REVIEW OF *Key* CONCEPTS

3.1 Polynomials

Refer to the Key Concepts on page 130.

a) To add $(3x^2 - x - 2) + (x^2 + 4x + 5)$, collect like terms.

$$\begin{aligned}(3x^2 - x - 2) + (x^2 + 4x + 5) &= 3x^2 - x - 2 + x^2 + 4x + 5\\ &= 3x^2 + x^2 - x + 4x - 2 + 5\\ &= 4x^2 + 3x + 3\end{aligned}$$

b) To subtract $(6x^2 + x - 1) - (4x^2 + 2x - 3)$, add the opposite of the second polynomial.

$$\begin{aligned}(6x^2 + x - 1) - (4x^2 + 2x - 3) &= (6x^2 + x - 1) + (-4x^2 - 2x + 3)\\ &= 6x^2 + x - 1 - 4x^2 - 2x + 3\\ &= 2x^2 - x + 2\end{aligned}$$

c) To multiply $(-3x^2y^2)(-2xy^2)$, multiply the numerical coefficients, then the variables.

$$\begin{aligned}(-3x^2y^2)(-2xy^2) &= (-3)(-2)(x^2)(x)(y^2)(y^2)\\ &= 6x^3y^4\end{aligned}$$

d) To divide $\dfrac{20x^2y^3}{-2xy^2}$, divide the numerical coefficients, then the variables.

$$\begin{aligned}\frac{20x^2y^3}{-2xy^2} &= \left(\frac{20}{-2}\right)\left(\frac{x^2}{x}\right)\left(\frac{y^3}{y^2}\right)\\ &= -10xy\end{aligned}$$

e) To simplify $3x(x - 2) - 2x(3x + 1)$, use the distributive property. Then, collect like terms.

$$\begin{aligned}3x(x - 2) - 2x(3x + 1) &= 3x(x - 2) - 2x(3x + 1)\\ &= 3x^2 - 6x - 6x^2 - 2x\\ &= -3x^2 - 8x\end{aligned}$$

1. Simplify.

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

b) $(5x^2 - 3x + 4) + (3x^2 - x - 1)$

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

d) $(2m^2 + 2mn - n^2) - (m^2 - mn - 2n^2)$

2. Multiply.

a) $(3xy^2)(-4x^3y^2)$

b) $(-4rs^3t^2)(-6rst^4)$

3. Simplify.

a) $\dfrac{20a^2b^3c}{-5ab^3c}$

b) $\dfrac{-36m^3n^4p^2}{-9m^3np}$

4. Expand and simplify.

a) $3(x - 4) + 5(x + 6)$

b) $6(a + 3) - 2(a - 5)$

c) $2t(3t - 4) + t(2t + 5)$

d) $3(y^2 - y - 1) - (2y^2 - 3y + 4)$

3.2 Multiplying Binomials

Refer to the Key Concepts on page 136.

a) To find and verify the product $(2x + 5)(x - 4)$, use FOIL.

$$\begin{aligned}(2x + 5)(x - 4) &= (2x + 5)(x - 4)\\ &= 2x^2 - 8x + 5x - 20\\ &= 2x^2 - 3x - 20\end{aligned}$$

b) To expand and simplify $4(3x + 1)(x - 2) - 2(x + 1)(4x + 1)$, first use FOIL to multiply the binomials. Then, remove brackets and collect like terms.

Solution

$$\begin{aligned}4(3x + 1)(x - 2) - 2(x + 1)(4x + 1) &= 4(3x^2 - 6x + x - 2) - 2(4x^2 + x + 4x + 1)\\ &= 4(3x^2 - 5x - 2) - 2(4x^2 + 5x + 1)\\ &= 12x^2 - 20x - 8 - 8x^2 - 10x - 2\\ &= 4x^2 - 30x - 10\end{aligned}$$

