needs $\frac{1}{12}$ cup more.

10. Answers may vary. For example:

a) $\frac{2}{3}-\frac{1}{3}=\frac{1}{3}$ **b)** $\frac{4}{5}-\frac{1}{5}=\frac{3}{5}$ **c)** $\frac{2}{3}-\frac{2}{4}=\frac{1}{6}$

11.a) More: $\frac{3}{4}-\frac{1}{8}=\frac{5}{8}>\frac{1}{2}$ **b)** $\frac{1}{8}$

12.a) iii **b)** Use estimation.

5.5 Using Symbols to Subtract Fractions, page 197

1.a) $\frac{2}{5}$ **b)** $\frac{1}{3}$ **c)** $\frac{1}{3}$ **d)** $\frac{2}{7}$

2.a) $\frac{1}{2}$ **b)** $\frac{1}{8}$ **c)** $\frac{4}{5}$ **d)** $\frac{1}{12}$

3.a) $\frac{1}{12}$ **b)** $\frac{2}{15}$ **c)** $\frac{19}{20}$ **d)** $\frac{1}{10}$

4.a) $\frac{1}{6}$ **b)** $\frac{11}{12}$ **c)** $\frac{17}{30}$ **d)** $\frac{1}{12}$

5. Walnuts; $\frac{1}{12}$ cup more

6.a) Terri; $1\frac{5}{12}>1\frac{1}{4}$

b) $\frac{1}{6}$ h

7. Answers may vary. For example: $\frac{9}{4}-\frac{3}{2}=\frac{3}{4}$

8. The other fraction is between $\frac{1}{2}$ and $\frac{3}{4}$.

9. 18 min

5.6 Adding with Mixed Numbers, page 202

1.a) $\frac{3}{2}$ **b)** $\frac{17}{4}$ **c)** $\frac{7}{4}$ **d)** $\frac{18}{5}$

2.a) $3\frac{2}{5}$ **b)** $2\frac{1}{4}$ **c)** $4\frac{1}{2}$ **d)** $4\frac{2}{3}$

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

4.a) 6 **b)** $4\frac{3}{4}$ **c)** $7\frac{7}{9}$ **d)** $8\frac{2}{5}$

5.a) $3\frac{3}{8}$ **b)** $3\frac{1}{12}$ **c)** $5\frac{1}{8}$ **d)** $4\frac{1}{10}$

6.a) $3\frac{7}{10}$ **b)** $2\frac{7}{10}$ **c)** $5\frac{7}{10}$ **d)** $7\frac{7}{10}$

7.a) $3\frac{7}{12}$ **b)** $2\frac{2}{5}$ **c)** $3\frac{7}{20}$ **d)** $2\frac{13}{14}$

e) $6\frac{13}{24}$ **f)** $5\frac{4}{15}$ **g)** $7\frac{11}{40}$ **h)** $6\frac{1}{12}$

8. $6\frac{7}{15}$ h

9.a) Estimates may vary. For example: About $3\frac{1}{2}$

b) $3\frac{5}{8}$

10. $9\frac{5}{12}$ cups

11.a) $3\frac{7}{10}$

b) $\frac{8}{5}$ and $\frac{21}{10}$

c) $\frac{37}{10}$

12. $4\frac{5}{12}$ h

13. $1\frac{2}{5}$ or $\frac{7}{5}$; equivalent fractions may vary.

5.7 Subtracting with Mixed Numbers, page 207

1.a) $1\frac{1}{5}$ **b)** $2\frac{1}{4}$ **c)** 3 **d)** $\frac{5}{3}=1\frac{2}{3}$

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

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

4.a) About $2\frac{1}{2}$; $\frac{9}{4} = 2\frac{1}{4}$

b) About $1\frac{1}{2}$; $\frac{3}{2} = 1\frac{1}{2}$

c) About $\frac{1}{2}$; $\frac{13}{20}$

d) About $1\frac{1}{2}$; $\frac{13}{20} = 1\frac{3}{10}$

5.a) **i)** $\frac{11}{5} = 2\frac{1}{5}$ **ii)** $\frac{25}{7} = 3\frac{4}{7}$

iii) $\frac{25}{6} = 4\frac{1}{6}$ **iv)** $\frac{50}{9} = 5\frac{5}{9}$

6.a) $2\frac{11}{20}$ **b)** $1\frac{2}{5}$ **c)** $2\frac{5}{12}$ **d)** $2\frac{1}{21}$

7. i) **a)** $2\frac{3}{10}$ **b)** $\frac{23}{10}$

c) Answers may vary. For example:

The first method is easier because $\frac{3}{5}$ is greater than $\frac{3}{10}$.

ii) **a)** $1\frac{7}{10}$ **b)** $\frac{17}{10}$

c) Answers may vary. For example:

The second method is easier because $\frac{3}{5}$ is less than $\frac{3}{10}$.

8. $1\frac{17}{40}$ cups

9. $\frac{11}{12}$ h

10.a) $\frac{19}{24}$ **b)** $\frac{31}{18}$ or $1\frac{13}{18}$

c) $\frac{44}{15}$ or $2\frac{14}{15}$ **d)** $\frac{101}{40}$ or $2\frac{21}{40}$

11.a) Estimates may vary.

For example: About $1\frac{1}{2}$

b) $\frac{35}{24}$ or $1\frac{11}{24}$ **d)** $\frac{29}{24}$ or $1\frac{5}{24}$

12. Answers may vary. For example: $\frac{21}{8}$ or $2\frac{5}{8}$

Unit 5 Unit Review, page 213

1.a) $\frac{13}{12}$ **b)** 1 **c)** $\frac{11}{12}$ **d)** $\frac{7}{10}$

2.a) $\frac{11}{9}$ **b)** $\frac{3}{2}$ **c)** $\frac{3}{4}$ **d)** $\frac{9}{8}$

3. Answers may vary. For example: $\frac{1}{4} + \frac{3}{8} = \frac{5}{8}$

4. Answers may vary. For example:

a) $\frac{12}{20}$ and $\frac{15}{20}$ **b)** $\frac{2}{5}$ and $\frac{1}{5}$

c) $\frac{8}{18}$ and $\frac{9}{18}$ **d)** $\frac{15}{24}$ and $\frac{4}{24}$

5.a) $\frac{4}{5}$ **b)** $\frac{13}{14}$ **c)** $\frac{29}{30}$ **d)** $\frac{17}{20}$

6.a) $1 - \frac{1}{3} = \frac{4}{6}$ **b)** $\frac{7}{10} - \frac{2}{5} = \frac{3}{10}$

c) $\frac{10}{12} - \frac{3}{4} = \frac{1}{12}$ **d)** $\frac{5}{8} - \frac{1}{4} = \frac{3}{8}$

7.a) $\frac{3}{5}$ **b)** $\frac{1}{2}$ **c)** $\frac{5}{12}$

8.a) Javon; $\frac{5}{6} > \frac{7}{9}$ **b)** $\frac{1}{18}$

9.a) $\frac{1}{2}$ **b)** $\frac{3}{2} = 1\frac{1}{2}$

c) $\frac{27}{20} = 1\frac{7}{20}$ **d)** $\frac{19}{12} = 1\frac{7}{12}$

10. Answers will vary. For example:

a) $\frac{4}{3} - \frac{5}{6} = \frac{1}{2}$ **b)** $\frac{31}{36} - \frac{1}{9} = \frac{3}{4}$ **c)** $\frac{17}{20} - \frac{3}{4} = \frac{1}{10}$

d) $\frac{5}{2} - \frac{7}{3} = \frac{1}{6}$ **e)** $\frac{5}{6} - \frac{7}{12} = \frac{1}{4}$

