5.1 Multiply Polynomials

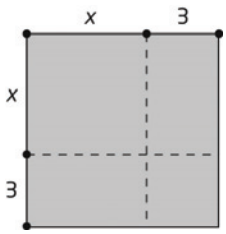
***Principles of Mathematics 10*, pages 210–219**

A

1. What binomial product does each model represent?

a)

b)



2. Model each binomial product using algebra tiles, virtual algebra tiles, or a diagram.

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

c) $(3x + 2)(2x + 1)$ **d)** $(3x + 1)(2x + 3)$

3. Use the distributive property to find each binomial product.

a) $(x + 2)(x + 5)$ **b)** $(x + 1)(x + 3)$

c) $(d + 3)(d + 2)$ **d)** $(q + 5)(q + 10)$

e) $(y + 6)(y + 1)$ **f)** $(z + 8)(z + 8)$

4. Use the distributive property to find each binomial product.

a) $(x - 3)(x - 4)$ **b)** $(x - 5)(x - 6)$

c) $(m - 2)(m - 7)$ **d)** $(a - 6)(a - 8)$

e) $(h - 1)(h - 4)$ **f)** $(k - 6)(k - 6)$

5. Use the distributive property to find each binomial product.

a) $(x + 5)(x - 4)$ **b)** $(x + 3)(x - 7)$

c) $(n - 4)(n + 6)$ **d)** $(r - 8)(r + 3)$

e) $(h + 9)(h - 5)$ **f)** $(e - 5)(e + 6)$

B

6. Expand and simplify.

a) $5(x + 4)(x + 6)$ **b)** $3(y + 7)(y - 3)$

c) $-2(t - 5)(t + 6)$ **d)** $-(h - 2)(h - 8)$

7. Expand and simplify.

a) $(x + 3)(x + 5) + (x + 4)(x + 2)$

b) $(y + 6)(y - 3) + (y - 5)(y + 4)$

c) $(c - 4)(c + 6) - (c + 2)(c - 3)$

d) $-(k + 7)(k + 5) + (k - 6)(k - 3)$

8. Expand and simplify.

a) $3(2x + 3)(3x - 5) + 4(5x - 2)(4x + 3)$

b) $5(3y - 4)(2y - 3) - 3(4y + 1)(2y - 1)$

c) $(g + 6)^2 - (g - 6)^2$

d) $-4(5r - 3)(3r + 2) + 5(3r + 4)(2r - 5)$

9. An athlete throws a metal ball in a shot-put event at a track and field meet. The predicted flight path of the ball is defined by the relation $h = -2(d - 4)(d - 7)$, where d is the distance, in metres, from the throwing circle and h is the height, in metres.

a) Expand and simplify the relation.

b) Verify that the relation from part a) is equivalent to the original relation. Use both relations to determine the height of the shot-put if d represents 5 m.

10. A square patio has side length x. One dimension is increased by 2 m and the other is increased by 3 m.

a) Write an algebraic expression for the area of the original patio.

b) Write an algebraic expression for the area of the new patio.

c) Expand and simplify your area expression from part b).

d) Find an expression that represents the increase in area.

e) If x represents 6 m, find the increase in area.

11. A rectangle has width w centimetres and length 3 cm more than its width.

a) Draw a diagram of the rectangle.

b) Express the area as a product.

c) Expand and simplify the area expression.

12. A square-based rectangular prism has a base length of w centimetres and height 5 cm more than its base length.

a) Draw a diagram of the square-based rectangular prism.

b) Express the volume of the square-based rectangular prism as a product.

c) Expand and simplify the volume expression.

C

13. A parabola has equation $y = (x + 4)(x - 2)$.

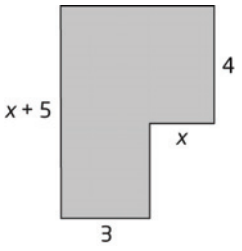
a) Find the x-intercepts of $y = (x + 4)(x - 2)$.

b) Expand and simplify the equation.

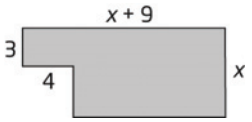
c) Graph the result from part b). Verify that the x-intercepts are the same.