5. Find the product.

a) $(x - 2)(x + 4)$ **b)** $(a + 5)(a - 6)$

c) $(2y - 3)(3y + 4)$ **d)** $(3x + y)(x - 4y)$

6. Expand and simplify.

a) $2(x + 1)(x - 3)$ **b)** $-2(y - 1)(y + 4)$

c) $4(m - 2)(3m - 1)$ **d)** $3(2x + 1)(2x - 3)$

7. Expand and simplify.

a) $(y + 4)(y - 3) + (y - 2)(y - 3)$ **b)** $(2x - 1)(x - 4) - (3x + 2)(3x - 1)$

c) $3(2a + 3)(2a - 1) - 4(a^2 - 7)$ **d)** $4(2x - 1)(x + 3) + 3(x - 2)(3x - 4)$

3.3 Special Products

Refer to the Key Concepts on page 142.

a) To expand $(4x + 5)^2$ and $(2x - 3)^2$, use the patterns for squaring binomials.

$$\begin{aligned}(a + b)^2 &= a^2 + 2ab + b^2\\ (4x + 5)^2 &= (4x)^2 + 2(4x)(5) + (5)^2\\ &= 16x^2 + 40x + 25\end{aligned}$$

$$\begin{aligned}(a - b)^2 &= a^2 - 2ab + b^2\\ (2x - 3)^2 &= (2x)^2 - 2(2x)(3) + (3)^2\\ &= 4x^2 - 12x + 9\end{aligned}$$

b) To expand $(5x + 2)(5x - 2)$, use the pattern for the product of the sum and difference.

$$\begin{aligned}(a + b)(a - b) &= a^2 - b^2\\ (5x + 2)(5x - 2) &= (5x)^2 - (2)^2\\ &= 25x^2 - 4\end{aligned}$$

8. Expand.

a) $(x + 4)^2$ **b)** $(y - 4)(y + 4)$ **c)** $(a - 5)^2$

d) $(3t + 1)(3t - 1)$ **e)** $(2x - 3y)^2$ **f)** $(5a + 3b)(5a - 3b)$

g) $2(3m + 1)^2$ **h)** $(1 - 2x)^2$ **i)** $3(4x + 3)(4x - 3)$

9. Expand and simplify.

a) $(m - 3)(m + 3) + (m - 4)^2$ **b)** $(x - 6)^2 - (x + 5)(x - 5)$

c) $3(2t + 1)^2 + 2(3t - 1)(3t + 1)$ **d)** $2(3x + 2y)(3x - 2y) - 3(3x - y)^2$

10. Communication **a)** Two numbers that differ by two can be multiplied by squaring their average, and then subtracting 1. For example, $14 \times 16 = 15^2 - 1$, which is $225 - 1$, or 224. How does the product of the sum and difference $(x + 1)(x - 1)$ explain the method?

b) Develop a similar method for multiplying two numbers that differ by 4.

c) Show how the product of the sum and difference explains your method from part b).

3.4 Common Factors

Refer to the Key Concepts on page 149.

a) To factor $2xy - 8xz + 4x$, remove the greatest common factor, which is $2x$.

$2xy - 8xz + 4x = 2x(y - 4z + 2)$

b) To factor $5y^4 - 10y^3 + 15y^2$, remove the greatest common factor, which is $5y^2$.

$5y^4 - 10y^3 + 15y^2 = 5y^2(y^2 - 2y + 3)$

c) To factor $3y(x - 2) - 5(x - 2)$, remove the common binomial factor, $(x - 2)$.

$3y(x - 2) - 5(x - 2) = (x - 2)(3y - 5)$

d) To factor $x^2 + xy + y + x$ by grouping, group pairs of terms with a common factor.

$$\begin{aligned} x^2 + xy + y + x &= (x^2 + x) + (xy + y) \\ &= x(x + 1) + y(x + 1) \\ &= (x + 1)(x + y) \end{aligned}$$

11. Factor, if possible.

a) $5t - 35$ **b)** $5y^2 + 20y$

c) $7st - 22mn$ **d)** $2xy - 8xy^2 - 4x^2y^3$

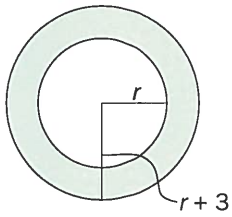
12. Factor, if possible.

a) $m(x + 4) - 3(x + 4)$ **b)** $5a(y - 2) + 7(y + 2)$ **c)** $2x(m + n) - (m + n)$

13. Factor by grouping.

a) $mx + my + 2x + 2y$ **b)** $x^2 - xy - x + y$ **c)** $2m^2 - 3t - 6m + mt$

14. **Measurement** The diagram shows two concentric circles of radii r and $r + 3$.



a) Write an expression in terms of r for the area of the smaller circle.
b) Write an expression in terms of r for the area of the larger circle. Expand and simplify the expression.
c) Subtract the expression you wrote in part a) from the simplified expression in part b). Factor the result.
d) If r represents 5 cm, calculate the area of the shaded part of the diagram, to the nearest tenth of a square centimetre.