11.a) Brad **b)** $\frac{1}{8}$ bottle

12. $\frac{3}{8}$

13.a) $6\frac{2}{3}$ **b)** $1\frac{7}{12}$ **c)** $5\frac{1}{2}$ **d)** $6\frac{13}{20}$

14.a) $4\frac{1}{2}$ **b)** $4\frac{5}{8}$ **c)** $10\frac{1}{10}$ **d)** $8\frac{2}{9}$

15. $3\frac{5}{8}$ h

16.a) $\frac{33}{8}$, or $4\frac{1}{8}$ **b)** $\frac{25}{9}$, or $2\frac{7}{9}$

c) $\frac{19}{12}$, or $1\frac{7}{12}$ **d)** $\frac{47}{24}$, or $1\frac{23}{24}$

17.a) The second recipe; $1\frac{7}{9} > 1\frac{3}{4}$

b) $\frac{1}{8}$ cup

18.a) $\frac{25}{6}$, or $4\frac{1}{6}$ **b)** $\frac{49}{30}$, or $1\frac{19}{30}$

c) $\frac{169}{24}$, or $7\frac{1}{24}$ **d)** $\frac{3}{4}$

19. $\frac{5}{6}$ h

Unit 5 Practice Test, page 215

1.a) 2 **b)** $\frac{19}{30}$

c) $\frac{1}{4}$ **d)** $\frac{29}{18} = 1\frac{11}{18}$

2. Answers may vary. For example:

a) $\frac{1}{5} + \frac{2}{5} = \frac{3}{5}$ **b)** $\frac{1}{35} + \frac{4}{7} = \frac{3}{5}$

3. Answers may vary. For example:

a) $\frac{3}{8} - \frac{1}{8} = \frac{1}{4}$ **b)** $\frac{3}{4} - \frac{1}{2} = \frac{1}{4}$

4.a) $\frac{343}{40}$, or $8\frac{23}{40}$ **b)** $\frac{13}{10}$, or $1\frac{3}{10}$

5. $7\frac{3}{4}$ h; Answers may vary. For example: No, Lana cannot do all the jobs. If she allows at least 3 h to travel from one place to another and $\frac{1}{2}$ h for her lunch break, her total time is $11\frac{1}{4}$ h.

6.a) $\frac{1}{2} + \frac{1}{4} = \frac{3}{4}$ **b)** $\frac{1}{2} + \frac{1}{8} = \frac{5}{8}$

7. Answers may vary. For example:

Counter 1: $\frac{1}{6}$ and $\frac{7}{12}$, Counter 2: $\frac{5}{12}$ and $\frac{2}{3}$

Unit 6 Equations, page 218

6.1 Solving Equations, page 223

1.a) equation **b)** expression **c)** expression
d) equation **e)** expression **f)** equation

2.a) $w = 12$ **d)** $x = 96$ **f)** $z = 11$

3.a) $x - 10 = 35$ **b)** $x = 45$

4.a) $7 + n = 18$; $n = 11$ **b)** $n - 6 = 24$; $n = 30$
c) $5n = 45$; $n = 9$ **d)** $\frac{n}{6} = 7$; $n = 42$
e) $4n + 3 = 19$; $n = 4$

5.a) $14x = 182$; $x = 13$ **b)** $b - 14 = 53$; $b = 67$
c) $100 = 56 + 11p$; $p = 4$

6. For example: **a)** $4s = 48$ **b)** $s = 12$

7. For example: **a)** $\frac{p}{6} = 11$ **b)** $p = 66$

8. Answers may vary. For example:

a) The perimeter of a triangle is 27 cm. Write an equation you can solve to find the side length of the triangle.
b) $27 = 3t$ **c)** $t = 9$

9.a) $130 = 10 + 24f$ **b)** $f = 5$

10.a) $n = 9$ **b)** $n = 12$ **c)** $n = 15$ **d)** $n = 81$

11.a) $x = 3$ **b)** $y = 6$ **c)** $z = 2166$ **d)** $x = 5$

6.2 Using a Model to Solve Equations, page 229

1.a) A = 30 g **b)** B = 65 g
c) C = 50 g **d)** D = 21 g

2.b) **i)** $x = 7$
ii) $x = 14$
iii) $y = 3$
iv) $m = 7$
v) $k = 8$
vi) $p = 21$

3. i) **a)** $5 + n = 24$ **b)** $n = 19$
ii) **a)** $n + 8 = 32$ **b)** $n = 24$
iii) **a)** $3n = 42$ **b)** $n = 14$
iv) **a)** $2n + 5 = 37$ **b)** $n = 16$

4.a) $60 = 12h$; $h = 5$ m **b)** $112 = 8h$; $h = 14$ cm
c) $169 = 13h$; $h = 13$ m

5.a) Left pan: x and 35 g; right pan: 35 g and 25 g
b) $x = 25$

6. Problems may vary. For example:

a) Helen is 16 years old. Kian is 4 years younger than Helen. How old is Kian?
b) Helen is 4 years older than Kian. Kian is 16 years old. How old is Helen?
c) Part a: $x = 12$; part b: $x = 20$

7. Answers may vary. The sum of the digits should be a multiple of nine. For example:
$5 + x + 7 = 18$, $x = 6$;
567 is divisible by 9.

6.3 Solving Equations Involving Integers, page 234

1.a) $x = 4$ **b)** $x = 7$ **c)** $x = 10$
d) $x = 12$ **e)** $x = 13$ **f)** $x = 14$

2.a) $n = 13$ **b)** $x = 2$ **c)** $p = 7$
d) $x = -5$ **e)** $s = -14$ **f)** $x = 3$

3. $x = 17$

4. $f - 6 = 5$; $f = 11$

5.a) $t - 8 = -3$ **b)** $t = 5$

6.a) $x = 7$ **b)** $n = 19$

7.a) $n + 2 = 4$; $+2$
b) $n - 2 = 1$; $+3$
c) $n - 4 = -2$; $+2$

Unit 6 Mid-Unit Review, page 236

1.a) **i)** $5 + d = 12$; $d = 7$
ii) $2d = 12$; $d = 6$
b) **i)** $67 + s = 92$; $s = 25$
ii) $3w + 8 = 29$; $w = 7$

2. i) **a)** $n + 9 = 17$ **c)** $n = 8$
ii) **a)** $3n = 21$ **c)** $n = 7$
iii) **a)** $7 + 2n = 19$ **c)** $n = 6$

3. $40 = 14 + 2B$; Bill is 13 years old.

