Practice

A

1. If possible, find two integers with the given product and sum.

	Product	Sum		Product	Sum
a)	15	8	**b)**	18	11
c)	–30	7	**d)**	–20	–8
e)	10	7	**f)**	10	–7
g)	36	–13	**h)**	36	–15

2. Factor, if possible. Check by substituting $x = 1$ into the expanded form and the factored form.

a) $x^2 + 5x + 4$ **b)** $x^2 + 8x + 15$ **c)** $t^2 + 9t + 12$

d) $r^2 - 13r + 42$ **e)** $n^2 + 11n + 30$ **f)** $r^2 - 7r + 10$

g) $w^2 - 10w + 16$ **h)** $x^2 - 9x + 24$ **i)** $m^2 - 10m + 24$

3. Factor, if possible.

a) $y^2 - y - 20$ **b)** $x^2 + 7x - 18$ **c)** $t^2 + t - 18$

d) $n^2 - 10n - 24$ **e)** $r^2 + 7r - 20$ **f)** $x^2 - 8x - 20$

4. Factor, if possible.

a) $m^2 + 18m + 80$ **b)** $m^2 + m - 12$ **c)** $x^2 + 2x + 5$

d) $r^2 - 17r + 42$ **e)** $y^2 - 17y + 72$ **f)** $x^2 - 6x - 16$

g) $y^2 - 2y - 4$ **h)** $m^2 + 7m - 6$ **i)** $x^2 - 10x + 21$

j) $w^2 + 12w + 20$ **k)** $r^2 - r - 30$ **l)** $y^2 - 20y + 36$

m) $n^2 - 4n + 5$ **n)** $8 + 7y - y^2$ **o)** $16 - 6x - x^2$

5. Factor, if possible.

a) $x^2 + 12xy + 35y^2$ **b)** $a^2 - 4ab - 77b^2$ **c)** $c^2 - cd - 2d^2$

d) $x^2 + 5xy - 36y^2$ **e)** $x^2 - 4xy + 6y^2$ **f)** $p^2 + 14pq - 32q^2$

6. Factor completely.

a) $3x^2 + 12x + 9$ **b)** $5y^2 + 40y + 60$ **c)** $4t^2 - 8t - 60$

d) $6x^2 + 18x - 24$ **e)** $ax^2 + 10ax - 24a$ **f)** $x^3 + 18x^2 + 72x$

g) $2x^2 - 22x + 56$ **h)** $5w^2 + 20w - 60$ **i)** $3x - 2x^2 - x^3$

Applications and Problem Solving

7. **Signboard** On the outside of the Skydome, there is a large, rectangular, electronic signboard. The approximate area of the signboard can be represented by the trinomial $x^2 - 3x - 4$.

a) Factor $x^2 - 3x - 4$ to find binomials that represent the length and width of the signboard.

b) If x represents 17 m, find the length and width of the signboard, in metres.

B

8. The area of a rectangle is represented by the expression $x^2 + 9x + 20$.

a) Factor the expression.

b) A smaller rectangle is 1 unit shorter on each side than the first rectangle. Write a factored expression for the area of the smaller rectangle.

c) Expand the expression for the area of the smaller rectangle.

d) What is the difference in the areas of the rectangles?

9. a) **Movies** Each letter shown in the table represents a different integer. The letter Y represents 5.

Letter	A	C	E	K	M	N	O	P	S	T	Y
Integer											5

Factor the following five trinomials. In each case, write the factored form with the larger binomial first. For example, the factored form of $x^2 + 2x - 8$ would be written as $(x + 4)(x - 2)$, because $x + 4 > x - 2$. Use the factored forms to find the integer represented by each capital letter. Then, copy and complete the table.

$x^2 + 20x - 96 = (x + \text{M})(x + \text{A})$

$x^2 - 27x + 72 = (x + \text{N})(x + \text{C})$

$x^2 - 16x - 80 = (x + \text{E})(x + \text{T})$

$x^2 - 25x - 84 = (x + \text{S})(x + \text{K})$

$x^2 + 9x - 90 = (x + \text{P})(x + \text{O})$

b) Replace each of the following integers with its corresponding letter from part a) to name a Canadian movie producer who was a silent-comedy pioneer, and find the films for which he was famous.