3.5 Factoring $x^2 + bx + c$

Refer to the Key Concepts on page 155.

To factor $x^2 - 7x + 10$, where $a = 1$, $b = -7$, and $c = 10$, use a table to find two integers whose product is 10 and whose sum is -7. The only two integers with a product of 10 and a sum of -7 are -5 and -2.
So, $x^2 - 7x + 10 = (x - 5)(x - 2)$.

	Product of 10		Sum
	10	1	11
	−10	−1	−11
	5	2	7
*	−5	−2	−7

15. Factor, if possible.

a) $x^2 - x - 12$
b) $y^2 + 3y - 18$
c) $m^2 + 11m + 24$
d) $t^2 - 8t + 15$
e) $x^2 + 3x + 4$
f) $n^2 - 13n + 40$
g) $w^2 - w - 30$
h) $14 + 5m - m^2$
i) $x^2 + 9xy + 8y^2$
j) $c^2 - 10cd + 16d^2$

16. Factor fully.

a) $2x^2 - 2x - 40$
b) $ay^2 + 12ay - 28a$
c) $3x^2 + 12x - 36$
d) $5x^2 - 15x + 10$

17. Write two different trinomials that have $x + 3$ as a factor.

18. Write two different trinomials that have $x - 2$ as a factor.

3.6 Factoring $ax^2 + bx + c$, $a \neq 1$

Refer to the Key Concepts on page 162.

a) To factor $2x^2 - 5x - 3$ by guess and check, list all the possible pairs of factors and expand to see which pair gives the correct middle term.

GUESS			CHECK
Possible Factors	**Expansion**	**Trinomial**	**Is the middle term correct?**
$(2x + 3)(x - 1)$	$2x^2 - 2x + 3x - 3$	$2x^2 + x - 3$	No
$(2x - 3)(x + 1)$	$2x^2 + 2x - 3x - 3$	$2x^2 - x - 3$	No
$(2x - 1)(x + 3)$	$2x^2 + 6x - x - 3$	$2x^2 + 5x - 3$	No
$(2x + 1)(x - 3)$	$2x^2 - 6x + x - 3$	$2x^2 - 5x - 3$	Yes

Therefore, $2x^2 - 5x - 3 = (2x + 1)(x - 3)$.

b) To factor $5x^2 + 12x + 4$, where $a = 5$, $b = 12$, and $c = 4$, break up the middle term.

Find two integers whose product is $a \times c$, or 20, and whose sum is b, or 12.

The only two integers with a product of 20 and a sum of 12 are 10 and 2.

$$\begin{aligned} 5x^2 + 12x + 4 &= 5x^2 + 10x + 2x + 4 \\ &= (5x^2 + 10x) + (2x + 4) \\ &= 5x(x + 2) + 2(x + 2) \\ &= (x + 2)(5x + 2) \end{aligned}$$

So, $5x^2 + 12x + 4 = (x + 2)(5x + 2)$.

	Product of 20		Sum
	20	1	21
	−20	−1	−21
*	10	2	12
	−10	−2	−12
	5	4	9
	−5	−4	−9

19. Factor, if possible.

a) $5m^2 + 17m + 6$ **b)** $6x^2 + 7x + 2$ **c)** $2x^2 - 7x + 5$

d) $3t^2 + 4t - 20$ **e)** $2m^2 + 2m - 3$ **f)** $6y^2 + y - 1$

g) $6x^2 - x - 1$ **h)** $9z^2 - 9z + 2$ **i)** $2x^2 + 11xy + 5y^2$

j) $4p^2 - 3pq - 7q^2$

20. Factor fully.

a) $4x^2 + 6x + 2$ **b)** $9t^2 + 3t - 6$

c) $20m^2 - 8m - 12$ **d)** $3y^3 - 7y^2 + 2y$

21. Basketball The backboard behind a basketball net is a rectangle whose area can be represented by the trinomial $77x^2 - 38x - 7$.

a) Factor $77x^2 - 38x - 7$ to find binomials that represent the length and the width of the backboard.

b) If x represents 17 cm, find the dimensions of the backboard, in centimetres.