4. i) **a)** $n - 8 = 7$ **c)** $n = 15$
ii) **a)** $t - 6 = -4$ **c)** $t = 2$
iii) **a)** $m - 7 = 5$ **c)** $m = 12$

6.4 Solving Equations Using Algebra, page 238

1.a) $x = 62$ **b)** $x = 12$ **c)** $x = 17$

2.a) $19 + n = 42$; $n = 23$

b) $3n + 10 = 25$; $n = 5$

c) $15 + 4n = 63$; $n = 12$

3.a) $27 = 5 + 2J$ **b)** $J = 11$

4.a) $33 = 3 + 6h$ **b)** $h = 5$

5.a) $25 = 4 + 7x$ **b)** $x = 3$

6.a) $56 = 24 + 4s$ **b)** $s = 8$

7.a) $72 + 24w = 288$ **b)** $w = 9$; After 9 weeks

8. Problems may vary. For example:

a) Sarah spent $9 at the bowling alley. How many games did she bowl?

b) $9 = 3 + 2g$; $g = 3$

9.a) 17 **b)** 13 **c)** 27

6.5 Using Different Methods to Solve Equations, page 243

1.a) $x = 8$ **b)** $x = 21$ **c)** $x = 64$ **d)** $x = 50$

2. Methods may vary.

a) $x = 7$ **b)** $x = 17$

c) $x = 54$ **d)** $x = -13$

e) $x = 9$ **f)** $x = 7$

g) $x = 7$ **h)** $x = 11$

3.a) $x + 7 = 21$; $x = 14$

4. $\frac{c}{8} = 4$; $c = 32$

6.a) For example: $20 + 8m = 92$; $m = 9$

b) Methods may vary. For example: I used algebra.

7.a) $37 = 5 + 4g$; $g = 8$ **b)** $37 = 10 + 9g$; $g = 3$

8.a) $85 = 40 + 15n$; $n = 3$

b) $140 = 90 + 10n$; $n = 5$

9.b) Answers may vary. For example:
$15 + 8 + 12 = 35$ or $25 + 8 + 2 = 35$

Unit 6 Reading and Writing in Math: Decoding Word Problems, page 247

1. One group of 6 rows by 6 columns; 4 groups of 3 rows by 3 columns; 9 groups of 2 rows by 2 columns

2. 144 fence posts

3. 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

Unit 6 Unit Review, page 248

1. $x = 13$; Jan started with 13 stamps.

2.a) $5 + n = 22$; $n = 17$ **b)** $n - 7 = 31$; $n = 38$

c) $6n = 54$; $n = 9$ **d)** $\frac{n}{8} = 9$; $n = 72$

e) $9 + 3n = 24$; $n = 5$

3.a) $m - 36 = 45$; $m = 81$ **b)** $13b = 208$; $b = 16$

c) $\frac{d}{15} = 17$; $d = 255$

4.a) $27 = 15 + x$; $x = 12$

b) $25 = 2x + 11$; $x = 7$

5.a) $x = 6$ cm **b)** $x = 16$ cm

6.a) $81 = 25 + 8c$; $c = 7$

7.a) $x = 3$ **b)** $n = -3$ **c)** $w = 15$ **d)** $x = 15$

8.a) $5 + x = -7$, $y - 5 = 7$

b) $x = -12$, $y = 12$

9. i) a) $-8 + x = 3$ **b)** $x = 11$

ii) a) $3 + y = -1$ **b)** $y = -4$

10.a) $56 = 7n$ **b)** $n = 8$

11.a) $400 = 140 + x$ **b)** $x = 260$

12.a) $228 = 4p$ **b)** $p = 57$

13.a) $x = 19$ **b)** $x = 7$ **c)** $x = 45$ **d)** $x = 8$

14.a) $x = 12$ **b)** $x = -10$ **c)** $x = 3$

d) $x = 7$ **e)** $x = 99$ **f)** $x = 13$

15. $25 = 1 + 3b$; $b = 8$

16.a) $545 = 125 + 12m$ **b)** $m = 35$

Unit 6 Practice Test, page 251

1.a) $x = 2$ **b)** $p = 14$

c) $c = 63$ **d)** $q = 13$

2.a) $44 = 4h$; $h = 11$

b) $50 = 2b + 32$; $b = 9$

3.a) 10 km

b) 48 km

c) 58 km

4.a) $47 = 12 + 5d$; $d = 7$ **b)** $107 = 12 + 5d$; $d = 19$

5.a) $75 + 3 \times 25$ **b)** $204 = 75 + 3s$; $s = 43$

Cumulative Review Units 1–6, page 254

1.a) 1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 20, 24, 30, 40, 60, 120

b) 1, 2, 3, 4, 6, 7, 12, 14, 21, 28, 42, 84

c) 1, 2, 3, 4, 6, 8, 9, 12, 18, 24, 27, 36, 54, 72, 108, 216

2.a) $x + 7 = 19$

b) $x = 12$

3.a) -8 **b)** -10 **c)** $+9$

4.a) -6 **b)** $+12$

c) $+6$ **d)** -12

5. Answers may vary. For example:

a) $1.\overline{6}$ **b)** 0.6

c) 2.2 **d)** 2.75

6. 56.16 m^2

7.a) $71.99

b) $82.07

8.a) Too many to count

b) Too many to count

9.a) About 37.7 cm

10. Greatest area: part b; least area: part c

11.a) 50 m

b) About 7.96 m

c) About 199.06 m^2

12.a) 120 students

b) Black: $\frac{60}{120} = \frac{1}{2}$; brown: $\frac{20}{120} = \frac{1}{6}$; blonde: $\frac{30}{120} = \frac{1}{4}$; red: $\frac{10}{120} = \frac{1}{12}$

c) Black: 50%; brown: about 17%; blonde: 25%; red: about 8%

13. $\frac{17}{24}$ cup of sugar

14.a) $\frac{23}{30}$ **b)** $\frac{5}{12}$

c) $\frac{13}{24}$ **d)** $\frac{17}{36}$

15. $\frac{5}{8}$

16.a) $8\frac{11}{12}$ **b)** $\frac{19}{30}$

c) $5\frac{4}{15}$ **d)** $1\frac{5}{24}$

17.a) **i)** $s = 5$

ii) $s = 9$

iii) $s = 9$

iv) $s = 6$

18.a) $x = 6$ **b)** $x = 17$

19.a) $7x + 5 = 250$

b) $x = 35$; Juan worked 35 h.

20.a) $x + 3 = 10$; $x = 7$

Shin's score after Round One was +7.

b) $x - 1 = -4$; $x = -3$

Lucia's score after Round One was –3.

Unit 7 Data Analysis, page 256

7.1 Mean and Mode, page 260

1.a) 4

b) 3

c) 3

2.a) 6

b) 34

3.a) 4

b) no mode

4.a) $13

b) $15

c) The mean is $14.50. The mode remains the same: $15

5.a) Mean: 29.5; mode: 18

b) Answers will vary. For example: 10, 13, 15, 15, 21, 28, 36, 36, 45, 54, 60

6.

	Mean	Mode
a) Games Played	55	no mode
b) Goals	23.25	no mode
c) Assists	29	39
d) Points	52.25	no mode

7.a) Volleyball and soccer

b) I could count the number of bars of equal length.
The length which occurs most often is the mode. Mode: 750 people

c) About 1003

8.a) Any pair of numbers whose sum is 11: 0 and 11, 1 and 10, 2 and 9, 3 and 8, 4 and 7, 5 and 6

b) 3 and 8

7.2 Median and Range, page 264

1.a) Median: 90; range: 20

b) Median: 25.5 kg; range: 73 kg

2.a) Class A: 12.5; Class B: 12

b) Class A: 7; Class B: 4

c) Class A; Class A's median mark is greater.

