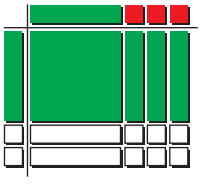
Chapter 5

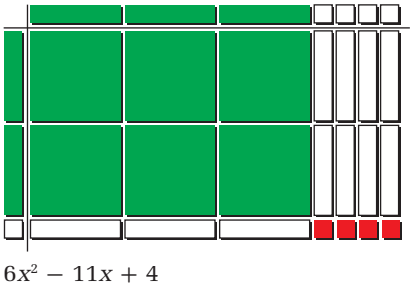
5.1 Multiplying Polynomials, pages 209 to 213

1. a)



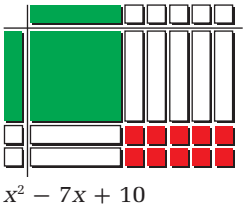
$x^2 + x - 6$

b)



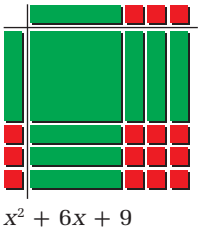
$6x^2 - 11x + 4$

c)



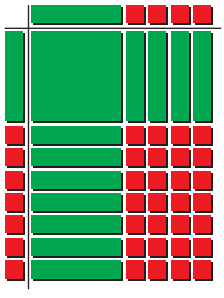
$x^2 - 7x + 10$

d)



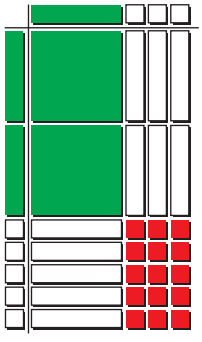
$x^2 + 6x + 9$

e)



$x^2 + 11x + 28$

f)



$2x^2 - 11x + 15$

2. a) $2x^2 + 3x - 2$ **b)** $2x - 1$ by $x + 2$

3. a) $x^2 + 3x - 10$ **b)** $x^2 - 6x + 9$
c) $c^2 - d^2$ **d)** $4x^2 + 5xy + y^2$
e) $y^2 + 6y + 9$ **f)** $24j^2 - 6k^2$

4. a) $3x^3 - 5x^2 + 8x$ **b)** $7ab^2 + ab - a$
c) $6x^3 - 22x^2 + 36$ **d)** $10x^3 + 3x^2 - 14x + 5$
e) $12s^4 - 5s^3 + 22s^2 + 6s$
f) $2y^4 + 11y^3 + 21y^2 + 11y - 5$

5. a) B **b)** H **c)** F **d)** D
e) J **f)** E **g)** A **h)** G

6. a) $6n^2 - 9n + 8$ **b)** $-7f^2 + 4f - 29$
c) $9b^2 - 8bd + 7d^2$ **d)** $40x^2 - 90x - 50$
e) $14a^2 - 35ac - 28c^2$
f) $4y^4 - 14y^3 - 53y^2 - 41y - 6$

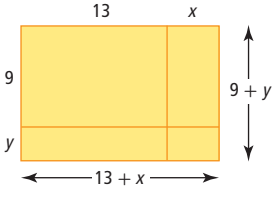
7. $A = (x + 4)(x + 4)$; $A = x^2 + 8x + 16$

10. $A = (x - 7)(x - 4)$; $A = x^2 - 11x + 28$

11. $A = \pi(3x + 2)^2$; $A = 9\pi x^2 + 12\pi x + 4\pi$

12. a) No. Step 3 is incorrect.
b) Example: $p = 1, -5 \neq -15$

13. a)



b) $A = (y + 9)(x + 13)$ **c)** 154 m²

14. a) $x + 2$ by $x - 1$ **b)** $A = (x + 2)(x - 1)$
c) The new rug has the greater area by 1 ft².

15. a) $A = (3x + 8)(2x + 4) = 6x^2 + 28x + 32$

16. a) In the check, the left side does not equal the right side.
b) In step 1, André multiplied -4 and 5 to get $+20$. This is actually equal to -20.