14. Write an algebraic expression for the area of each figure. Expand and simplify. Then, find the area in another way to verify your results.

a)



b)



15. The number of glasses of pink lemonade, n, sold by the Lemonade Dreams Café on a given day is modelled by $n = 300 - 50p$, where p is the price, in dollars.

a) Solve this equation for p.

b) The revenue generated by lemonade sales is $R = 2np$. Substitute your expression for p from part a), and expand to obtain an expression for the daily pink lemonade revenue.

5.2 Special Products

***Principles of Mathematics 10*, pages 220–227**

A

1. Draw a diagram to illustrate each product.

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

c) $(x + c)^2$ **d)** $(cx + d)^2$

2. Expand and simplify.

a) $(x + 2)^2$ **b)** $(y + 3)^2$

c) $(a + 8)^2$ **d)** $(n + 1)^2$

e) $(w + 12)^2$ **f)** $(m + 5)^2$

g) $(p + 13)^2$ **h)** $(z + 15)^2$

3. Expand and simplify.

a) $(x - 1)^2$ **b)** $(r - 6)^2$

c) $(f - 7)^2$ **d)** $(b - 4)^2$

e) $(e - 5)^2$ **f)** $(k - 14)^2$

g) $(s - 11)^2$ **h)** $(h - 9)^2$

4. Expand and simplify.

a) $(x + 5y)^2$

b) $(2x + y)^2$

c) $(3a + 4b)^2$

d) $(4c - 5d)^2$

e) $(5d + 7m)^2$

f) $(6r - 8j)^2$

g) $(2q + 3r)^2$

h) $(3s - 5t)^2$

i) $(4g - 9h)^2$

i) $(7u - 6w)^2$

B

5. Expand and simplify.

a) $(x + 4)(x - 4)$

b) $(y - 7)(y + 7)$

c) $(v + 8)(v - 8)$

d) $(u - 6)(u + 6)$

e) $(t - 3)(t + 3)$

f) $(e + 5)(e - 5)$

g) $(i - 16)(i + 16)$

h) $(u + 25)(u - 25)$

6. Expand and simplify.

a) $(a - b)(a + b)$

b) $(5c - d)(5c + d)$

c) $(s + 4t)(s - 4t)$

d) $(q - 6n)(q + 6n)$

e) $(4p + 7w)(4p - 7w)$

f) $(8h - 3f)(8h + 3f)$

7. Expand and simplify. Verify your answers. Check that substituting $x = 3$ into the original expression and the simplified expansion yields the same answer.

a) $(x - 2)(x + 2)$

b) $(x + 6)^2$

8. Expand and simplify. Verify your answers. Check that graphing both the original expression and the simplified expansion using a graphing calculator yields only one graph.

a) $(x + 3)(x - 3)$

b) $(x - 4)^2$

9. Expand and simplify. Verify your answers. Check that using a CAS to expand the original expression yields the same answer.

a) $(x + 6)(x - 6)$

b) $(x - 12)^2$

10. The base, s, of a square has been increased by x. Both s and x are measured in the same units. Write a formula for the area of the new square. Expand and simplify.

11. Each dimension of a square deck at the back of a house is increased by 3 m.

a) Draw a diagram of the situation.

b) Find a simplified algebraic expression of the new deck.

c) Find a simplified algebraic expression for the increase in area.

12. A square has side length $8a$. One dimension is increased by $3b$ and the other is decreased by $3b$.

a) Find an algebraic expression for the resulting area. Expand and simplify.

b) Find an algebraic expression for the change in area.

c) Calculate the area of the square and change in area if a represents 4 cm and b represents 2 cm.

C

13. A parabola has equation $y = (x - 3)^2$.

a) Identify the coordinates of the vertex.

b) Expand and simplify the equation.

c) Verify that the coordinates of the vertex satisfy the equation from part b).

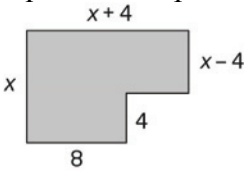
14. A parabola has equation $y = (x + 4)^2$.

a) Identify the coordinates of the vertex.

b) Expand and simplify the equation.

c) Verify that the coordinates of the vertex satisfy the equation from part b).

15. Use two methods to determine an algebraic expression to represent the area of the figure. Verify that they are equivalent expressions.