3.7 Factoring Special Quadratics

Refer to the Key Concepts on page 167.

a) To factor $25x^2 - 9$, use the pattern for the difference of squares.

$$\begin{aligned} a^2 - b^2 &= (a + b)(a - b) \\ 25x^2 - 9 &= (5x)^2 - 3^2 \\ &= (5x + 3)(5x - 3) \end{aligned}$$

b) To factor $4x^2 - 28x + 49$, use the appropriate perfect square trinomial pattern.

$$\begin{aligned} a^2 - 2ab + b^2 &= (a - b)^2 \\ 4x^2 - 28x + 49 &= (2x)^2 - 2(2x)(7) + 7^2 \\ &= (2x - 7)^2 \end{aligned}$$

22. Factor, if possible.

a) $x^2 - 25$ **b)** $1 - 49m^2$

c) $m^2 + 16$ **d)** $49t^2 - 81s^2$

e) $4a^2 - 16b^2$ **f)** $144p^2 - q^2$

23. Determine whether the trinomial is a perfect square trinomial. If it is, factor it.

a) $x^2 + 10x + 25$ **b)** $y^2 - 12y + 36$

c) $9t^2 - 6t + 1$ **d)** $m^2 + 6m + 16$

e) $4x^2 + 12x + 9$ **f)** $25r^2 - 20rs + 4s^2$

24. Factor fully.

a) $5x^2 - 5$ **b)** $16m^2 - 36n^2$

c) $18y^2 + 60y + 50$ **d)** $5x^2 - 20xy + 20y^2$

25. Egyptian pyramid The North Stone Pyramid at Dahshur in Egypt has a square base with an area that can be represented by the trinomial $9x^2 - 12x + 4$.

a) Factor the trinomial to find a binomial that represents the side length of the base.

b) If x represents 74 m, what is the side length of the base, in metres?

b) ±13, ±14, ±22, ±41 **c)** ±5, ±1 **d)** ±35, ±16, ±9, ±5, 0
9. a) $(2x^2 + 1)(x^2 + 1)$ **b)** $(2x^2 - 1)(x^2 + 3)$
c) $(3x^2 - 4)(x^2 + 1)$ **d)** $(2x^2 - 3)(3x^2 - 2)$
e) $(2x^2 + y)(x^2 + 2y)$ **f)** $(3x^2 - y)(x^2 + 4y)$