17. a) As the price of a burger increases, the average number of burgers sold decreases.
b) $p = \frac{550 - b}{100}$ **c)** $R = \frac{550n - bn}{100}$

18. a) The product of the first and last numbers is 2 less than the product of the middle numbers.
b) $n + 1$, $n + 2$, $n + 3$
c) Example: The first and last product is $n^2 + 3n$; the middle product is $n^2 + 3n + 2$. I noticed that the product of the middle values is 2 more than the product of the first and last values.

19. a) $3t + 4$ **b)** 1530

5.2 Common Factors, pages 220 to 223

1. a) 20: 1, 2, 4, 5, 10, 20; 30: 1, 2, 3, 5, 6, 10, 15, 30; GCF: 10
b) 28: 1, 2, 4, 7, 14, 28; 40: 1, 2, 4, 5, 8, 10, 20, 40; GCF: 4
c) 30: 1, 2, 3, 5, 6, 10, 15, 30; 48: 1, 2, 3, 4, 6, 8, 12, 16, 24, 48; GCF: 6
d) 36: 1, 2, 3, 4, 6, 9, 12, 18, 36; 27: 1, 3, 9, 27; GCF: 9

2. a) 12 **b)** 48 **c)** 27
d) 2 **e)** 25

3. a) 48 **b)** 60 **c)** 90
d) 150 **e)** 132

4. a) $3ab$ **b)** $27m^2n$ **c)** $8x^2y^2$
d) $4a^2c$ **e)** p^3q^3

5. a) $5(x + 3)$ **b)** $y(3y - 5)$
c) $w^2(x + y - z)$ **d)** $6ab(a^2 - 3b)$
e) $3x(3x^2 - 4x + 2)$

6. a) $3ab$ **b)** $s^2 - 5$ **c)** $d - 7$
d) $8x - 1$ **e)** $4xy$

7. a) $(y - 2)(3y + 4)$ **b)** $(a - 4)(5a - 2)$
c) $(c - 4)(2x + 7)$ **d)** $(x - 3)(3x - 8)$
e) $(2y + 1)(y^3 - 5)$

8. 36 cm

9. Example: When you list the factors of a number, you list all the numbers that divide evenly into the number. When you list the multiples of a number, you list the products of the number and all natural numbers.

10. a) $3x + 9$; 3 by $x + 3$; $3(x + 3)$
b) $2x^2 + 3x$; x by $2x + 3$; $x(2x + 3)$

11. Example:
a) $6x^2 + 18x$ **b)** $8a^2b - 4ab$
c) $4m^4n^2 + 6m^3n^3 - 10m^3n^2$

12. a) Incorrect: $3x \div 3x \neq 0$;
Correct: $3x(5x - 1)$
b) Incorrect: $(x - 2) \div (x - 2) \neq 0$;
Correct: $(x - 2)(5x - 1)$
c) Incorrect: GCF $\neq 9ab$;
Correct: $9a^2b^2(b - 3 + 9ab)$
d) Incorrect: factoring incomplete;
Correct: $2(x + 4)(2f + 1)$
e) Incorrect: expression not simplified;
Correct: $2(p^2 - 7p - 5)$

13. 6

14. $4r^2(4 - \pi)$

15. 6 in. by 6 in.

16. Example: $15x$ by $x + 2$

17. 3484, 5226

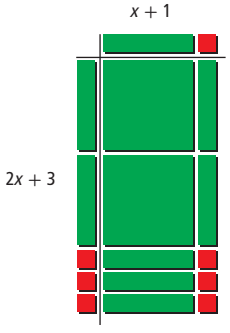
18. a) $(2x + 5)^2 + (2x + 2)^2 + (2x - 1)^2$
b) $12x^2 + 24x + 30$ **c)** $6(2x^2 + 4x + 5)$

19. a) $SA = b(b + 2s)$ **b)** 65 cm^2
c) Example: The surface areas are the same, but the equations used to calculate them are different.
d) Example: It is less complicated to find the surface area using the factored form.