16. Expand and simplify. Use a CAS to verify your answers.

a) $(x + 2)^4$

b) $(x - 4)^3$

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

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

5.3 Common Factors

***Principles of Mathematics 10*, pages 228–235**

A

1. Find the greatest common factor of each pair of terms.

a) $4x$ and $5x$ **b)** $4cd$ and $-6cf$

c) x^3 and x^4 **d)** m^5 and m^8

e) $7h^2$ and $3h$ **f)** $-8y^5$ and $-6y^3$

2. Use algebra tiles or a diagram to illustrate the factoring of each polynomial.

a) $3x + 9$ **b)** $x^2 + 3x$

c) $2x^2 + 4x$ **d)** $4x^2 + 2x$

3. Factor fully, if possible.

a) $14m + 21n$

b) $5c + 10d$

c) $13ab - 7ac$

d) $3x^3 - 5x^2$

e) $5p + 7q$

f) $12r^5 + 18r^3$

g) $2h^4 + 6h^3 - 4h^2$

h) $9b + 7c - 5d$

4. Factor fully, if possible.

a) $16x^3y + 18xy^3$

b) $15a^4b^3 - 10a^2b^5$

c) $4gh^2 - 5i$

d) $30r^4s^2t + 25r^3st^2$

e) $5d^3e^2 + 3d^2e - 7de^3$

f) $9ab - 5cd + 7ef$

g) $3h^4k^2 + 6h^3k^4 - 9h^2k^3$

h) $12m^5n^3 - 10m^2n^4 + 14m^3n^5$

B

5. Factor, if possible.

a) $2x(x + 5) + 3(x + 5)$

b) $x(x - 3) - 2(x - 3)$

c) $5a(a + 3b) + 4b(a + 3b)$

d) $3s(2s + 5t) - 7t(2s + 5t)$

e) $4c(3d - 2) - 3(3d + 2)$

f) $6h(2h + 5) - 7(2h + 5)$

6. Factor by grouping.

a) $gx + gy + 3x + 3y$

b) $x^2 + 4x + 2x + 8$

c) $cd^2 + 5cd + 3d + 15$

d) $9m^2 - 12m - 12m + 16$

e) $10p^2 - 15p + 8p - 12$

f) $12r^2 - 9r - 8r + 6$

7. **a)** Write a polynomial with two terms that has a GCF of 8.

b) Write a polynomial with two terms that has a GCF of y.

c) Write a polynomial with two terms that has a GCF of $3a^2$.

d) Write a polynomial with two terms that has a GCF of $5m^3n^4$.

8. The formula for the area of a trapezoid can be expressed as $A = \frac{1}{2}b_1h + \frac{1}{2}b_2h$, where h is the height, in centimetres, and b_1 and b_2 are the lengths of the parallel sides, in centimetres.

a) Write the formula in factored form.

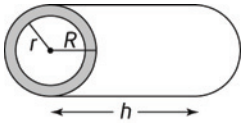
b) If $h = 3$ cm, $b_1 = 2$ cm, and $b_2 = 4$ cm, find the area using both the original and the factored forms. What do you notice? Explain why this is so.

9. The formula for the surface area of a cone is $SA = \pi r^2 + \pi rs$.

a) Write the formula in factored form.

b) If r represents 3 cm and s represents 5 cm, find the surface area using both the original and the factored forms. What do you notice? Explain why this is so.

10. The formula for the volume of material used to make the hollow cylinder shown is $V = \pi hR^2 - \pi hr^2$, where h is the height, in centimetres, R is the length of the external radius, in centimetres, and r is the length of the internal radius, in centimetres.



a) Write the formula in factored form.

b) If h represents 5 cm, R represents 8 cm, and r represents 6 cm, find the volume using both the original and the factored forms. What do you notice? Explain why this is so.

C

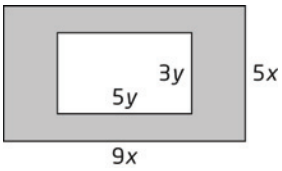
11. A rectangle has area given by the expression $4x^2 + 8x$. The length and width of the rectangle can be found by factoring the expression. Find all possible expressions for the length and width.