Name: 24 −4 −24 −28
3 4 −3 −3 4 −20 −20

Films: −28 4 5 3 −20 −6 −3 4
−28 −6 15 3

10. Communication **a)** Complete the factoring by supplying the missing terms.

$x^2 + 6x + \square = (x + \square)(x + \square)$
$x^2 - 5x + \square = (x - \square)(x - \square)$
$x^2 + \square x + 12 = (x + \square)(x + \square)$
$x^2 - \square x + 5 = (x - \square)(x - \square)$
$x^2 - \square x - 12 = (x - \square)(x + \square)$

b) Compare your answers with a classmate's. Which cases have more than one solution? Explain.

C

11. Communication Find three values of k such that each trinomial can be factored over the integers. Explain and justify your reasoning.

a) $x^2 + 2x + k$ **b)** $x^2 - 7x + k$

12. Factor.

a) $x^4 + 2x^2 + 1$ **b)** $x^4 + x^2 - 6$
c) $x^4 - 3x^2 - 10$ **d)** $x^4 + 10x^2y + 9y^2$

13. Factor.

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

14. Communication **a)** Copy and complete each statement.

$x^2 - 2x - 35 = (\square)(\square)$
$t^2 + 3t - 40 = (\square)(\square)$

b) How do the factors help you determine the values of the variable that give the trinomial a value of zero?

15. Make up five trinomials in the form $x^2 + bx + c$. Make three factorable and two impossible to factor. Exchange trinomials with a classmate. Try to factor each other's trinomials.

NUMBER POWER

In the diagram, each letter represents a number. The numbers outside the square show the sums of each row, three of the columns, and one diagonal. What is the sum of the second column?

A	B	B	C	20
B	A	C	C	21
B	C	C	A	21
D	D	A	D	25
21	☐	21	23	25

R.S. = 13 **b)** $x^2 + 8x + 12$ **7. a)** The length of the rectangle is $3x + 2y$. The width is $2x + y$. The area is $(3x + 2y)(2x + y)$. **b)** $6x^2 + 7xy + 2y^2$
8. a) $3x^2 + 13xy + 4y^2$ **b)** $8a^2 - 22ab + 5b^2$
c) $20m^2 - 7mn - 6n^2$ **d)** $20s^2 - 39st + 18t^2$
e) $7a^2 + ab - 8b^2$ **f)** $-6a^2 - ab + 12b^2$
9. a) $(x + 10)(x + 5)$ **b)** 750 m^2 **10. a)** $7x^2 - 72x + 20$
b) 29 280 cm^2; 2.928 m^2 **11. a)** $x^2 + x - 2$
b) $x^2 + 3xy + 2y^2 + 3x - 3y$ **12.** $14x^2 + 17x - 3$
13. a) 42 cm^2 **b)** $(n + 2)(n + 3)$ **c)** $n^2 + 5n + 6$
d) 930 cm^2 **14. a)** $10x^2 + 10x - 10$ **b)** 290 cm^2
15. No, the product of $(x - 1)$ and $(x + 1)$ is $x^2 - 1$, which is a binomial. The product of $(a + b)$ and $(c + d)$ is $ac + ad + bc + cd$, which has four terms. **16. a)** Take four consecutive numbers. Subtract the product of the outer numbers from the product of the inner numbers. **b)** 2, 2, 2, 2 **c)** $(x + 1)(x + 2) - (x)(x + 3) = 2$
d) The expression simplifies to 2.

Modelling Math p. 139

a) The product of three consecutive numbers plus the middle number. **b)** 8, 27, 64, 125 **c)** The answer is the cube of the middle number.
d) $(x - 1)(x)(x + 1) + x = x^3$ **e)** The expression simplifies to x^3.