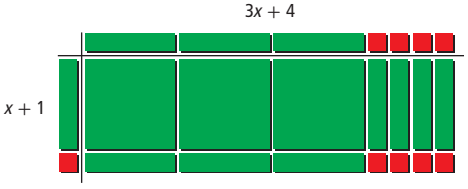
5.3 Factoring Trinomials, pages 234 to 237

1. a) $x^2 + 4x + 3$; $(x + 1)(x + 3)$
b) $x^2 + 2x + 1$; $(x + 1)(x + 1)$
c) $x^2 + x - 2$; $(x + 2)(x - 1)$
d) $x^2 + 5x + 4$; $(x + 4)(x + 1)$

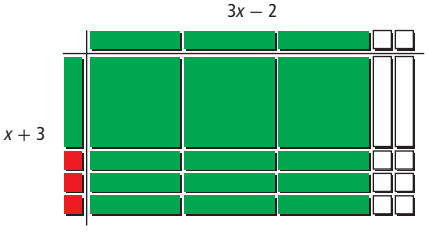
2. a) $(2x + 3)(x + 1)$



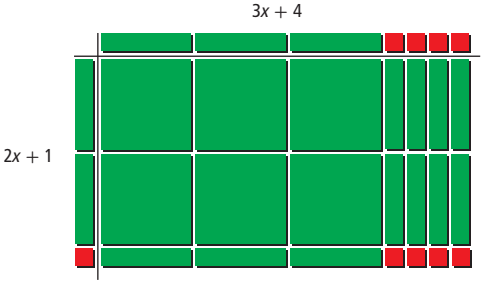
b) $(3x + 4)(x + 1)$



c) $(3x - 2)(x + 3)$



d) $(3x + 4)(2x + 1)$



3. a) 5 and 9 **b)** -2 and -3
c) 5 and -2 **d)** -10 and 2

4. a) $(x + 2)(x + 5)$ **b)** $(j + 3)(j + 9)$
c) $(k + 4)(k + 1)$ **d)** not factorable
e) $(d + 6)(d + 4)$ **f)** not factorable

5. a) $(m - 5)(m - 2)$ **b)** $(s + 5)(s - 2)$
c) $(f - 6)(f - 1)$ **d)** $(g - 7)(g + 2)$
e) $(b - 4)(b + 1)$ **f)** $2(r - 3s)(r - 4s)$

6. a) $(2x + 5)(x + 1)$ **b)** $(3y + 8)(2y + 1)$
c) $(3m + 4)(m + 2)$ **d)** not factorable
e) $(4q + 3)(3q + 2)$ **f)** $(3x + y)(x + 2y)$

7. a) $(4x - 3)(x - 2)$ **b)** not factorable
c) $(x - 2)(x - 3)$ **d)** $(2m - 3)(m + 3)$
e) $3(2x + y)(x - y)$ **f)** $(4y - 1)(3y + 1)$
g) $(6c - 5d)(c + 2d)$ **h)** $(k + 3)(4k + 3)$
i) $(a + 3b)(a + 8b)$ **j)** $(6m + n)(m + 2n)$

8. a) $x + 10$ and $x + 8$; 25 cm by 23 cm
b) $3x + 8$ and $2x - 1$; 53 cm by 29 cm

9. Example:
a) 7, 8 **b)** 4, 5
c) 2, 7 **d)** 3, 9

10. Example:
a) 8, 9 **b)** 9, 20 **c)** $-2, -3$ **d)** 8, 15

11. Example:
a) $\pm 8, \pm 17$ **b)** $\pm 20, \pm 28$ **c)** $\pm 13, \pm 23$

12. Example:
a) $k = 2$ **b)** $k = 2$ **c)** $k = 2$

13. Example:
a) $5x^2 + x + 16$
b) No two numbers multiply to 80 and add to 1.

15. $h = -(t - 5)(5t + 2)$; 34 m

16. $(40 - 2x)$; $(18 + x)$

17. any three of the following values: $-16, -11, -8$, 8, 11, 16

18. $12x + 20y$. Factor the expression and then multiply the length of a single side (factor) by 4.