12. Factor.

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

b) $6x(y - 4) - 5(4 - y)$

13. Write an expression, in factored form, for the shaded region.



14. Factor the quadratic relation $y = 3x^2 - 5x$ to find the x-intercepts.

15. Factor the quadratic relation $y = 6x^2 + 7x$ to find the x-intercepts.

16. Factor fully using a fraction as one of the common factors.

a) $\frac{1}{4}x^2 + \frac{3}{4}y^2$

b) $\frac{2}{5}a^2b - \frac{1}{5}ab^2$

5.4 Factor Quadratic Expressions of the Form $x^2 + bx + c$

***Principles of Mathematics 10*, pages 236–241**

A

1. Illustrate the factoring of each trinomial using algebra tiles or a diagram.

a) $x^2 + 3x + 2$ **b)** $x^2 + 5x + 6$

c) $x^2 + 7x + 10$ **d)** $x^2 + 6x + 9$

2. Find two integers with the given product and sum.

a) product = 42, sum = 13

b) product = 8, sum = 6

c) product = –6, sum = –1

d) product = –18, sum = –3

3. Factor, if possible.

a) $x^2 + 6x + 5$

b) $m^2 + 8m + 15$

c) $n^2 + 8n + 6$

d) $k^2 + 8k + 12$

e) $f^2 + 10f + 5$

f) $g^2 + 11g + 30$

g) $w^2 + 6w + 8$

h) $a^2 + 7a + 6$

i) $b^2 + 3b + 3$

j) $n^2 + 8n + 7$

4. Factor, if possible.

a) $n^2 - 10n + 16$

b) $p^2 - 12p + 12$

c) $r^2 - 7r + 10$

d) $z^2 - 15z + 56$

e) $w^2 - 9w + 18$

f) $m^2 - 13m + 26$

g) $r^2 - 3r + 2$

h) $p^2 - 13p + 12$

i) $k^2 - 11r + 10$

j) $c^2 - 7c + 12$

B

5. Factor, if possible.

a) $a^2 - 5a - 24$

b) $q^2 + 5q - 6$

c) $h^2 - 7h - 18$

d) $x^2 + x - 13$

e) $k^2 - k - 12$

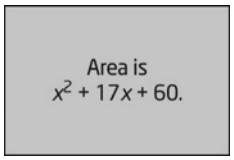
f) $b^2 + 2b - 3$

g) $f^2 - 5f - 10$

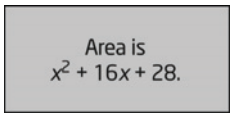
h) $t^2 + 11t - 26$

6. Determine binomials that represent the length and width of each rectangle. Then determine the dimensions of the rectangle if x represents 12 cm.

a)



b)



7. Factor completely by first removing the greatest common factor.

a) $3x^2 + 15x + 18$

b) $4m^2 - 32m + 48$

c) $5k^2 + 50k + 80$

d) $4p^2 - 36p + 80$

e) $x^3 + 19x^2 - 42x$

f) $cx^2 - 6cx - 27c$

8. Determine two values of d so that each expression can be factored.

a) $x^2 + 10x + d$

b) $x^2 - 12x + d$

c) $x^2 + x - d$

d) $x^2 - 3x - d$

9. Determine two values of k so that each expression can be factored.

a) $x^2 + kx + 24$

b) $x^2 - kx + 6$

c) $x^2 + kx - 12$

d) $x^2 - kx - 20$

10. Factor, if possible.

a) $m^2 + 14mn + 24n^2$

b) $p^2 - 8pq + 15q^2$

c) $r^2 + 2rs - 48s^2$

d) $w^2 - 3wz - 10z^2$

11. A parabola has equation $y = x^2 + 2x - 8$.

a) Factor the right side of the equation.

b) Identify the x-intercepts of the parabola.

c) Find the equation of the axis of symmetry, find the vertex, and draw the graph.

C

12. The height of a rock thrown from a walkway over a lagoon can be approximated by the formula $h = -5t^2 + 20t + 60$, where t is the time in seconds, and h is the height, in metres.

a) Write the formula in factored form.

b) When will the rock hit the water?

13. a) Factor each of the following expressions.

$x^4 + 2x^2 + 1$
$x^4 + 4x^2 + 4$
$x^4 + 6x^2 + 9$
$x^4 + 8x^2 + 16$

b) How are the expressions and the factored forms of the expressions alike?

c) How are the expressions and the factored forms of the expressions different?

d) Write the next two expressions and the factored form of each of these expressions.