Section 3.7 pp. 167–169

Practice **1. a)** $(x + 3)(x - 3)$ **b)** $(y + 4)(y - 4)$ **c)** not possible **d)** $(5a + 6)(5a - 6)$ **e)** $(1 + 8t)(1 - 8t)$
f) $(6 + 7a)(6 - 7a)$ **g)** not possible **h)** $(5x + 8y)(5x - 8y)$
i) $(2t + 3s)(2t - 3s)$ **j)** $(10p + 11q)(10p - 11q)$
k) $(16 + 9y)(16 - 9y)$ **l)** $(15b + a)(15b - a)$
2. a) yes, $(x + 3)^2$ **b)** yes, $(y - 5)^2$ **c)** no **d)** yes, $(2t + 1)^2$
e) yes, $(4t + 3)^2$ **f)** yes, $(7 + x)^2$ **g)** yes, $(1 - 8t)^2$ **h)** yes, $(3x - 4)^2$ **i)** yes, $(2 + 7r)^2$ **j)** no **k)** yes, $(11m - 1)^2$ **l)** yes, $(3a + 2b)^2$ **3. a)** $(y + 12)(y - 12)$ **b)** not possible
c) $(3a - 4)^2$ **d)** $2(x + 4)(x - 4)$ **e)** not possible
f) $3(x + 1)^2$ **g)** $(m - 7)^2$ **h)** $(2p + 5q)^2$
i) $(7x + 11y)(7x - 11y)$ **j)** $5(4a + 3b)(4a - 3b)$ **k)** not possible **l)** $y(y + 6)(y - 6)$ **m)** $y(y - 9)^2$ **n)** $4(9x^2 + 25y^2)$
o) $3x(x + 4)(x - 4)$ **p)** $5m(m - 4)^2$ **q)** $(9x + 12)(9x - 12)$
r) $3(b + 10)(b - 10)$
Applications and Problem Solving **4. a)** 600 **b)** 800
c) 640 000 **5. a)** $2(x - 1)^2$ **b)** $2(x - 1)$, $x - 1$ **c)** 18 m by 9 m **6. a)** $(x - 1)(x + 5)$ **b)** $(1 + y)(7 - y)$ **c)** $-(2m + 3)$
d) $(x^2 + 11)^2$ **e)** $(t^3 - 9)^2$ **f)** $\left(\frac{x}{2} + \frac{1}{3}\right)\left(\frac{x}{2} - \frac{1}{3}\right)$
g) $(5x^2 + 9)(5x^2 - 9)$ **h)** $8xy$ **7. a)** ±8 **b)** ±42 **c)** 4 **d)** 9
e) 25 **f)** 16 **8. a)** $2x(x - 6)^2$ **b)** x, $(x - 6)$, $2(x - 6)$; $2x$, $(x - 6)$, $(x - 6)$ **c)** 8 cm by 2 cm by 4 cm or 16 cm by 2 cm by 2 cm **d)** No, then two of the dimensions would be negative. **9.** 5, 2; −5, 2; 5, −2; −5, −2; 11, 10; −11, 10; 11, −10; −11, −10 **10.** 20, 12, 4
11. a) $(x + 3 + y)(x + 3 - y)$ **b)** $(x - 2 + 3y)(x - 2 - 3y)$
c) $(2x + 3y + 2z)(2x + 3y - 2z)$ **d)** $(x^2 - y + z)(x^2 - y - z)$
12. 16 cm

Modelling Math p. 169

a) side length minus one all squared **b)** $(s - 1)^2$ **c)** 121; 8100 **d)** 24

Career Connection p. 170

1. a) $10\pi[(1.2)^2 - 10\pi(1)^2]$ **b)** $10\pi(1.2 + 1)(1.2 - 1)$; 4.4π **c)** The inner cylinder contains no concrete.
d) 13.8 m^3 **2.** Evaluate the expression in question 1a) without factoring.

Technology Extension pp. 171

1 Factoring Polynomials **1. a)** $3(2x^2 + 5x - 4)$
b) $7(2y^2 - 6y + 3)$ **c)** $5(4x - 3x^2 + 2)$
d) $2xy(2x + 3 - 4y)$ **e)** $3pq(p^2 + 6pq + 2q^2)$
f) $2b^2(6a^3 + 2a^2b + 4ab^2 - 3b^3)$ **2. a)** $(x + 2)(x + 17)$
b) $(x - 12)(x + 6)$ **c)** not possible **d)** $(5 - t)(3 - t)$
e) $(n + 1)(4n + 9)$ **f)** not possible **g)** $(x - 4)(5x + 3)$
h) $(3y - 2)(5y + 7)$ **i)** $(x + 2y)(x + 5y)$ **j)** $(x - 4y)(3x - 2y)$
k) $(3a - 2b)(5a + 3b)$ **l)** $(2x + 9y)(7x - 4y)$
m) $(x + a + 2)(x + a + 4)$ **n)** $(x - y - 2)(x - y - 3)$
o) $(x^2 + 5)(x^2 - 3)$ **3. a)** $3(x - 1)(x - 9)$
b) $2(2x - 3)(x + 4)$ **c)** $5(5y + 1)(3y + 8)$
d) $2(u - 2v)(u - v)$ **e)** $6(3x - y)(2x + 3y)$
f) $x(x + 1)(x + 2)$ **g)** $2t(t - 7)(2t + 1)$
h) $3(5x^2 + 2)(2x^2 + 5)$ **i)** $8(x + 1)(x - 1)(3x^2 + 1)$
2 Factoring Special Products **1. a)** $(5x + 6)^2$
b) $(3y - 5)^2$ **c)** $(3n + 8)(3n - 8)$ **d)** $(5 + 13x)(5 - 13x)$
e) $(2x + 3y)(2x - 3y)$ **f)** $(7a - 4b)^2$
2. a) $16(m + 2)(m - 2)$ **b)** $4(3 + 2x)(3 - 2x)$
c) $5(5x^2 + 4)(5x^2 - 4)$ **d)** $2(6x + 7y^2)(6x - 7y^2)$
e) $2(x - 7)^2$ **f)** $3(2x + 5)^2$ **g)** $8w(2w - 5)^2$
h) $12(5 + 2x^2)(5 - 2x^2)$ **i)** $4(3y^2 + 5x^2)^2$