3.a) **i)** Mean: 7; median: 7; no mode

ii) Mean: 60; median: 60; modes: 50, 70

iii) Mean: 56; median: 68; mode: 71

iv) Mean: 13; median: 13; mode: 13

b) i, ii, and iv; iv; iii

4. Answers may vary. For example:

a) 85, 90, 100, 100, 110, 115

b) 80, 85, 100, 100, 105, 110

5. Answers may vary. For example (in cm):

a) 135, 143, 146, 155, 158, 158, 160, 163, 164, 166

b) 150, 154, 158, 163, 163, 163, 165, 170, 174, 178

6.a) Median: 120 s; mode: 118 s

b) 122 s

c) The mean would be most affected.
The mean increases to 135.7 s.
The mode remains 118 s.
The median increases to 122 s.

7. a)

	Mean	Median	Mode
Games	12.4	12	11
Goals	9.7	6	3
Assists	10.9	10.5	4
Points	20.7	17	10
Penalty Minutes	18.3	8	2 and 8

8. Edward's answer is correct.

7.3 The Effects of Outliers on Average, page 269

1.a) Mean: 4.96 min; median: 5 min; mode: 5 min
b) The outliers are 0, 1, 2.
c) Mean: about 5.8 min; median: 5 min; mode: 5 min
The mean increases. The median and the mode remain the same.
2.a) Mean: 21.35 min; median: 18 min; mode: 15 min
b) The outlier is 95 min.
Explanations may vary.
c) Mean: about 17.47 min; median: 18 min; mode: 15 min
The mean decreases. The median and the mode remain the same.
d) About 18 min; Bryan should use the median time to answer.
3.a) Mean: 34.4; median: 36; mode: 36
b) The outlier is 4.
c) Mean: about 36.6; median: 36; mode: 36
The mean increases. The median and the mode remain the same.
d) No. The outlier is a recording error.
4.a) Mean: about 67.6; median: 68; modes: 65 and 68
b) The outlier is 0.
c) Mean: about 73.7; median: 68; modes: 65 and 68
The mean increases. The median and the modes remain the same.
d) No. The outlier does not represent the data.
5.a) Examples will vary. For example:
The outliers should be ignored when reporting pulse rates.
b) Examples will vary. For example:
The outliers cannot be ignored when reporting average daily temperatures.
6.a) 460 raisins
b) **i)** Mean: About 454.5; median: 465; no mode
ii) 400 and 499
iii) Mean: About 455.2; median: 465; no mode; The mean increases. The median and the mode remain the same.
iv) Yes. These outliers provide important information.
v) No. The mean is significantly less than 460.
7.a) Mean: 5; median: 5; mode: 5 **b)** 19

7.4 Applications of Averages, page 273

1.a) Mean: About 26.4°C; median: 27°C; modes: 23°C and 28°C
b) The mean best describes the daily high temperature.
c) No. Explanations may vary. For example: The weather channel reported one of the mode temperatures. The mean and the median are significantly higher than 23°C.
2.a) Math: Mean: About 74.6; median: 75; no mode
Music: Mean: About 77.3; median: 81; mode: 81
French: Mean: About 74.4; median: 74; mode: 74
b) The mean is not one of Caitlin's marks. The median is the middle value in each ordered set of marks. The mode represents the mark that occurs most often.
c) Caitlin is best at music because the mean, median, and mode are highest for this subject. Caitlin is worst at French because the mean, median, and mode are lowest for this subject.
3.a) Week 1: Mean: $825; median: $800; no mode
Week 2: Mean: $825; median: $775; no mode
b) Mean: $825; median: $787.50; mode: $600
c) The means are the same. The medians and modes are different.
d) The median best represents the tips earned.
4.a) Mean: About $62 667; median: $50 000; modes: $50 000 and $28 000
b) $102 000
c) **i)** Mean **ii)** The lesser mode
5.a) Yes **b)** No
6.a) Mode **b)** Mean **c)** Median
7.a) Mean: About 395.3 g; median: 395 g; mode: 405 g
b) 25 g **c)** Mode
8. a) **i)** 85% **ii)** 90% **iii)** 95%

b) No, Andrew cannot get a mean mark of 84% or higher because he would need a math mark greater than 100%.

9. No, Celia's reasoning is not correct. Her mean mark is 83.5%.

Technology: Using Spreadsheets to Investigate Averages, page 277

1.a) Mean: About $15.68; median: $15; mode: $9

2.a) Mean: About $51.23; median: $47.19; mode: $34.45

3. Mean: 110.9; median: 113; no mode

Unit 7 Mid-Unit Review, page 278

1.a) Mean: 165 cm; median: 166 cm; mode: 170 cm

b) 20 cm

2. Answers may vary. For example: 13, 15, 23, 24, 25; 5, 17, 23, 25, 30

3.a) Mean: About $82.13; median: $75; mode: $75

b) The outlier, $20, may be a recording error. The outlier, $229, may be the rate charged for a luxury suite.

c) Mean: About $76.07; median: $75; mode: $75
The mean decreases. The median and the mode remain the same.

d) The outlier, $20, is a recording error and should not be used. The outlier, $229, is an actual rate and should be used.

4.a) Mean: About 99.8 g; median: About 99.8 g; mode: 100.3 g

b) Mode

5.b) False

7.5 Different Ways to Express Probability, page 282

1.a) $\frac{1}{3}$, or about 33.3%, or 1:3

b) 0, or 0%

c) $\frac{2}{16}$, or $\frac{1}{8}$, or 12.5%, or 1:8

b) 1, or $\frac{100}{100}$, or 100%, or 1:1

2.a) $\frac{14}{54}$, or $\frac{7}{27}$, or about 26%, or 7:27

b) $\frac{12}{54}$, or $\frac{2}{9}$, or about 22%, or 2:9

3.a) $\frac{1}{250}$, or 0.4%, or 1:250

b) $\frac{10}{250}$, or $\frac{1}{25}$, or 4%, or 1:25

c) $\frac{225}{250}$, or $\frac{9}{10}$, or 90%, or 9:10

4.a) $\frac{5}{20}$, or $\frac{1}{4}$, or 25%, or 1:4

b) $\frac{11}{20}$, or 55%, or 11:20

c) 1, or 100%, or 1:1

d) 0, or 0%, or 0:20

e) $\frac{1}{20}$, or 5%, or 1:20

5.a) $\frac{1}{8}$, or 12.5%, or 1:8

b) $\frac{7}{8}$, or 87.5%, or 7:8

c) $\frac{4}{8}$, or $\frac{1}{2}$, or 50%, or 1:2

d) $\frac{4}{8}$, or $\frac{1}{2}$, or 50%, or 1:2

e) 0, or 0%, or 0:8 **f)** 1, 100%, 1:1

6. Answers may vary. For example:
You roll a die.

a) The probability of getting a number less than 10

b) The probability of getting an even number

c) The probability of getting a 4

d) The probability of getting a 7

7. I divided the spinner into 10 equal sectors: 2 red, 5 yellow, 1 blue, and 2 green

8.a) The third candy is most likely white.