19. First factor out 3. Then, factor the new expression $10x^2 - 13xy - 3y^2$; $3(5x + y)(2x - 3y)$

20. **a)** rectangle **b)** $2x - 1$ by $4x + 7$

21. Example: For factorable trinomials, the operations of factoring the trinomial and multiplying the resulting binomials are opposite operations. For example, the product of $(x + 5)(x - 3)$ results in the trinomial $x^2 + 2x - 15$, and the result of factoring the trinomial $x^2 + 2x - 15$ is $(x + 5)(x - 3)$.

5.4 Factoring Special Trinomials, pages 246 to 251

1. **a)** $(x + 2)(x - 2)$ **b)** $(2x + 3)(2x - 3)$
c) $(x + 4)(x + 4)$ **d)** $(x - 3)(x - 3)$

2. **a)** $x^2 - 64$ **b)** $4x^2 - 25$
c) $9a^2 - 4b^2$ **d)** $3t^2 - 75$

3. **a)** $x^2 + 6x + 9$ **b)** $25a^2 - 30ab + 9b^2$
c) $4h^2 + 12h + 9$ **d)** $5x^2 - 20xy + 20y^2$

4. **a)** $m^2 - y^2 = (m - y)(m + y)$
b) $16r^6 - 81 = (4r^3 - 9)(4r^3 + 9)$
c) $x^2 - 12x + 36 = (x - 6)^2$
d) $4x^2 + 20x + 25 = (2x + 5)^2$
e) $25x^2 + 70x + 49 = (5x + 7)(5x + 7)$

5. **a)** $(x + 4)(x - 4)$ **b)** $(b + 11)(b - 11)$
c) not factorable **d)** $(3a + 4b)(3a - 4b)$
e) $(6c + 7d)(6c - 7d)$ **f)** not factorable
g) not factorable **h)** $(10 + 3t)(10 - 3t)$

6. **a)** $(x + 6)(x + 6)$ **b)** $(x + 5)(x + 5)$
c) not factorable **d)** $(m - 13)(m - 13)$
e) $(4k - 1)(4k - 1)$ **f)** $(7 - m)(7 - m)$
g) not factorable **h)** $(6a + 7)(6a + 7)$

7. **a)** $5(t^2 - 20)$ **b)** $10xy(x + 3)(x - 3)$
c) $4(x^2 - 12x + 9)$ **d)** $2x(3x + 2)(3x + 2)$
e) $(x^2 + 4)(x + 2)(x - 2)$ **f)** $(x + 3)^2(x - 3)^2$

8. **a)** ± 10; $(x + 5)^2$; $(x - 5)^2$
b) ± 20; $(a + 10)^2$; $(a - 10)^2$
c) ± 70; $(5b + 7)^2$; $(5b - 7)^2$
d) ± 132; $(6t + 11)^2$; $(6t - 11)^2$

9. **a)** $-16b$ is not a perfect square term.
b) There are no pairs of integers that have a product of -12 and a sum of -7.
c) The trinomial is not of the form $(ax)^2 - 2abx + b^2$.
d) $49t^2 + 100$ is not a difference of squares.

11. **a)** 280 **b)** 460 **c)** 600 **d)** -600

13. $(x + y)(x - y)$

14. **a)** $\pi(r + 4)^2 - \pi r^2$ **b)** $8\pi(r + 2)$
c) 201.1 cm^2

15. **a)** $[3(2x - 3)]^2 - (2x - 3)^2$
$= [3(2x - 3) - (2x - 3)][3(2x - 3) + (2x - 3)]$, or $[4x - 6][8x - 12]$
b) $32x^2 - 96x + 72$
c) Example: $x = 1$; $8 = 8$

16. Example: The top striped rectangle has an area of $x(x - y)$. The bottom striped rectangle has an area of $y(x - y)$. Adding these areas gives the difference between the areas of the larger and smaller squares. The difference of squares is $x^2 - y^2 = (x - y(x + y)$.