Section 3.3 pp. 142–145

Practice 1. a) x^2 **b)** a^2 **c)** $4x^2$ **d)** $81t^2$ **e)** $9y^2$ **f)** $49p^2$
g) $16j^2$ **h)** $36q^2$ **2. a)** $-6x$ **b)** $+16y$ **c)** $+2xy$ **d)** $-2ab$
e) $+12x$ **f)** $-40a$ **g)** $+12xy$ **h)** $-84p$ **3. a)** $a + 7$ **b)** $x - 2$
c) $3m + 7$ **d)** $9x - 8$ **e)** $x + y$ **f)** $2a - 3b$
4. a) $x^2 + 10x + 25$ **b)** $y^2 + 2y + 1$ **c)** $x^2 - 12x + 36$
d) $m^2 - 6m + 9$ **e)** $x^2 - 9$ **f)** $y^2 - 36$ **g)** $m^2 - 49$ **h)** $t^2 - 64$
5. a) $9x^2 + 12x + 4$ **b)** $25x^2 - 10x + 1$ **c)** $4x^2 - 9$
d) $4m^2 + 28m + 49$ **e)** $9y^2 - 4$ **f)** $16y^2 - 24y + 9$
g) $1 - 25m^2$ **h)** $4 - 12t + 9t^2$ **6. a)** $4x^2 - 9y^2$
b) $4x^2 + 12xy + 9y^2$ **c)** $9a^2 - b^2$ **d)** $16t^2 - 40ts + 25s^2$
e) $16m^2 - 25n^2$ **f)** $9c^2 + 42cd + 49d^2$ **g)** $y^2 - 36x^2$
h) $a^2 - 16ab + 64b^2$ **7. a)** $2x^2 + 4x + 20$
b) $2y^2 + 14y + 13$ **c)** $-16m + 65$ **d)** $5a^2 + 12a - 6$
e) $-2x^2 + 100x - 94$ **f)** $-19t^2 - 30t + 105$
8. a) $-x^2 - 26x - 107$ **b)** $-8x^2 - 23x + 14$
c) $-7m^2 - 33m + 24$ **d)** $19t^2 + 12t - 14$
e) $-21y^2 + 13y + 28$ **f)** $54t^2 - 12t - 2$
g) $100s^2 - 22t^2 + 6t$ **h)** $12m^2 - 12mn + 2n^2 - 3m + 45$
i) $5x^2 + 4xy - 3y^2$ **j)** $-13a^2 - 28ab + 8b^2$
Applications and Problem Solving 9. a) L.S. = 16, R.S. = 10 **b)** $x^2 + 6x + 9$ **10. a)** $x + 10$ **b)** x^2, $(x + 10)^2 = x^2 + 20x + 100$ **c)** 625 cm^2; 1225 cm^2
11. $(20 + 4)(20 - 4) = 384$; $(50 - 3)(50 + 3) = 2491$; $(60 + 2)(60 - 2) = 3596$ **12. a)** 96 **b)** 216 **c)** 396 **d)** 84
e) 391 **f)** 896 **13. a)** $y^2 - 6y + 11$ **b)** $3y^2 - 7y - 7$
14. $2(x - 3)^2 + 4(x - 3)(x + 3) = 6x^2 - 12x - 18$
15. $6(2x - y)^2 = 24x^2 - 24xy + 6y^2$ **16. a)** $(x + 7)^2$
b) $(x - 8)^2$ **c)** $(2a + 3)^2$ **d)** $(3b - 4)^2$ **e)** $(8m - 2)^2$
f) $(9n + 5)^2$ **17. a)** $x^2 + 12x + 36$ **b)** $a^2 + 8a + 16$
c) $y^2 - 6y + 9$ **d)** $m^2 - 8m + 16$ **e)** $4x^2 - 4x + 1$
f) $9y^2 + 12y + 4$ **18. a)** $x^4 + 2x^2 + 1$ **b)** $y^4 - 2y^2 + 1$
c) $x^4 + 2x^2y^2 + y^4$ **d)** $x^4 - 2x^2y^2 + y^4$ **e)** $4x^4 + 12x^2 + 9$
f) $9y^4 - 24y^2 + 16$ **g)** $x^4 - 4x^2y^2 + 4y^4$
h) $16x^4 + 24x^2y^2 + 9y^4$ **19. a)** $x^4 - 1$ **b)** $y^4 - 4$ **c)** $x^4 - y^4$
d) $64a^4 - 9$ **e)** $9x^4 - 4y^4$ **f)** $16 - 9c^4$ **20.** The square, by 9 cm^2. **21.** The original garden is 25 m^2 larger than the new garden. **22. a)** $a^2 + b^2 + c^2 + 2ab + 2ac + 2bc$
b) $4x^2 + 9y^2 + 1 + 12xy + 4x + 6y$ **23.** 1 term, 5 terms
24. a) {7, 24, 25}; {9, 40, 41}, {9, 12, 15}; {12, 35, 37}, {12, 16, 20}, {9, 12, 15}, {5, 12, 13} **b)** Let a represent the given leg, $c + b$ represent one factor of a^2, and $c - b$ represent the other factor of a^2. Thus $(c + b)(c - b) = a^2$, or $c^2 - b^2 = a^2$, or $c^2 = a^2 + b^2$. So $\{a, b, c\}$ is a Pythagorean triple, and represents the sides of a right triangle.