b) $\frac{3}{7}$, or about 43%, or 3:7

c) $\frac{4}{7}$, or about 57%, or 4:7

7.6 Tree Diagrams, page 287

1.a) 3H, 3T, 4H, 4T, 5H, 5T, 6H, 6T, 7H, 7T, 8H, 8T
The outcome of rolling a die does not depend on the outcome of tossing a coin.

b) 1B, 1Y, 1P, 2B, 2Y, 2P, 3B, 3Y, 3P, 4B, 4Y, 4P
The outcome of rolling a tetrahedron does not depend on the outcome of spinning the pointer on a spinner.

c) 1, 1; 1, 2; 1, 3; 1, 4; 1, 5; 1, 6; 2, 1; 2, 2; 2, 3; 2, 4; 2, 5; 2, 6; 3, 1; 3, 2; 3, 3; 3, 4; 3, 5; 3, 6; 4, 1; 4, 2; 4, 3; 4, 4; 4, 5; 4, 6; 5, 1; 5, 2; 5, 3; 5, 4; 5, 5; 5, 6; 6, 1; 6, 2; 6, 3; 6, 4; 6, 5; 6, 6
The outcome of rolling one die does not depend on the outcome of rolling the other die.

2. Aseea; $\frac{3}{4}$ is greater than $\frac{1}{3}$.

3. Answers may vary. For example:
The probability of rolling an even number

4. The probability of rolling both numbers greater than 4 is: $\frac{4}{36}$, or $\frac{1}{9}$

5. a)

Seat Colour	Paint Colour:	Black	Blue	Red	Silver	Gold
	Grey	Gr, Bla	Gr, Blu	Gr, R	Gr, S	Gr, G
	Black	Bla, Bla	Bla, Blu	Bla, R	Bla, S	Bla, Go

b) $\frac{2}{10}$, or $\frac{1}{5}$, or 20%

6. The player should choose to roll the tetrahedron twice to have the greatest probability of winning.

Unit 7 Unit Review, page 292

1.a) Under par: 10; at par: 2; over par: 7
b) 26
c) Mean: About 34.3; median: 35; mode: 33

2. Answers will vary.
For example: 4, 5, $6\frac{1}{2}$, $6\frac{1}{2}$, 7, $7\frac{1}{2}$, 8,
or 4, 5, 5, 6, 7, 8, 8, 9

3.a) Mean: 12.6 h; median: 13.5 h; mode: 15 h
b) 3 h
c) Mean: About 13.7 h; median: 15 h; mode: 15 h
The mean and median decrease. The mode remains the same.
d) No. The outlier is not typical of the number of hours Josephine works in a week.

4.a) Mean: About 46.3 min; median: 40.5 min; mode: 47 min
b) 8 min, 74 min, 125 min
Mean: About 40.1 min; the mean decreases.
So, it is greatly affected by the outliers.
c) Median
d) Yes, the outliers are actual times spent by students on math homework.

5.a) Mean: 122 s; median: 119.5 s; mode: 118 s
b) Median **c)** 19 s
d) Annette must get a time greater than or equal to 120 s in her next run.
e) 113 s; unlikely

6.a) Mode **b)** Median **c)** Mean **d)** Median

7.a) $\frac{10}{20}$, or $\frac{1}{2}$, or 50%, or 1:2

b) $\frac{5}{20}$, or $\frac{1}{4}$, or 25%, or 1:4

c) $\frac{8}{20}$, or $\frac{2}{5}$, or 40%, or 2:5

d) 0, or 0%, or 0:20 **e)** 1, or 100%, or 1:1

8.a) 2, 3, 4, 6, 8, 9, 12
b) The probability of getting a product of 2, 3, 8, 9, and 12: $\frac{1}{9}$
The probability of getting a product of 4 and 6: $\frac{2}{9}$
c) 2, 3, 8, 9, and 12; 4 and 6
d) $\frac{8}{9}$

9.b) **i)** $\frac{1}{3}$ **ii)** $\frac{1}{3}$
iii) $\frac{1}{9}$ **iv)** $\frac{1}{9}$

11. No, each player has a 50% probability of winning and each prize has a greater value than the cost.

Unit 7 Practice Test, page 295

1.a) 243.25 s **b)** 208 s
c) 158 s **d)** 237.5 s

2.a) Mean: about 7.8; median: 7.25; mode: 7
b) 18
c) Mean: about 7.3; median: 7; mode: 7
The mean and the median decrease.
The mode remains the same.
d) No. The outlier is a recording error.

3.a) ii) **b)** i **c)** iv **d)** iii

Unit 8 Geometry, page 298

8.1 Parallel Lines, page 302

1. Parts a and c

4. Answers may vary. For example:
Use tracing paper.

5. Answers may vary. For example:
Shelves on a bookshelf

6. JE and AB, CL and BK, BE and AF, BF and GK, AF and GK

8.2 Perpendicular Lines, page 305

1. Parts a and b

4. Answers may vary. For example: Book covers, desks, floor, ceiling

5. AE and FR, BR and KL, AE and AC, AC and BL, FH and GJ, ED and DL, FR and RB

8.3 Constructing Perpendicular Bisectors, page 308

1.b) The distance from C and the distance from D to any point on the perpendicular bisector are the same.

2.b) Any point on the perpendicular bisector is the same distance from E as from F.

4.b) The distances from A and from B to the point on the perpendicular bisector are equal.

5.a) Circles intersect only once, at the midpoint of the line segment.

b) Circles do not intersect.

7. Answers may vary. For example: Ceiling or floor tiles

9.a) Connect the points to form a triangle; draw the perpendicular bisector of each side. The point where the bisectors meet is the centre of the circle through the points.

b) Repeat the construction in part a.

8.4 Constructing Angle Bisectors, page 312

1. Yes

2. Yes

3.a) The two angles formed by the bisector will measure 25°.

b) The two angles formed by the bisector will measure 65°.

4. Methods may vary. For example: Use a Mira; use a plastic right triangle; use paper folding.

5. Answers may vary. For example: A ruler and a compass allow for a more accurate construction.

6.c) Two; Opposite angles have the same bisector.

7. c) i) Yes **ii)** Yes **iii)** No

8. Answers may vary. For example: Frame of a kite

9.a) The two angles are equal.

b) The centre of the circle is at the intersection of the folded creases.

c) The folding constructed angle bisectors.

Unit 8 Mid-Unit Review, page 314

2.a) AH and CE and FL and GN, AC and HE, FH and EN

b) EH and FL, AC and CE, CE and EH, AH and HE, AH and AC, GN and EH

3.c) Angle measures should be equal.

4.c) Isosceles triangle; AD = BD; CD bisects $\angle ADB$.

5.c) Angle measures should be equal.

8.5 Graphing on a Coordinate Grid, page 318

1. Each grid square represents 5 units. A(10, 15); B(0, 25); C(5, –10); D(–30, 0); E(0, –25); F(0, 0); G(–5, –5); H(–25, 15); J(20, 0); K(–25, –30).

2.a) B, E, and F

b) D, F, and J

c) B, E, and F; H and K

d) D, F, and J; A and H

e) F and G

f) none

3. Answers may vary. For example: Each grid square represents 5 units. O is the origin.

5. Quadrant 3; Quadrant 1; Quadrants 2 and 4

6.c) 16-sided shape with 4 lines of symmetry that intersect at (0, 2). The vertical line of symmetry coincides with the y-axis.