17. $28 - 8x$

18. $6x + 10$

19. **a)** Never true. $(-b)^2 \neq -b^2$
b) Sometimes true. It is true if $a = 0$ or $b = 0$.
c) Sometimes true. When $b = 0$,
$a^2 - 0^2 = a^2 - 2a(0) + 0^2$
$a^2 = a^2$
d) Always true. $(a + b)^2 = a^2 + 2ab + b^2$.

20. Rahim is correct; $4(4x^2 + y^2)$ cannot be factored further.

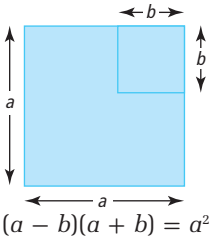
21. $x + 3y$ by $x - 3y$ by $xy - 7$

22. $16x^2 - 52x + 36$

23. **a)** $x^2 - y^2 = x + y$
Factor as a difference of squares to get $x - y = 1$.
b) any pair of consecutive integers from 11 to 20, for example 11 and 12, 12 and 13, and so on

24. **a)** $b = 2\sqrt{c}$ **b)** $b = 2\sqrt{ac}$

25.



$(a - b)(a + b) = a^2 - ab + ab - b^2 = a^2 - b^2$

26. $x^2 + 2bx + b^2$ has factors $(x + b)^2$ and $x^2 - 2bx + b^2$ has factors $(x - b)^2$.

27. $30^2 - 1 = 899$; $60^2 - 1 = 3599$

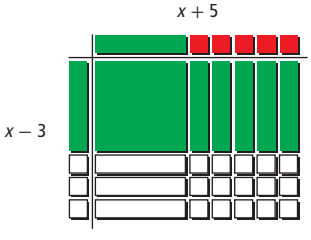
a) Example: $a^2 - b^2 = (a + b)(a - b)$ represents a difference of squares and also the product of two numbers that differ by 2. In this case, the average of a and b represents half the difference between the numbers. Since the two numbers differ by 2, adding 1 to the average gives the larger number and subtracting 1 gives the smaller number.

b) Square the average of the two numbers and subtract 9.

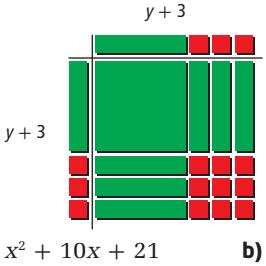
c) (average $-$ 3)(average $+$ 3)

Chapter 5 Review, pages 252 to 253

1. a)



b)



2. a) $x^2 + 10x + 21$ **b)** $b^2 - 81$

c) $y^2 - 121$ **d)** $15a^2 + 58ab + 48b^2$

e) $-20x^2 - 100xb - 125b^2$

f) $36b^2 - a^2$

3. a) $a^3 + 3a^2 - 16a - 6$ **b)** $19b^3 + 2b^2 - 16b$

4. $x(x - 3) + 2(9)$; $x^2 - 3x + 18$

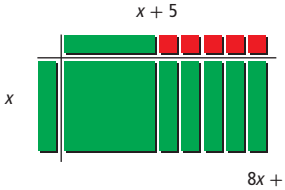
5. $10x^2 + 100x + 250$

6. a) 16 **b)** 27 **c)** 6

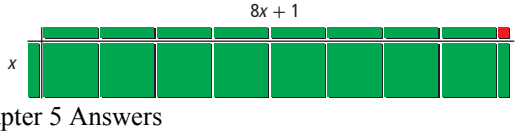
d) $2x$ **e)** 10 **f)** x

7. a) 54 **b)** 375

8. a)

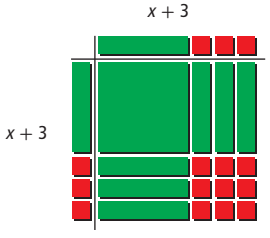


b)