Rich Problem pp. 172–173

1 Writing Expressions for Areas **1.** πr^2 **2.** r; $r + 1$
3. a) $\pi(r + 1)^2 - \pi r^2$ **b)** $\pi(2r + 1)$
4. a) $\pi(r + 2)^2 - \pi(r + 1)^2$; $\pi(2r + 3)$
b) $\pi(r + 3)^2 - \pi(r + 2)^2$; $\pi(2r + 5)$
c) $\pi(r + 4)^2 - \pi(r + 3)^2$; $\pi(2r + 7)$
d) $\pi(r + 5)^2 - \pi(r + 4)^2$; $\pi(2r + 9)$ **5. a)** The area is π times the sum of twice the radius and one less than twice the ring number. **b)** $\pi(2r + 2n - 1)$ **c)** $\pi(2r + 15)$
6. a) 44 m^2 **b)** 57 m^2 **c)** 75 m^2 **d)** 88 m^2
7. a) $13\pi(2r + 13)$ **b)** 740 m^2
2 Writing Expressions for Circumferences **1.** $2\pi r$
2. a) $2\pi(r + 1)$ **b)** $2\pi(r + 2)$ **c)** $2\pi(r + 5)$ **d)** $2\pi(r + 12)$
3. a) $26\pi(r + 6)$ **b)** 690 m
3 Estimating Seating Capacities **1.** Answers may vary. Assume each person needs about 1 m of inner circumference. **a)** 22 **b)** 41 **c)** 60 **d)** 690 **2.** 785 000

Review of Key Concepts pp. 174–179

1. a) $5x - 3y$ **b)** $8x^2 - 4x + 3$ **c)** $-a^2 - 6a - 8$
d) $m^2 + 3mn + n^2$ **2. a)** $-12x^4y^4$ **b)** $24r^2s^4t^6$ **3. a)** $-4a$
b) $4n^3p$ **4. a)** $8x + 18$ **b)** $4a + 28$ **c)** $8t^2 - 3t$ **d)** $y^2 - 7$
5. a) $x^2 + 2x - 8$ **b)** $a^2 - a - 30$ **c)** $6y^2 - y - 12$
d) $3x^2 - 11xy - 4y^2$ **6. a)** $2x^2 - 4x - 6$ **b)** $-2y^2 - 6y + 8$
c) $12m^2 - 28m + 8$ **d)** $12x^2 - 12x - 9$ **7. a)** $2y^2 - 4y - 6$
b) $-7x^2 - 12x + 6$ **c)** $8a^2 + 12a + 19$ **d)** $17x^2 - 10x + 12$
8. a) $x^2 + 8x + 16$ **b)** $y^2 - 16$ **c)** $a^2 - 10a + 25$ **d)** $9t^2 - 1$
e) $4x^2 - 12xy + 9y^2$ **f)** $25a^2 - 9b^2$ **g)** $18m^2 + 12m + 2$
h) $1 - 4x + 4x^2$ **i)** $48x^2 - 27$ **9. a)** $2m^2 - 8m + 7$
b) $-12x + 61$ **c)** $30t^2 + 12t + 1$ **d)** $-9x^2 + 18xy - 11y^2$