Technology Extension p. 146

1 Multiplying Binomials 1. a) $8x^2 + 42x + 27$
b) $6x^2 - 5x - 25$ **c)** $20y^2 - 52y + 33$
d) $32x^2 - 4xy - 21y^2$ **e)** $20x^2 + 7xy - 6y^2$ **f)** $9x - 14$
g) $7x^2 + 9x - 13$ **h)** $-6y^2 - 26y + 49$ **i)** $22x^2 + 12xy + y^2$
2 Special Products 1. a) $x^2 + 30x + 225$
b) $t^2 - 10t + 25$ **c)** $81 - 18y + y^2$ **d)** $16m^4 + 56m^2 + 49$
e) $36 - 60r + 25r^2$ **f)** $64x^2 + 48xy + 9y^2$
2. a) $4x^2 - 121$ **b)** $16 - 25x^2$ **c)** $9y^2 - 25x^2$ **3. a)** $4x$
b) $-4x - 13$ **c)** $44y^2 + 68y + 26$ **d)** $15 + 48m - 40m^2$

Section 3.4 p. 150–151

Practice 1. a) $5(x + 5)$ **b)** not possible **c)** $9(y - 1)$
d) $3(x - 5y)$ **e)** $5x(5x + 2)$ **f)** $2a(2x + 4y - 3z)$
g) $pq(5r - s - 10t)$ **h)** $2(x^2 - x - 3)$ **i)** not possible
2. a) $9(a^3 + 3b^2)$ **b)** $3x(x^4 - 2x^2 + 3)$ **c)** $4y(3 - 2y + 6y^2)$
d) $6w^3(4w^2 + 1)$ **e)** not possible **f)** $11b(3a + 2c - b)$
g) $8xy(3y + 2x)$ **h)** $5y(7x - 2y)$ **i)** not possible
j) $12xy(2y - 1 + 3x)$ **k)** $9a^2b^2(3b + 1 - 2a)$
l) $6mn^2(m^2 + 3mn - 2)$ **3. a)** $(a + b)(5x + 3)$
b) $(x - 1)(3m + 5)$ **c)** not possible **d)** $(p + q)(4y - x)$
e) $(m + 7)(4t + 1)$ **f)** not possible **4. a)** $(x + y)(w + z)$
b) $(x + 3)(y + 4)$ **c)** $(x + 1)(x - y)$ **d)** $(m + 4)(m - n)$
e) $(x + 2)(2x + 3y)$ **f)** $(t - 2)(5m^2 + t)$

Applications and Problem Solving **5. a)** $20t - 5t^2$ **b)** 0 m, 15 m, 20 m, 15 m, 0 m, −25 m **c)** 20 m **d)** The height is negative. Distance cannot be negative. **e)** 0 s and 4 s **f)** $5t(4 - t)$ **g)** The height of the ball is 0 m when $5t = 0$ and when $4 - t = 0$. **6. a) i)** $4\pi x^2 - x^2$ **ii)** $x^2(4\pi - 1)$ **b) i)** $6xy - 3xz$ **ii)** $3x(2y - z)$ **c) i)** $\pi r^2 = 2r^2$ **ii)** $r^2(\pi - 2)$ **d) i)** $10x + 10y + 100$ **ii)** $10(x + y + 10)$ **e) i)** $6a + 3b + 3c + 6d + 36$ **ii)** $3(2a + b + c + 2d + 12)$ **f) i)** $4a + 4b - 16$ **ii)** $4(a + b - 4)$ **7.** k must be divisible by 2, since the only common factor of $2x^2$ and 4 is 2. **8.** Answers may vary. **a)** $s^3t^2 + s^2t^2 + st^2$ **b)** $st^2(s^2 + s + 1)$ **9.** Answers may vary. **a)** $12x^3y^2 + 9x^2y^3 + 6x^2y^2 + 3xy$ **b)** $3xy(4x^2y + 3xy^2 + 2xy + 1)$