8.a) 8 cm

b) 11 cm

10. Too many to count. For example: A(0,0), B(4, 0), C(5, 3), D(1, 3)

11.b) N(–15, –10)

12.a) Answers may vary. For example: Each grid square represents 2 units.

b) 442 units^2

13. Answers may vary. For example: C(2, 10) and D(–4, 10); C(2, –2) and D(–4, –2); C(–1, 7) and D(–1, 1)

8.6 Graphing Translations and Reflections, page 322

1.a) Reflection

b) Translation

2.a) 3 units left and 9 units up

b) 2 units left and 3 units down

c) 2 units right and 4 units up

d) 3 units left and 2 units down

e) 6 units left

f) 4 units up

3.a) A and C; C is the image of A after a translation 10 units right and 7 units down.

b) B and C; C is the image of B after a reflection in the x-axis.

4. P(2, 3), Q(–2, 2), R(1, –1), S(–1, –3), T(4, –4)

a) P'(–1, 5), Q'(–5, 4), R'(–2, 1), S'(–4, –1), T'(1, –2); the pentagons have the same orientation.

b) P'(2, –3), Q'(–2, –2), R'(1, 1), S'(–1, 3), T'(4, 4); the pentagons have different orientations.

c) P'(–2, 3), Q'(2, 2), R'(–1, –1), S'(1, –3), T'(–4, –4); the pentagons have different orientations.

5.a) A'(1, –3), B'(3, 2), C'(–2, –5), D'(–1, 4), E'(0, 3), F(–2, 0); the sign of each *y*-coordinate changes.

b) A'(–1, 3), B'(–3, –2), C'(2, 5), D'(1, –4), E'(0, –3), F(2, 0); the sign of each *x*-coordinate changes.

c) The coordinates of the image should match the patterns in parts a and b.

6.b) A(1, 3), B(3, –2), C(–2, 5), D(–1, –4), E(0, –3), F(–2, 0); A'(–3, 1), B'(–1, –4), C'(–6, 3), D'(–5, –6), E'(–4, –5), F'(–6, –2); Each *x*-coordinate decreases by 4. Each *y*-coordinate decreases by 2.

c) Use the pattern in part b: add the number of units moved to the right or subtract the number of units moved to the left from the *x*-coordinate. Add the number of units moved up or subtract the number of units moved down from the *y*-coordinate.

7.b) The line segments are horizontal. The *y*-axis is the perpendicular bisector of each line segment.

8.b) A'(6, 10), B'(8, 10), C'(8, 8), D'(10, 8), E'(10, 12)

c) A"(–6, 10), B"(–8, 10), C"(–8, 8), D"(–10, 8), E"(–10, 12)

d) Answers may vary. For example: ABCDE and A"B"C"D"E" are congruent, but have different orientations.

9.e) Translation 12 units right and 6 units down

10. Answers may vary. For example: The shape has a line of symmetry that is parallel to the mirror line.

8.7 Graphing Rotations, page 327

1.a) 90° clockwise about the origin or 270° counterclockwise about the origin

b) 180° about the origin

2. The shape was rotated 90° clockwise about the origin (Image 1), reflected in the *x*-axis (Image 2), translated 5 units right and 5 units down (Image 3).

3.a) D(–2, –1), E(–5, –3), F(–1, –5)

b) D'(–1, 2), E'(–3, 5), F'(–5, 1)

c) D"(–1, 2), E"(–3, 5), F"(–5, 1)

d) Yes. The images in parts b and c are the same.

4.a) A'(–2, –5), B'(3, –4), C'(–4, 1)

b) **i)** OA = OA'
ii) OB = OB'
iii) OC = OC'

c) **i)** 180° **ii)** 180° **iii)** 180°
All angles measure 180°.

d) A rotation of –180° about the origin

5.a) A'(5, –2), B'(4, 3), C'(–1, –4)

b) **i)** OA = OA' **ii)** OB = OB'
iii) OC = OC'

c) **i)** 90° **ii)** 90° **iii)** 90°
All angles measure 90°.

d) A rotation of 270° about the origin

6.a) A(6, 0), B(6, 2), C(5, 3), D(4, 2), E(2, 2), F(2, 0)

b) A'(0, 2), B'(0, 4), C'(–1, 5), D'(–2, 4), E'(–4, 4), F'(–4, 2)

c) A"(–2, 0), B"(–4, 0), C"(–5, –1), D"(–4, –2), E"(–4, –4), F"(–2, –4)

d) Answers may vary. For example: ABCDEF and A"B"C"D"E"F" are congruent and have the same orientation.

7.c) The images coincide. A rotation of 180° is equivalent to a reflection in one axis followed by a reflection in the other axis.

i) Yes
ii) Yes

8. Answers may vary. For example:

b) Rotation about U: R'(2, –4), S'(–3, –4), T'(–3, –1), U(2, –1)

c) Second rotation about U: R"(5, –1), S"(5, –6), T"(2, –6), U(2, –1)
Third rotation about U: R'"(2, 2), S'"(7, 2), T'"(7, –1), U(2, –1)

d) After each 90° rotation counterclockwise about a vertex, the horizontal sides of rectangle RSTU become vertical and the vertical sides become horizontal.

e) Yes. A 90° rotation clockwise about U

9.a) C'(2, –6), D'(3, 3), E'(5, 7); C'(–6, –2), D'(3, –3), E'(7, –5)

b) P'(6, –2), Q'(–3, –3), R'(–7, –5); P'(6, 2), Q'(–3, 3), R'(–7, 5)

c) No

Unit 8 Unit Review, page 335

2.c) The height of ΔCDE

5.a) Scales may vary. For example: Each grid square represents 5 units.

b) A: Quadrant 3, B: Quadrant 4, C: Quadrant 1, D: Quadrant 2

c) Parallelogram; Area = 2500 units^2

6.a) Quadrant 4

b) Quadrant 3

c) Quadrant 2

d) Quadrant 1

7.a) **i)** 12 units **ii)** 11 units
b) **i)** 8 units **ii)** 6 units
8. (–1, 1) and (3, –1)
9.a) PQRS has only one pair of parallel sides.
b) P'(7, 1), Q'(11, 1), R'(9, 3), S'(7, 3)
c) P"(7, –1), Q"(11, –1), R"(9, –3), S"(7, –3)
d) PQRS and P"Q"R"S" are congruent, but have different orientations.
10.b) P'(3, –1), Q'(7, –1), R'(5, –3), S'(3, –3)
c) P"(7, –1), Q"(11, –1), R"(9, –3), S"(7, –3)
Yes, the image remains the same when the translation and rotation are reversed.
11.c) All the images are congruent.
Under the translation and rotation, the images have the same orientation as quadrilateral ABCD. Under the reflection, the orientation of the image is changed.
12.a) A would be in Quadrant 4, B would be on the negative x-axis, between Quadrants 2 and 3, C would be in Quadrant 2.
b) Reflection
c) A 90° or 270° (–90°) rotation
13.b) C'(1, 1), D'(–9, 7), E'(1, 7)
c) C"(–1, 1), D"(–7, –9), E"(–7, 1)
d) ABC and A"B"C" are congruent; they have the same orientation.