14. Factor each of the following expressions.

a) $x^4 + 12x^2 + 20$

b) $x^4 + 8x^2y^2 + 7y^4$

c) $x^6y^6 - 4x^3y^3z^2 - 12z^4$

5.5 Factor Quadratic Expressions of the Form $ax^2 + bx + c$

***Principles of Mathematics 10*, pages 242–247**

A

1. Illustrate the factoring of each trinomial using algebra tiles or a diagram.

a) $2x^2 + 9x + 4$

b) $3x^2 + 8x + 5$

c) $4x^2 + 9x + 2$

d) $2x^2 + 7x + 3$

2. Factor, if possible.

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

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

c) $5m^2 + 14m + 8$

d) $3d^2 + 17d + 10$

e) $4p^2 + 7p + 8$

f) $12s^2 + 31s + 20$

3. Factor, if possible.

a) $6m^2 - 17m + 5$

b) $4m^2 - m + 7$

c) $12r^2 - 11r + 2$

d) $5b^2 - 13b + 6$

e) $2k^2 - 13k + 21$

f) $12h^2 - 28h + 15$

B

4. Factor, if possible.

a) $8k^2 - 2k - 3$

b) $12g^2 - 7g - 10$

c) $16c^2 + 14c - 15$

d) $5u^2 + 7u - 3$

e) $10a^2 + 9a - 7$

f) $6v^2 - v - 15$

5. Factor.

a) $2x^2 + 9xy + 4y^2$

b) $6a^2 - 11ab + 3b^2$

c) $8r^2 + 22rs + 15s^2$

d) $6g^2 + 7gh - 20h^2$

e) $9p^2 + 15pq - 14q^2$

f) $12c^2 - 11cd - 15d^2$

6. Factor.

a) $16d^2 - 28d - 30$

b) $6j^2 + 3j - 45$

c) $32b^2 + 40b - 12$

d) $30z^2 - 34z - 8$

e) $12v^2 - 8v - 4$

f) $10t^2 - 4t - 14$

7. Factor. Then substitute $x = 3$ into both forms. Are the results the same? Explain.

a) $2x^2 + 7x + 3$

b) $4x^2 - 16x + 15$

c) $2x^2 - 5x - 3$

d) $3x^2 - x - 10$

e) $6x^2 - x - 15$

f) $15x^2 + 7x - 2$

g) $10x^2 + 9x - 9$

h) $8x^2 + 10x - 3$

i) $2x^2 + x - 3$

j) $6x^2 + 17x + 5$

8. Determine two values of h so that each trinomial can be factored over the integers.

a) $2x^2 + hx + 4$

b) $3y^2 + hy + 16$

c) $5g^2 + hg + 12$

d) $6s^2 - hs - 12$

9. Determine two values of k so that each trinomial can be factored over the integers.

a) $9x^2 + 15x + k$

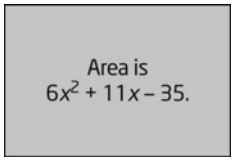
b) $5y^2 - 11y + k$

c) $4m^2 + 16m + k$

d) $3w^2 - 10w + k$

C

10. A rectangle has area defined by $6x^2 + 11x - 35$.



a) Factor to find algebraic expressions for the length and width of the rectangle.

b) If x represents 8 cm, determine the perimeter and area of the rectangle.

11. The height of a ball thrown from the top of a ladder can be approximated by the formula $h = -2t^2 + 4t + 48$, where t is the time, in seconds, and h is the height, in metres.

a) Write the formula in factored form.

b) Determine when the ball will hit the ground.