Modelling Math p. 152

a) Number of Squares: 8, 14, 20, 26, 32; Perimeter: 18, 30, 42, 54, 66 **b)** $6n + 2$ **c)** $2(3n + 1)$ **d)** 452; 620 **e)** 28 **f)** $12n + 6$ **g)** $6(2n + 1)$ **h)** 822; 1254 **i)** 22 **j)** $2s + 2$ **k)** $2(s + 1)$ **l)** 186; 630 **m)** 152; 428

Section 3.5 pp. 156–158

Practice **1. a)** 3, 5 **b)** 2, 9 **c)** −3, 10 **d)** 2, −10 **e)** 2, 5 **f)** −5, −2 **g)** −9, −4 **h)** −12, −3 **2. a)** $(x + 4)(x + 1)$ **b)** $(x + 5)(x + 3)$ **c)** not possible **d)** $(r - 6)(r - 7)$ **e)** $(n + 6)(n + 5)$ **f)** $(r - 2)(r - 5)$ **g)** $(w - 2)(w - 8)$ **h)** not possible **i)** $(m - 4)(m - 6)$ **3. a)** $(y + 4)(y - 5)$ **b)** $(x + 9)(x - 2)$ **c)** not possible **d)** $(n - 12)(n + 2)$ **e)** not possible **f)** $(x + 2)(x - 10)$ **4. a)** $(m + 10)(m + 8)$ **b)** $(m + 4)(m - 3)$ **c)** not possible **d)** $(r - 3)(r - 14)$ **e)** $(y - 9)(y - 8)$ **f)** $(x + 2)(x - 8)$ **g)** not possible **h)** not possible **i)** $(x - 3)(x - 7)$ **j)** $(w + 2)(w + 10)$ **k)** $(r + 5)(r - 6)$ **l)** $(y - 2)(y - 18)$ **m)** not possible **n)** $(1 + y)(8 - y)$ **o)** $(8 + x)(2 - x)$ **5. a)** $(x + 7y)(x + 5y)$ **b)** $(a - 11b)(a + 7b)$ **c)** $(c - 2d)(c + d)$ **d)** $(x - 4y)(x + 9y)$ **e)** not possible **f)** $(p - 2q)(p + 16q)$ **6. a)** $3(x + 1)(x + 3)$ **b)** $5(y + 6)(y + 2)$ **c)** $4(t - 5)(t + 3)$ **d)** $6(x + 4)(x - 1)$ **e)** $a(x + 12)(x - 2)$ **f)** $x(x + 12)(x + 6)$ **g)** $2(x - 7)(x - 4)$ **h)** $5(w + 6)(w - 2)$ **i)** $x(3 + x)(1 - x)$

Applications and Problem Solving **7. a)** $(x - 4)(x + 1)$ **b)** 18 m by 13 m **8. a)** $(x + 4)(x + 5)$ **b)** $(x + 3)(x + 4)$ **c)** $x^2 + 7x + 12$ **d)** $2x + 8$ **9. a)** $(x + 24)(x - 4)$; $(x - 3)(x - 24)$; $(x + 4)(x - 20)$; $(x + 3)(x - 28)$; $(x + 15)(x - 6)$; A = −4, C = −24, E = 4, K = −28, M = 24, N = −3, O = −6, P = 15, S = 3, T = −20, Y = 5 **b)** Mack Sennett, Keystone Kops **10. a)** $x^2 + 6x + 5 = (x + 5)(x + 1)$, $x^2 + 6x + 8 = (x + 4)(x + 2)$, $x^2 + 6x + 9 = (x + 3)(x + 3)$; $x^2 - 5x + 4 = (x - 1)(x - 4)$, $x^2 - 5x + 6 = (x - 2)(x - 3)$; $x^2 + 7x + 12 = (x + 3)(x + 4)$, $x^2 + 8x + 12 = (x + 2)(x + 6)$, $x^2 + 13x + 12 = (x + 1)(x + 12)$; $x^2 - 6x + 5 = (x - 1)(x - 5)$; $x^2 - 11x - 12 = (x - 12)(x + 1)$, $x^2 - 4x - 12 = (x - 6)(x + 2)$, $x^2 - x - 12 = (x - 4)(x + 3)$ **b)** All have more than one except $x^2 - \blacksquare x + 5 = (x - \blacksquare)(x + \blacksquare)$. Because 5 is a prime number, there is only one pair of negative integers with a product of 5. **11.** Answers may vary. **a)** $k = -8, -3, 1$ **b)** $k = 12, 6, 10$ **12. a)** $(x^2 + 1)^2$ **b)** $(x^2 + 3)(x^2 - 2)$ **c)** $(x^2 - 5)(x^2 + 2)$ **d)** $(x^2 + 9y)(x^2 + y)$ **13. a)** $(x + a + 1)(x + a + 2)$ **b)** $(x - b + 5)(x - b - 1)$ **14. a)** $x^2 - 2x - 35 = (x - 7)(x + 5)$, $t^2 + 3t - 40 = (t + 8)(t - 5)$ **b)** The trinomial has the value zero when either factor is zero, or both factors are zero.