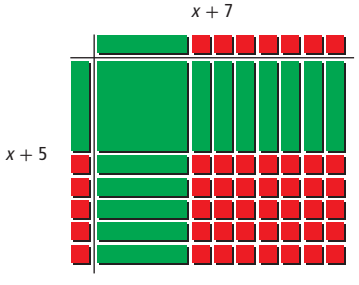


9. $xy(2x + 5)$

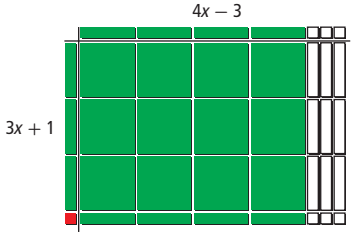
10. a)



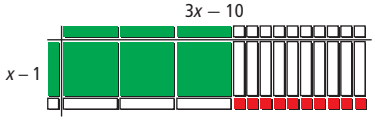
b)



c)



d)



11. a) $(x - 6)(x + 2)$ **b)** $(x - 3)(x - 4)$

c) $3(5x + 4)(2x - 1)$ **d)** $-2(x + 6)(3x - 1)$

e) $-2(x - 3)(x - 5)$ **f)** $x(x + 7)(x - 4)$

12. $(x - 9)$ and $(x - 10)$; 2 cm by 1 cm

13. a) $(x + 10)(x - 10)$ **b)** $(c + 5)(c - 5)$

c) $(3x + 4)(3x - 4)$ **d)** $2(8 + 3x)(8 - 3x)$

e) $(1 + 15y)(1 - 15y)$ **f)** $-3(x + 3y)(x - 3y)$

14. a) $(y + 8)^2$ **b)** $(x - 10)^2$

c) $9(5 - y)^2$ **d)** $(11c + 14d)^2$

15. a) x by $2x + 3$ by $2x + 3$

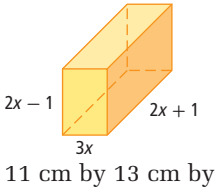
b) a rectangular prism with a square base with sides $2x + 3$ and height x

c) 270 cm^2

16. $x^2 + y^2 + 4x + 4y + 8$

Chapter 5 Practice Test, pages 254 to 255

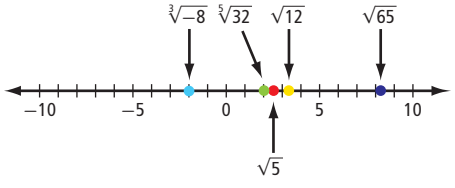
1. A
2. B
3. A
4. C
5. GCF: 4; LCM: 15 960
6. **a)** $x^2 - 12x + 27$ **b)** $4x^2 + 4x - 3$
c) $-x^2 + 24x - 66$ **d)** $11c^2 + 4cd + d^2$
e) $-10x^2 - 2x + 9$
f) $c^2 + 9d^2 + 12cd - 6c - 3$
7. **a)** $6x^4 + 17x^3 + 5x^2$ **b)** 252 cm^3
8. **a)** $(x + 5)^2$ **b)** $(5r - 2s)^2$
c) $5(x + 1)(x - 1)$ **d)** $(1 + 7m)(1 - 7m)$
e) $(m + 3)(5m + 2)$ **f)** $(m - 7n)(m - 2n)$
9. **a)** $y(3y - 1)(y - 2)$ **b)** $4(m^2 + 4)$
c) $(2y + 1)(3y - 1)$ **d)** $(x - 4)(m - 2)$
e) $(x + y)(2 + y)$ **f)** $t(3 - 2t)(3 + 2t)$
10. **a)** $(2x + 5)(5x - 8)$ **b)** 69 mm by 152 mm
11. $A = \pi(2x + 3)^2$ m; $A = \pi(4x^2 + 12x + 9)$ m
12. No. The expression $4y^2 - 6y - 9$ cannot be factored over the integers. The correct answer should be $2(4y^2 - 6y - 9)$.
13. **a)** $3x(2x + 1)(2x - 1)$
b)



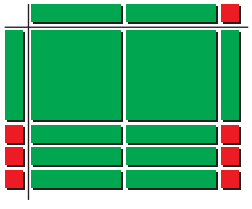
c) 11 cm by 13 cm by 18 cm

Unit 2 Review, pages 256 to 259

1. B
2. D
3. C
4. A
5. Perfect squares: 16, $\sqrt{16} = 4$; 169, $\sqrt{169} = 13$.
Perfect cubes: -8, $\sqrt[3]{-8} = -2$; 27, $\sqrt[3]{27} = 3$; 125, $\sqrt[3]{125} = 5$; 1000, $\sqrt[3]{1000} = 10$.
Neither: 15, -4, 99
6.