12. Factor each of the following expressions.

a) $6m^4 + 31m^2 + 40$

b) $8q^4 - 38q^2 + 35$

c) $10a^4 - 7a^2 - 12$

13. Factor.

a) $3(x + c)^2 + 7(x + c) + 2$

b) $2(x - d)^2 + 9(x - d) + 10$

c) $6(x + m)^2 + 5(x + m) + 1$

5.6 Factor a Perfect Square Trinomial and a Difference of Squares

***Principles of Mathematics 10*, pages 248–255**

A

1. Factor.

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

c) $4h^2 - 49$ **d)** $121k^2 - 64$

e) $81a^2 - 4$ **f)** $100r^2 - 9$

g) $144y^2 - 169$ **h)** $196u^2 - 1$

2. Factor.

a) $a^2 - 36b^2$ **b)** $r^2 - 49s^2$

c) $25 - 36c^2$ **d)** $64 - 81d^2$

e) $9q^2 - 4r^2$ **f)** $g^2 - 16h^2$

g) $18v^2 - 98b^2$ **h)** $12k^2 - 27c^2$

3. Verify that each trinomial is a perfect square. Then factor.

a) $x^2 + 10x + 25$

b) $f^2 + 14f + 49$

c) $r^2 - 8r + 16$

d) $u^2 - 18u + 81$

e) $e^2 + 20e + 100$

f) $36 - 12y + y^2$

4. Verify that each trinomial is a perfect square. Then factor.

a) $16m^2 + 24m + 9$

b) $4k^2 + 28k + 49$

c) $25w^2 + 10w + 1$

d) $81y^2 + 180y + 100$

e) $36p^2 + 60p + 25$

B

5. Factor fully, if possible.

a) $9x^2 + 24xy + 16y^2$

b) $4m^2 - 20mn + 25n^2$

c) $49a^2 + 42ab + 9b^2$

d) $25p^2 - 64q^2$

e) $26w^2 - 8wz + 9z^2$

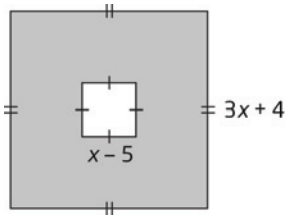
f) $100r^2 - 81s^2$

g) $9q^2 - 2r^2$

h) $64j^2 - 112jk + 49k^2$

6. **a)** Find an algebraic expression for the area of the shaded region.

b) Write the area expression in factored form.



7. Determine all values of b so that each trinomial is a perfect square.

a) $x^2 + bx + 36$

b) $9y^2 + by + 16$

c) $25p^2 - bpq + 49q^2$

d) $81r^2 - brs + 4s^2$

8. Determine all values of c so that each trinomial is a perfect square.

a) $x^2 + 16x + c$

b) $9y^2 - 30y + c$

c) $25m^2 + 20mn + c^2n^2$

d) $z^2 + 30z + c$

9. Determine two values of k so that each trinomial can be factored as a difference of squares.

a) $a^2 - kb^2$

b) $ky^2 - 16$

c) $64m^2 - k$

d) $36p^2 - kq^2$

10. The area of an unknown shape is represented by $16x^2 + 56x + 49$. If x must be an integer, what shape(s) could this figure be?

11. a) A parabola has equation $y = x^2 - 8x + 16$. Rewrite the equation in factored form to find the coordinates of the vertex.

b) A parabola has equation $y = x^2 + 6x + 9$. Rewrite the equation in factored form to find the coordinates of the vertex.

C

12. Factor to evaluate each difference.

a) $20^2 - 13^2$

b) $57^2 - 23^2$

c) $104^2 - 103^2$

d) $88^2 - 77^2$

e) $67^2 - 39^2$

f) $49^2 - 47^2$

13. Factor.

a) $(x - 5)^2 - 9$

b) $(x + 3)^2 + 5(x + 3) + 6$

c) $36x^4 - 49y^4$

d) $m^6 - 6m^3 + 9$

e) $a^8 + 14a^4 + 49$

f) $\frac{x^6}{16} - \frac{y^6}{25}$

14. a) Show that $x^3 - 1 = (x - 1)(x^2 + x + 1)$.

b) Show that $x^3 + 1 = (x + 1)(x^2 - x + 1)$.

c) Show that $x^3 - 8 = (x - 2)(x^2 + 2x + 4)$.

d) Show that $x^3 + 8 = (x + 2)(x^2 - 2x + 4)$.

15. a) Factor $y^3 - 27$.

b) Factor $y^3 + 27$.