10. a) $(x+1)(x-1) = x^2 - 1$, and x is the average of the numbers. **b)** Square their average and subtract 4. **c)** $(x-2)(x+2) = x^2 - 4$, where x is the average of $x-2$ and $x+2$. **11. a)** $5(t-7)$ **b)** $5y(y+4)$ **c)** not possible **d)** $2xy(1-4y-2xy^2)$ **12. a)** $(x+4)(m-3)$ **b)** not possible **c)** $(m+n)(2x-1)$ **13. a)** $(m+2)(x+y)$ **b)** $(x-y)(x-1)$ **c)** $(m-3)(2m+t)$ **14. a)** πr^2 **b)** $\pi r^2 + 6\pi r + 9\pi$ **c)** $3\pi(2r+3)$ **d)** 122.5 cm^2 **15. a)** $(x-4)(x+3)$ **b)** $(y+6)(y-3)$ **c)** $(m+3)(m+8)$ **d)** $(t-3)(t-5)$ **e)** not possible **f)** $(n-5)(n-8)$ **g)** $(w-6)(w+5)$ **h)** $(7-m)(2+m)$ **i)** $(x+y)(x+8y)$ **j)** $(c-2d)(c-8d)$ **16. a)** $2(x-5)(x+4)$ **b)** $a(y-2)(y+14)$ **c)** $3(x+6)(x-2)$ **d)** $5(x-2)(x-1)$ **17.** Answers may vary. x^2+4x+3, x^2+5x+6 **18.** Answers may vary. x^2-x-2, x^2+x-6 **19. a)** $(5m+2)(m+3)$ **b)** $(2x+1)(3x+2)$ **c)** $(2x-5)(x-1)$ **d)** $(t-2)(3t+10)$ **e)** not possible **f)** $(3y-1)(2y+1)$ **g)** $(2x-1)(3x+1)$ **h)** $(3z-2)(3z-1)$ **i)** $(2x+y)(x+5y)$ **j)** $(4p-7q)(p+q)$ **20. a)** $2(2x+1)(x+1)$ **b)** $3(3t-2)(t+1)$ **c)** $4(m-1)(5m+3)$ **d)** $y(y-2)(3y-1)$ **21. a)** $(7x+1)(11x-7)$ **b)** 120 cm by 180 cm **22. a)** $(x+5)(x-5)$ **b)** $(1+7m)(1-7m)$ **c)** not possible **d)** $(7t+9s)(7t-9s)$ **e)** $4(a-2b)(a+2b)$ **f)** $(12p+q)(12p-q)$ **23. a)** yes, $(x+5)^2$ **b)** yes, $(y-6)^2$ **c)** yes, $(3t-1)^2$ **d)** no **e)** yes, $(2x+3)^2$ **f)** yes, $(5r-2s)^2$ **24. a)** $5(x+1)(x-1)$ **b)** $4(2m+3n)(2m-3n)$ **c)** $2(3y+5)^2$ **d)** $5(x-2y)^2$ **25. a)** $(3x-2)^2$; $3x-2$ **b)** 220 m

Chapter Test pp. 180–181

1. a) $8y^2-3y-3$ **b)** $-7x+2$ **2. a)** $10a^4b^5$ **b)** $5xz^2$ **3. a)** $-6m-14$ **b)** $5x^2-11x$ **c)** $-4a^3-7a^2+4a$ **4. a)** $y^2+2y-15$ **b)** $6x^2-7x+2$ **c)** $2a^2-5ab-3b^2$ **5. a)** $m^2-12m-3$ **b)** $6x^2+2x+19$ **6. a)** x^2-2x+1 **b)** $4y^2-9$ **c)** $x^2+4xy+4y^2$ **d)** $30x^2+12x-1$ **7. a)** $4m(m-7)$ **b)** $3ab(1-3b+2a)$ **c)** $(m-2)(x-4)$ **d)** $(y+2)(y+x)$ **8. a)** $(x-4)(x-3)$ **b)** $(a+7)(a-3)$ **c)** $(y+4)(y+5)$ **d)** $(t-9)(t+3)$ **e)** $(x+5y)(x+y)$ **f)** $(m-2n)(m-7n)$ **9. a)** $3(x-2)(x+1)$ **b)** $4(t-2)(t-5)$ **c)** $a(y+4)(y-3)$ **10. a)** $(t+1)(3t+5)$ **b)** $(m-4)(2m-1)$ **c)** $(3x-2)(2x+1)$ **d)** $(2y-1)(2y+3)$ **e)** $(r-2s)(5r-s)$ **f)** $(2x-5y)(2x+y)$ **11. a)** $(x+2)(x-2)$ **b)** $(1+6m)(1-6m)$ **c)** $(6t+7s)(6t-7s)$ **d)** $(11a+b)(11a-b)$ **e)** $(x+4)^2$ **f)** $(y-3)^2$ **g)** $(2t-1)^2$ **h)** $(2m+5)^2$ **12. a)** $3(y+3)(y-3)$ **b)** $t(3+2t)(3-2t)$ **c)** $2(2x+3)^2$ **d)** $x(x-2)^2$ **13. a)** $(5x+3)^2 = 25x^2+30x+9$ **b)** 1444 cm^2 **14. a)** $(5x-8)(2x+5)$ **b)** 152 mm by 69 mm