Unit 8 Practice Test, page 337

4.b) A'(–4, –3), B'(2, –3), C'(1, 1), D'(–3, 0)
c) A'(2, 4), B'(8, 4), C'(7, 8), D'(3, 7)
d) A translation 4 units right and 4 units up
e) The image remains the same.

Cumulative Review Units 1–8, page 342

1.a) $4n + 2$
c) The graph goes up to the right.
When the Input number increases by 1, the Output number increases by 4.
2.a) \$145; \$185
b) $85 + 2s$
c) $85 + 4s$
d) $170 + 2s$
3.a) **i)** $(+4) + (-5) = -1$
ii) $(+1) + (-7) = -6$
4.a) High: –4°C; low: –13°C
b) +9°C or –9°C
5.a) About 9
b) About 3
c) About 35
d) About 249
6.a) \$28.89 **b)** Yes; Justin spent \$3.89 more.
7.a) 75%, 0.75
b) 28%, 0.28
c) 90%, 0.9
d) 4%, 0.04
8. 20 cm; I assume the medium-sized circles touch the large circle and each other.
9.a) About 58 cm
b) About 182.21 cm
c) About 182 cm
d) About 5 rotations
10.a) 8.64 cm^2
b) 10.125 cm^2
11.a) $\frac{8}{10} = \frac{4}{5}$
b) $\frac{5}{12}$
c) $\frac{9}{8} = 1\frac{1}{8}$
d) $\frac{13}{12} = 1\frac{1}{12}$
12.a) About 2 cups more
b) $\frac{43}{24} = 1\frac{19}{24}$ cups
13.a) **i)** $x - 1 = -2$
ii) $x + 1 = -3$
b) **i)** $x = -1$
ii) $x = -4$
14.a) $9x = 63$; $x = 7$; \$7
b) $x - 27 = 61$; $x = 88$; 88 lures
15.a) \$171 000
b) The mean prize is greater than the median: About 179 571
c) 79 000
16.a) Mean = 34; median = 33.5; mode = 30
b) **i)** Mean = 44; median = 43.5; mode = 40
The mean, median, and mode increase by 10.
ii) Mean = 68; median = 67; mode = 60
The mean, median, and mode double.
17.a) Mean $\doteq 308.4$; median = 305; mode = 305
b) Outlier: 395
Mean $\doteq 304.3$; median = 305; mode = 305
The mean decreases. The median and the mode remain the same.
18.a) Mean = \$8.30, median $\doteq$ \$7.88; mode = \$7.75
b) Mean
c) Outliers: \$10.00 and \$12.50
Mean $\doteq$ \$7.97; median = \$7.75; mode = \$7.75
The mean and the median decrease.
The mode remains the same.
19. False

20.a) $\frac{1}{6}, 0.1\overline{6},$ about 16%

b) $\frac{100}{100}$, 1, 100%

c) 0, 0%

21.a) There are 48 possible outcomes: 1, 1; 1, 2; 1, 3; 1, 4; 1, 5; 1, 6; 2, 1; 2, 2; 2, 3; 2, 4; 2, 5; 2, 6; 3, 1; 3, 2; 3, 3; 3, 4; 3, 5; 3, 6; 4, 1; 4, 2; 4, 3; 4, 4; 4, 5; 4, 6; 5, 1; 5, 2; 5, 3; 5, 4; 5, 5; 5, 6; 6, 1; 6, 2; 6, 3; 6, 4; 6, 5; 6, 6; 7, 1; 7, 2; 7, 3; 7, 4; 7, 5; 7, 6; 8, 1; 8, 2; 8, 3; 8, 4; 8, 5; 8, 6

b) The outcome of rolling an octahedron does not depend on the outcome of rolling a die.

c) $\frac{4}{48} = \frac{1}{12}$, or $0.08\overline{3}$, or about 8.3%

24. Answers may vary. For example: If both coordinates are positive, the point is in Quadrant 1. If the x-coordinate is negative and the y-coordinate is positive, the point is in Quadrant 2. If both coordinates are negative, the point is in Quadrant 3. If the x-coordinate is positive and the y-coordinate is negative, the point is in Quadrant 4.
If the x-coordinate is 0, the point is on the y-axis. If the y-coordinate is 0, the point is on the x-axis.

25.a) Each grid square represents 5 units.

d) H

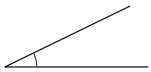
26.b) C′(–3, 9), D′ (1, 9), E′ (1, 3)

c) C″ (–3, –9), D″ (1, –9), E″ (1, –3)

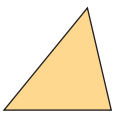
d) C‴(9, –3), D‴ (9, 1), E‴ (3, 1)

Illustrated Glossary

acute angle: an angle measuring less than 90°



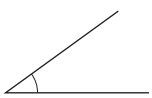
acute triangle: a triangle with three acute angles



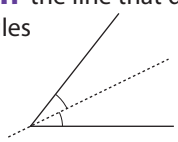
algebra tiles: a collective term for unit tiles and variable tiles

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

angle: formed by two rays from the same endpoint



angle bisector: the line that divides an angle into two equal angles



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

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

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 an object from which the height is measured

bisector: a line that divides a line segment or an angle into two equal parts

capacity: the amount a container can hold

Cartesian Plane: another name for a coordinate grid (see *coordinate grid*)

central angle: the angle between the two radii that form a sector of a circle

certain event: an event with probability 1, or 100%

chance: a description of a probability expressed as a percent

circle graph: a diagram that uses parts of a circle to display data

circumcentre: the point where the perpendicular bisectors of the sides of a triangle intersect (see *circumcircle*)

circumcircle: a circle drawn through all vertices of a triangle and with its centre at the circumcentre of the triangle

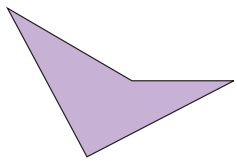
circumference: the distance around a circle, also known as the perimeter of the circle

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

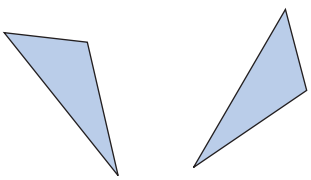
common factor: a number that is a factor of each of the given numbers; for example, 3 is a common factor of 15, 9, and 21

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°



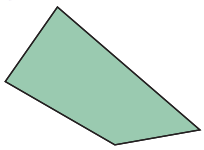
congruent: shapes that match exactly, but do not necessarily have the same orientation



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

constant term: the number in an expression or equation that does not change; for example, in the expression $4x + 3$, 3 is the constant term

convex polygon: has all angles less than 180°

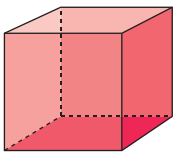


coordinate axes: the horizontal and vertical axes on a grid

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

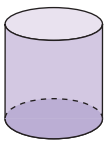
coordinates: the numbers in an ordered pair that locate a point on the grid (see *ordered pair*)

cube: an object with six congruent square faces



cubic units: units that measure volume

cylinder: an object with two parallel, congruent, circular bases

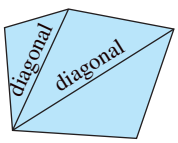


data: facts or information

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 shape, but is not a side



diameter: the distance across a circle, measured through its centre

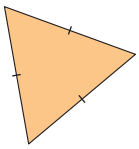
digit: any of the symbols used to write numerals; for example, in the base-ten system the digits are 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9