Chapter 5 Review

***Principles of Mathematics 10*, pages 256–257**

1. Use the distributive property to find each binomial product.

a) $(x + 7)(x + 4)$

b) $(x - 3)(x - 5)$

c) $(x + 2y)(x - 5y)$

d) $(4a - 3b)(2a + 5b)$

2. Expand and simplify.

a) $-(k - 3)(k + 5)$

b) $3(m + 2n)(m - 3n)$

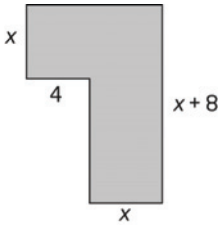
c) $t(t - 3v)(t - 4v)$

d) $(y + 2)(y + 5) - (y - 2)(y - 5)$

e) $2x(x + 1)(x - 3)$

f) $4x(2x + 1)(x - 3) - 2x(x + 4)(x - 5)$

3. Write an algebraic expression to represent the area of the figure. Expand and simplify.



4. Draw a diagram to illustrate each product.

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

5. Expand and simplify.

a) $(x + 4)^2$

b) $(q + 7)^2$

c) $(r - 8)^2$

d) $(t - 5)^2$

e) $(n + 8)^2$

f) $(p - 6)^2$

6. Expand and simplify.

a) $(k + 11)(k - 11)$

b) $(r - 8)(r + 8)$

c) $(s + 13)(s - 13)$

d) $(u - 5)(u + 5)$

e) $(x - 9)(x + 9)$

f) $(t + 4)(t - 4)$

7. Expand and simplify.

a) $(3x + y)^2$

b) $(4m - n)^2$

c) $(6p + 5q)^2$

d) $(8p - 7q)^2$

e) $(2g - 3h)(2g + 3h)$

f) $-(4r + 5s)(4r - 5s)$

8. Use algebra tiles or a diagram to illustrate the factoring of each polynomial.

a) $x^2 + 5x$ **b)** $2x^2 + 6x$

9. Factor.

a) $5x + 15y$

b) $13ab - 15bc$

c) $t^2 + 5t$

d) $3m^2 - 6m^3$

10. Factor by grouping.

a) $15x^2 + 10x + 12x + 8$

b) $3m^2 - 15m - 2m + 10$

c) $10p^2 + 2p - 5p - 1$

d) $6x^2 - 2x - 15x + 5$

11. Factor, if possible.

a) $6m^2 - 8m + 4$

b) $cx + cy + dx + dy$

c) $7a^2 - 13ab - 6b^2$

d) $ghz^2 - g^2hz + ghz$

12. A rectangle has area given by the expression $14x^2 + 7x$. The length and width can be found by factoring the expression. Find all possible expressions for the length and width.

13. Illustrate the factoring of each trinomial using algebra tiles or a diagram.

a) $x^2 + 8x + 15$

b) $x^2 + 5x + 4$

c) $x^2 + 8x + 16$

14. Factor.

a) $d^2 + 11d + 30$

b) $q^2 + 10q + 16$

c) $m^2 - 15m + 56$

d) $z^2 - 8z + 12$

e) $r^2 + 6r - 7$

f) $w^2 + 5w - 24$

g) $p^2 - 7p - 18$

h) $e^2 - 3e - 10$

15. A parabola has equation $y = x^2 + 2x - 15$.

a) Factor the right side of the equation.

b) Identify the x-intercepts of the parabola.

c) Find the equation of the axis of symmetry, find the vertex, and draw the graph.

16. Factor.

a) $8x^2 + 18x + 7$

b) $15y^2 + 26y + 8$

c) $6c^2 - 13c + 5$

d) $8h^2 - 10h + 3$

e) $4w^2 + 8w - 21$

f) $6p^2 - 19p - 7$

17. Factor, if possible.

a) $6x^2 + 5xy - 25y^2$

b) $12m^2 - 7mn - 12n^2$

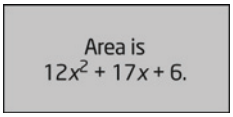
c) $4p^2 + 7pq + 3q^2$

d) $3k^2 - 13kv + 4v^2$

e) $7c^2 + 8cd - 5d^2$

f) $6h^2 - 13hk + 5k^2$

18. A rectangle has area defined by $12x^2 + 17x + 6$.



a) Factor to find the algebraic expressions for the length and width of the rectangle.

b) If x represents 10 cm, determine the perimeter and the area of the rectangle.

19. Factor.

a) $x^2 - 16$ **b)** $y^2 - 64$

c) $9a^2 - 16b^2$ **d)** $25m^2 - 49n^2$

20. Verify that each trinomial is a perfect square. Then, factor.

a) $x^2 + 12x + 36$

b) $q^2 - 10q + 25$

c) $16m^2 + 24m + 9$

d) $9a^2 - 30a + 25$

e) $4a^2 + 28ab + 49b^2$

f) $64p^2 - 80pq + 25q^2$