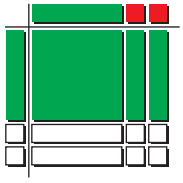


7. 81 $in.^2$
8. 9 cm^2
9. **a)** $2\sqrt{3}$ **b)** $9\sqrt{2}$ **c)** $2\sqrt[3]{2}$
10. **a)** $\sqrt{20}$ **b)** $\sqrt{75}$ **c)** $\sqrt[3]{40}$
11. **a)** $\sqrt[5]{7^4}$ **b)** $\sqrt[3]{\frac{27}{8}}$ **c)** $\sqrt[4]{6x^2}$
12. **a)** $\frac{m^{\frac{3}{2}}}{n}$ **b)** $6^{\frac{3}{4}}$ **c)** $2s^{\frac{4}{3}}$
13. **a)** $\left(\frac{1}{3}\right)^{\frac{11}{2}}$ **b)** $\frac{1}{y^3}$ **c)** $\frac{1}{3}$
14. **a)** $\frac{125}{8}$ **b)** 150 **c)** 100
15. **a)**



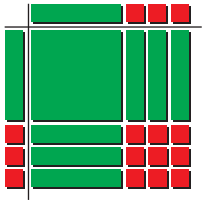
$2x^2 + 7x + 3$

b)



$x^2 - 4$

c)



$x^2 + 6x + 9$

16. **a)** $a^2 + 3a - 28$ **b)** $10x^2 + 19x + 6$
c) $-x^2 + 25$ **d)** $9y^2 + 24y + 16$
e) $4a^2 - 13ab + 3b^2$ **f)** $2v^3 - 6v^2 - 5v + 9$
17. Example:
a) $k = 7$ **b)** $k = 2$
18. **a)** $161 \neq 12$
b) No. $4x(11x) = 44x^2$ not $44x$; $4x(-7) = -28x$ not $-24x$; $-1(-7) = 7$ not 6.
Correct: $8x^3 + 42x^2 - 39x + 7$
19. **a)** not factorable **b)** $2(5x - 3y)^2$
c) not factorable
20. k is an integer that is divisible by 2.
21. **a)** $7x$ **b)** $5x^2$ **c)** $3ab(a - 1)$
22. **a)** not factorable **b)** $(v + 3)(2v - 3)$
c) $-2(x + 5)(x - 2)$ **d)** $(2y + 5)(2y - 5)$
e) $(x - 20)(x - 1)$ **f)** $-(3x - 2)(5x + 3)$
23. **a)** Julio divided the first and last terms by 2, but subtracted 2 from the middle term instead of dividing by 2.
b) $2(x + 3)(x + 3)$
24. **a)** $(4a + 6)(4a - 6)$ **b)** $16a^2 - 36$
c) 36 $units^2$
25. $r = 7n + 8$

Unit 2 Test, pages 260 to 261

1. D
2. C
3. A
4. D
5. A
6. 12
7. 5
8. 19
9. 4
10. $\frac{1}{20^{\frac{1}{6}}}$
11. **a)** $2x^2 + 9xy - 5y^2$ **b)** $6a^3 - 5a^2 - 20a + 21$
c) $3x^3 - 7x^2 + 7x + 1$
12. **a)** $(x - 9)(x - 1)$ **b)** $(a - 2)(4a + 3)$
c) $(4x + y)(4x - y)$
13. **a)** $x^2 - 1$ **b)** $14x^2 + 17x - 3$