Section 3.6 pp. 163–164

Practice **1. a)** $(2y + 3)(y + 3)$ **b)** $(3m + 1)(m + 3)$ **c)** $(5t + 2)(t + 1)$ **d)** not possible **e)** $(x + 2)(2x + 7)$ **f)** $(3x + 1)(2x + 3)$ **2. a)** $(2x - 3)(x - 1)$ **b)** $(x - 1)(3x - 2)$ **c)** $(t - 2)(3t - 4)$ **d)** $(m - 2)(5m - 1)$ **e)** $(2m - 3)(3m - 2)$ **f)** not possible **3. a)** $(x - 2)(2x + 3)$ **b)** $(3x - 4)(2x + 1)$ **c)** $(2t - 1)(t + 5)$ **d)** $(5n - 2)(3n + 1)$ **e)** $(x - 1)(3x + 4)$ **f)** $(y - 3)(5y + 1)$ **g)** $(2x - 3)(4x + 1)$ **h)** not possible **i)** $(5t - 2)(2t + 3)$ **4. a)** $(2t + 1)(2t + 3)$ **b)** $(2x - 3)(5x - 1)$ **c)** not possible **d)** $(2y + 5)(y + 3)$ **e)** $2(4y - 3)(y - 2)$ **f)** not possible **g)** $3(2r + 3)(r + 1)$ **h)** $(3y - 2)(4y - 1)$ **i)** $2(x - 5)(2x + 1)$ **j)** $m(2m - 5)(m + 6)$ **k)** $t(2t + 1)(t + 4)$ **l)** $(2s - 1)(9s + 1)$ **m)** $3(r + 1)(4r + 5)$ **n)** $s(r - 1)(5r - 2)$ **o)** $(2 - y)(3 + 4y)$ **p)** $(2 - m)(1 - 3m)$ **q)** $2(6 + 9t + 4t^2)$ **r)** $(3 - 2y)(2 + 3y)$ **5. a)** $(2m - n)(3m + 2n)$ **b)** $(3x + y)(x + 2y)$ **c)** $(2a - b)(5a + b)$ **d)** $(x - 5y)(2x - y)$ **e)** $(6c + d)(c + 2d)$ **f)** $3(x - y)(2x - y)$ **g)** $2(m - 3n)(m + n)$ **h)** $4(y - x)(y + 2x)$ **i)** $2(3a - 2b)(a + 3b)$

Applications and Problem Solving

6. a) $(10x + 3)(x - 1)$ **b)** 503 m by 49 m **7. a)** $10x^2 - 29x + 10 = (2x - 5)(5x - 2)$; $4x^2 - 27x + 18 = (x - 6)(4x - 3)$; $18x^2 - 27x + 4 = (3x - 4)(6x - 1)$; $56x^2 + 15x + 1 = (7x + 1)(8x + 1)$; $10x^2 - 91x + 9 = (x - 9)(10x - 1)$; A = 2, C = 5, D = −2, E = 4, H = −3, I = −4, J = 3, L = −6, M = 6, N = −1, O = 7, R = 8, S = −9, T = 10, U = −5, W = 1, Y = −7 **b)** Joni Mitchell: folk singer; Ned Hanlan: world champion rower; Marshall McLuhan: author, communication theorist; Emily Stowe: first Canadian woman to practise medicine in Canada **8. a)** ±8, ±16

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)** $-9x^2 + 18xy - 11y^2$