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

discount: the amount by which a price is reduced

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

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

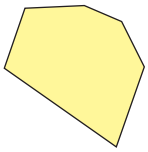
fraction strips: strips of paper used to model fractions

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

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

height: the perpendicular distance from the base of a shape to the opposite side or vertex; the perpendicular distance from the base of an object to the opposite face or vertex

hexagon: a six-sided polygon



horizontal axis: the horizontal number line on a coordinate grid

image: the shape that results from a transformation

impossible event: an event that will never occur; an event with probability 0, or 0%

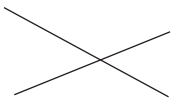
improper fraction: a fraction with the numerator greater than the denominator; for example, both $\frac{6}{5}$ and $\frac{5}{3}$ are improper fractions

independent events: two events in which the result of one event does not depend on the result of the other event

inspection: solving an equation by finding the value of the variable by using addition, subtraction, multiplication, and division facts

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

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



inverse operation: an operation that reverses the result of another operation; for example, subtraction is the inverse of addition, and division is the inverse of multiplication

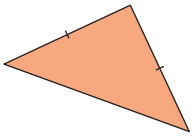
irrational number: a number that cannot be represented as a terminating or repeating decimal; for example, π

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

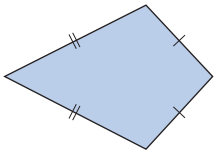
isosceles obtuse triangle: a triangle with two equal sides and one angle greater than 90°

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



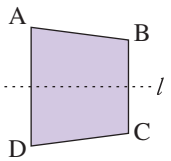
legend: part of a circle graph that shows what category each sector represents

linear relation: a relation whose points lie on a straight line

line graph: a graph that displays data by using points joined by line segments

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

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

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

measure of central tendency: a single number that represents a set of numbers (see *mean, median,* and *mode*)

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, …

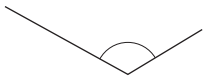
natural numbers: the set of numbers 1, 2, 3, 4, 5, …

negative number: a number less than 0

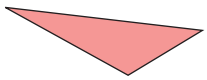
numerator: the term above the line in a fraction

numerical coefficient: the number by which a variable is multiplied; for example, in the expression $4x + 3$, 4 is the numerical coefficient

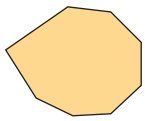
obtuse angle: an angle greater than 90° and less than 180°



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



octagon: an eight-sided polygon



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

ordered pair: two numbers in order, for example, (2, 4); on a coordinate grid, the first number is the horizontal coordinate of a point, and the second number is the vertical coordinate of the point

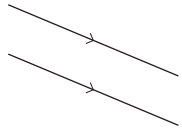
order of operations: the rules that are followed when simplifying or evaluating an expression

origin: the point where the *x*-axis and the *y*-axis intersect

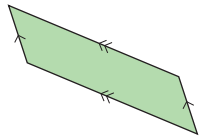
outcome: a possible result of an experiment or a possible answer to a survey question

outlier: a number in a set that is significantly different from the other numbers

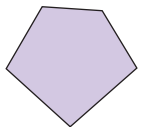
parallel lines: lines on the same flat surface that do not intersect



parallelogram: a quadrilateral with both pairs of opposite sides parallel



pentagon: a five-sided polygon



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

percent circle: a circle divided into 10 congruent sectors, with each sector further divided into 10 parts; each part is 1% of the circle

perimeter: the distance around a closed shape

perpendicular bisector: the line that is perpendicular to a line segment and divides the line segment into two equal parts

perpendicular lines: intersect at 90°

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

polyhedron (*plural,* polyhedra): an object with faces that are polygons

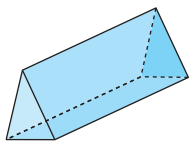
population: the set of all things or people being considered

positive number: a number greater than 0

prediction: a statement of what you think will happen

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

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

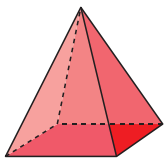


probability: the likelihood of a particular outcome; the number of times a particular outcome occurs, written as a fraction of the total number of outcomes

product: the result when two or more numbers are multiplied

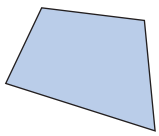
proper fraction: a fraction with the numerator less than the denominator; for example, $\frac{5}{6}$

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



quadrant: one of four regions into which coordinate axes divide a plane

quadrilateral: a four-sided polygon



quotient: the result when one number is divided by another

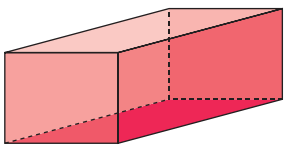
radius (*plural,* radii): the distance from the centre of a circle to any point on the circle

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

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

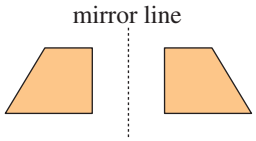
rectangle: a quadrilateral that has four right angles

rectangular prism: a prism that has rectangular faces



rectangular pyramid: a pyramid with a rectangular base

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



reflex angle: an angle between 180° and 360°

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

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

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

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

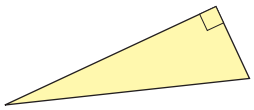
relation: a variable compared to an expression that contains the variable

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, $\frac{1}{11} = 0.\overline{09}$

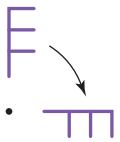
rhombus: a parallelogram with four equal sides

right angle: a 90° angle

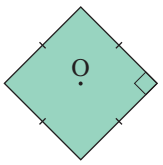
right triangle: a triangle that has one right angle



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



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



sample/sampling: a representative portion of a population

sample space: a list of all possible outcomes for an experiment that has independent events

scale: the numbers on the axes of a graph

scalene triangle: a triangle with all sides different

sector: part of a circle between two radii and the included arc

sector angle: see *central angle*

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

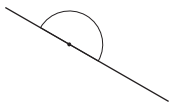
spreadsheet: a computer-generated arrangement of data in rows and columns, where a change in one value results in appropriate calculated changes in the other values

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

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

straight angle: an angle measuring 180°



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

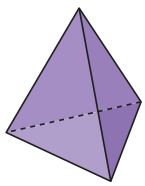
symmetrical: possessing symmetry (see *line symmetry* and *rotational symmetry*)

systematic trial: solving an equation by choosing a value for the variable, then checking by substituting

term: (of a fraction) the numerator or the denominator of the fraction

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

tetrahedron: an object with four triangular faces; a triangular pyramid

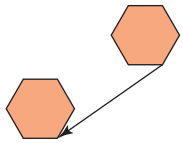


theoretical probability: the number of favourable outcomes written as a fraction of the total number of possible outcomes

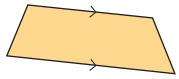
three-dimensional: having length, width, and depth or height

transformation: a translation, rotation, or reflection

translation: a transformation that moves a point or a shape 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

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 tile: a tile that represents $+1$ or -1

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

variable tile: a tile that represents a variable

vertex (*plural,* vertices): the corner of a shape or object

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, …

***x*-axis:** the horizontal number line on a coordinate grid

***y*-axis:** the vertical number line on a coordinate grid

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

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