

Practice

A

1. Factor, if possible.

a) $5x + 25$

b) $4x + 13$

c) $9y - 9$

d) $3x - 15y$

e) $25x^2 + 10x$

f) $4ax + 8ay - 6az$

g) $5pqr - pqs - 10pqt$

h) $2x^2 - 2x - 6$

i) $3y^2 - 9y - 20$

2. Factor, if possible.

a) $9a^3 + 27b^2$

b) $3x^5 - 6x^3 + 9x$

c) $12y - 8y^2 + 24y^3$

d) $24w^5 + 6w^3$

e) $6rst + 3rs - 7t$

f) $33ab + 22bc - 11b^2$

g) $24xy^2 + 16x^2y$

h) $35xy - 10y^2$

i) $5rst - 15ab + 7cd$

j) $24xy^2 - 12xy + 36x^2y$

k) $27a^2b^3 + 9a^2b^2 - 18a^3b^2$

l) $6m^3n^2 + 18m^2n^3 - 12mn^2$

3. Factor, if possible.

a) $5x(a + b) + 3(a + b)$

b) $3m(x - 1) + 5(x - 1)$

c) $7x(m + 4) - 3(m - 4)$

d) $4y(p + q) - x(p + q)$

e) $4t(m + 7) + (m + 7)$

f) $3t(x - y) - (x + y)$

4. Factor by grouping.

a) $wx + wy + xz + yz$

b) $xy + 12 + 4x + 3y$

c) $x^2 + x - xy - y$

d) $m^2 - 4n + 4m - mn$

e) $2x^2 + 6y + 4x + 3xy$

f) $5m^2t - 10m^2 + t^2 - 2t$

Applications and Problem Solving

5. **Vertical motion** If an object is thrown vertically upward at a speed of v metres per second, the approximate height of the object, in metres, after t seconds is given by the expression $vt - 5t^2$.

a) A ball is thrown vertically upward at a speed of 20 m/s. Write the expression that gives the height of the ball, in metres, after t seconds.

b) Make a table to find the height of the ball after 0 s, 1 s, 2 s, 3 s, 4 s, and 5 s.

c) What is the maximum height of the ball?

d) **Communication** Why does the height of the ball after 5 s have no meaning?

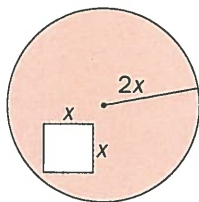
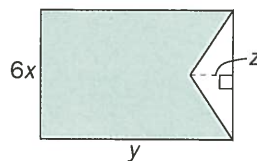
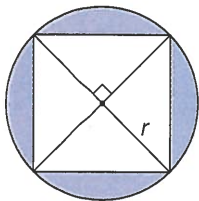
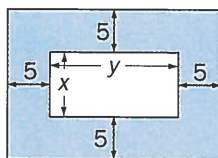
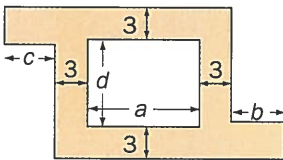
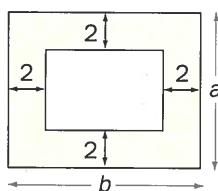
e) At what times is the height 0 m?

f) Factor the expression you wrote in part a).

g) **Communication** How does the factored expression let you determine the times when the height of the ball is 0 m?

B

6. Measurement Write an expression for the area of each shaded region as a polynomial and then in factored form

a)**b)****c)****d)****e)****f)**

7. Communication If it is possible to remove a common factor from the expression $2x^2 + ky + 4$, where k is an integer, what can you state about the possible values of k ? Explain.

C

8. a) Write a polynomial in which there are three terms, each numerical coefficient is 1, and the greatest common factor is st^2 .

b) Write your polynomial in factored form.

9. a) Write a polynomial that has four terms with different numerical coefficients and a greatest common factor of $3xy$.

b) Write your polynomial in factored form.

10. Communication Write a problem similar to questions 8 and 9. Have a classmate solve your problem.

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. a)** $14x^2 + 17x - 3$
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) $(x - 1)(x + 1) + x = x^3$ **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) $(x - 1)(3m + 5)$ not possible **d)** $(p + q)(4y - x)$
e) $(m + 7)(4t + 1)$ 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)** $\pm 8, \pm 16$

- b)** $\pm 13, \pm 14, \pm 22, \pm 41$ **c)** $\pm 5, \pm 1$ **d)** $\pm 35, \pm 16, \pm 9, \pm 5, 0$
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)** $-9x^2 + 18xy - 11y^2$