Problem Solving: Use Logic p. 183

Applications and Problem Solving **1.** 10 **2.** 25, 85 **3.** Toronto and Calgary, Boston and Vancouver, Edmonton and Detroit, Chicago and Montréal **4.** $h = 22$, $g = 3$ **5.** 6, 1, 10, 8; 5, 9, 2; 4, 7; 3 **6. a)** one thousand **b)** one billion **7.** Move 7 from the 11 pile to the 7 pile and you have 4, 14, 6. Move 6 from the 14 pile to the 6 pile and you have 4, 8, 12. Move 4 from the 12 pile to the 4 pile and you have 8, 8, 8. **8.** Rohana **9.** Sharif **10.** Donna

Problem Solving: Guess and Check p. 185–186

Applications and Problem Solving **1. a)** 7821 km **c)** 17.7 h **e)** 5959 m **2.** Mary: 12, Sasha: 17, Paula: 19, Amandi: 21, Heather: 24 **3.** 118 and 119 **4.** {6, 3, 1} and {6, 1, 3} **5.** 2, 6, 10, 14, 18 **6.** 2, 9, 4, 3; 5, 7, 6; 10, 8; 1 **7.** 9 **8. a)** 8 m **b)** 16 **9. a)** $\frac{1}{2}+\frac{1}{3}+\frac{1}{6}=1$ **b)** No, $\frac{1}{3}$ is the largest unit fraction, and two of these are required to sum to 1. **10.** front face, clockwise from lower left: 4, 7, 2, 5; rear face, clockwise from lower left: 6, 1, 8, 3

Problem Solving: Using the Strategies p. 187

2. 001 **4. b)** twice **5.** 120 **6.** 6 **7.** 4 cm by 8 cm by 18 cm **8.** 18, 20, 24 **9.** Alexi: green, Kala: blue, Lisa: yellow, Jamal: red **10.** 68 **11.** 9 **12.** About 3.8 billion, assuming tiles are 8.5 cm by 8.5 cm. **13.** 10

Chapter 4

Getting Started p. 190

1. $d = 5t^2$ **2. a)** 245 m **b)** 320 m **c)** 55 m **3.** No, the graph is not a straight line.

Review of Prerequisite Skills p. 191

1. a) 11, 5, −4, −13, −19 **b)** 16, 4, 0 , 4, 16 **c)** 5, −3, 0, 21, 45 **d)** 23, 5, −5, −7, −1 **2. a)** 7, 19, 7, 19 **b)** 1, 1, 17, 17 **c)** 2, 0, 6, 42 **d)** 1, −3, −3, −24 **e)** 4, 7, 15, 20 **f)** −3, 3, 3, 9 **g)** 10, 2, 26, 5 **h)** −3, −4, 0, 5 **3. a)** x^2+x **b)** x^2-3x **c)** x^2+2x **d)** x^2+2x **e)** x^2-4x **f)** x^2+4x **g)** x^2-6x **h)** x^2+12x **4. a)** $(x+2)^2$ **b)** $(x+3)^2$ **c)** $(x-1)^2$ **d)** $(x-4)^2$ **e)** $(x+10)^2$ **f)** $(x-6)^2$ **g)** $(x-9)^2$ **h)** $(x+11)^2$ **5. a)** 1 **b)** 2 **c)** 2 **d)** 3 **e)** 2 **f)** 4 **6. a)** non-linear **b)** linear **7. b)** Yes, a figure and its translation image are always congruent. **8. b)** Yes, a figure and its reflection image are always congruent.