

## Practice

### A

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

a)  $2y^2 + 9y + 9$

b)  $3m^2 + 10m + 3$

c)  $5t^2 + 7t + 2$

d)  $4r^2 + 12r + 3$

e)  $2x^2 + 11x + 14$

f)  $6x^2 + 11x + 3$

2. Factor, if possible.

a)  $2x^2 - 5x + 3$

b)  $3x^2 - 5x + 2$

c)  $3t^2 - 10t + 8$

d)  $5m^2 - 11m + 2$

e)  $6m^2 - 13m + 6$

f)  $4y^2 - 11y + 9$

3. Factor, if possible.

a)  $2x^2 - x - 6$

b)  $6x^2 - 5x - 4$

c)  $2t^2 + 9t - 5$

d)  $15n^2 - n - 2$

e)  $3x^2 + x - 4$

f)  $5y^2 - 14y - 3$

g)  $8x^2 - 10x - 3$

h)  $9x^2 - 15x - 4$

i)  $10t^2 + 11t - 6$

4. Factor, if possible.

a)  $4t^2 + 8t + 3$

b)  $10x^2 - 17x + 3$

c)  $5t^2 + 2t - 2$

d)  $2y^2 + 11y + 15$

e)  $8y^2 - 22y + 12$

f)  $6x^2 + x - 4$

g)  $6r^2 + 15r + 9$

h)  $12y^2 - 11y + 2$

i)  $4x^2 - 18x - 10$

j)  $2m^3 + 7m^2 - 30m$

k)  $2t^3 + 9t^2 + 4t$

l)  $18s^2 - 7s - 1$

m)  $12r^2 + 27r + 15$

n)  $5r^2s - 7rs + 2s$

o)  $6 + 5y - 4y^2$

p)  $2 - 7m + 3m^2$

q)  $12 + 18t + 8t^2$

r)  $6 + 5y - 6y^2$

5. Factor.

a)  $6m^2 + mn - 2n^2$

b)  $3x^2 + 7xy + 2y^2$

c)  $10a^2 - 3ab - b^2$

d)  $2x^2 - 11xy + 5y^2$

e)  $6c^2 + 13cd + 2d^2$

f)  $6x^2 - 9xy + 3y^2$

g)  $2m^2 - 4mn - 6n^2$

h)  $4y^2 + 4xy - 8x^2$

i)  $6a^2 + 14ab - 12b^2$

## Applications and Problem Solving

6. **Transportation** Sydney Harbour Bridge in Australia is unusually wide for a long-span bridge. It carries two rail lines, eight road lanes, a cycle lane, and a walkway.

a) Factor the expression  $10x^2 - 7x - 3$  to find binomials that represent the length and the width of the bridge.

b) If  $x$  represents 50 m, what are the length and the width of the bridge, in metres?

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)**  $750 \text{ m}^2$  **10. a)**  $7x^2 - 72x + 20$   
**b)**  $29 \text{ 280 cm}^2$ ;  $2.928 \text{ m}^2$  **11. a)**  $x^2 + x - 2$   
**b)**  $x^2 + 3xy + 2y^2 + 3x - 3y$  **12. a)**  $14x^2 + 17x - 3$   
**13. a)**  $42 \text{ cm}^2$  **b)**  $(n + 2)(n + 3)$  **c)**  $n^2 + 5n + 6$   
**d)**  $930 \text{ cm}^2$  **14. a)**  $10x^2 + 10x - 10$  **b)**  $290 \text{ cm}^2$   
**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.

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**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)**  $625 \text{ cm}^2$ ;  $1225 \text{ cm}^2$

**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  $9 \text{ cm}^2$ . **21.** The original garden is  $25 \text{ m}^2$  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.

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**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 **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)**  $3xy(4x^2y + 3xy^2 + 2xy + 1)$

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**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)**  $\pm 8$  **b)**  $\pm 42$  **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)**  $10\pi(1.2 + 1)(1.2 - 1)$ ;  $4.4\pi$  **c)** The inner cylinder contains no concrete.  
**d)**  $13.8 \text{ m}^3$  **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.**  $\pi r^2$  **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  $\pi$  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)**  $44 \text{ m}^2$  **b)**  $57 \text{ m}^2$  **c)**  $75 \text{ m}^2$  **d)**  $88 \text{ m}^2$   
**7. a)**  $13\pi(2r + 13)$  **b)**  $740 \text{ m}^2$   
**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)**  $-9x^2 + 18xy - 11y^2$