

3.5 Collect Like Terms

Part 1

Principles of Mathematics 9, pages 144–153

A

1. Classify each pair of terms as either like or unlike.

- a) $5x$ and $-4x$
- b) $4a$ and $4b$
- c) $-x^3$ and $-3x$
- d) $5m^2$ and $4m^2$
- e) $4xy$ and $3yx$
- f) $4a^2b$ and $-3ab^2$

2. Write two like terms for each.

- a) $10d$
- b) $-m$
- c) $5a^2$
- d) $-4ab$
- e) $4x^2y^2$
- f) 8

3. Copy the two columns of terms into your notebook. Connect each term in the first column with the like term in the second column.

$5x$	$-3a^2b^2$
$-3mn$	$2x^3$
8	$-3x$
$4a^5$	-5
$-2x^3$	$5mn$
$6a^2b^2$	$7a^5$

4. Simplify by collecting like terms.

- a) $5x + 2 + 3x + 4$
- b) $4y + 5 - 2y - 3$
- c) $4m - 3 - m + 4$
- d) $6n - 4 - 5n - 2$
- e) $3x^2 + 5 + 2x^2 + 4$
- f) $7a + 3b - 4a - 5b$

5. Simplify.

- a) $3x^2 + 5x + 4x^2 + 2x$
- b) $5a - 1 + 3 - 2a - 4 - a$
- c) $4m^2 + 3m + 2 - 2m^2 - 5m - 3$
- d) $5w^3 + 4w^2 - 3w - w^3 + 2w^2 + 2w$

6. Simplify.

- a) $3a^2 - 2ab - 2b^2 - 2a^2 - ab + b^2$
- b) $2m^3n^2 + 3m^2n^3 - m^3n^2 - 2m^2n^3$
- c) $-4x^2y + 5x - 3 - 3x^2y - 8x + 5$
- d) $5r^4 + 3r^2 - 4 + 2r^4 - 2r^2 + 1$

B

7. The length of a rectangular garden is five times its width.

- a) Write an expression for the perimeter of the garden.
- b) Find the perimeter if the garden is 20 m wide.
- c) Find the length and width if the perimeter is 180 m.
- d) Write an expression for the area of the garden.
- e) Find the area if the garden is 30 m wide.
- f) Find the length and width if the area is 500 m^2 .

8. Use algebra tiles, virtual algebra tiles, or a diagram to model and simplify each expression.

- a) $2x + 3 + 4x + 1$
- b) $5y + 2 - 3y - 1$
- c) $2c^2 + 3c + 4c^2 - 4c$

Collect Like Terms Part 2



9. A square has an unknown side length, x .

- Write a simplified expression for its perimeter.
- Write a simplified expression for its area.
- If the area of the square is 25 m^2 , find the perimeter of the square.

10. Kathe's Kitchen Stores estimates its profits at its five stores for the next x months as follows.

Store	Profit (\$)
North End	$1500x - 3200$
South End	$1300x - 900$
West End	$2150x - 1100$
East End	$1700x - 5000$
Central	$1850x - 800$

- Copy the table, and add a column titled **Profit (or Loss) After 2 Months (\$)**. Complete the table and find the sum of the profits (or losses).
 - Write a polynomial representing the total profit (or loss) at all five stores.
 - Use your polynomial from part b) to calculate the sum of the profits (or losses) from all five stores after 2 months. Compare this to your answer from part a).
 - Calculate the total profit (or loss) after 1 year.
11. A regular pentagon has an unknown side length, x . Write a simplified expression for its perimeter.

C

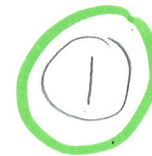
12. John simplified the following expression:

$$x^2 + 3x + x^2 + 2x$$

$$= x^4 + 6x^2$$

- Describe the error that John made.
 - How can you convince John that these two expressions are not equal?
 - Simplify the expression properly. How can you convince John that your answer is correct?
13. When asked his birth year, the 19th-century British mathematician Augustus De Morgan said that he was x years old in the year x^2 . In what year was he born?

Writing Algebraic Expressions



B

7. The students at Northdale High School sell coupon books to raise money for a school trip. The school receives 45% of the money paid for the coupon books.
- Choose a variable to represent the money paid for the coupon books.
 - Using your variable from part a), write the expression for the amount of money the school will receive.
 - Shannon sold one coupon book to her grandmother for \$20. Calculate the amount of money the school receives on this sale.
 - The sum of all coupon book orders was \$14 000. Use your formula to calculate how much the school will receive for this fundraiser.
8. In a basketball game, each player on the team receives 2 points for a basket and 1 point for a free throw.
- Write an expression to represent a player's total score for the game.
 - In the game, Mohamed scored six baskets and five free throws. Use your expression to find Mohamed's total score.
9. On a multiple-choice test, you earn 1 point for each correct answer and lose 2 points for each incorrect answer.
- Write an expression for a student's total score.
 - Tim answered 22 questions correctly and 3 incorrectly. Find Tim's score.
10. Elizabeth has a summer job at a camera store. She earns a \$10 bonus for each gold membership and a \$5 bonus for each silver membership.
- Write a polynomial expression that describes Elizabeth's total bonus.
 - Identify the variable and the coefficient of each term and explain what they mean.
 - How much will Elizabeth's bonus be if she sells 20 gold memberships and 30 silver memberships?
11. A theatre charges \$80 for orchestra seats, \$50 for dress circle seats, and \$25 for balcony seats.
- Write an expression that describes the total earnings from seat sales.
 - Identify the variable and the coefficient of each term and explain what they mean.
 - How much will the theatre earn if it sells 100 orchestra seats, 200 dress circle seats, and 150 balcony seats?
 - How much will the theatre earn if it sells 80 orchestra seats, 250 dress circle seats, and 200 balcony seats?

3.6 Add and Subtract Polynomials

Principles of Mathematics 9, pages 154–159

A

1. Simplify by removing brackets and collecting like terms.

- a) $(3x + 2) + (5x + 3)$
- b) $(7m - 5) + (3m + 4)$
- c) $(-3n + 5) + (n - 4)$
- d) $(3k + 2) + (5k + 4) + (2k + 3)$
- e) $(6r + 5) + (4r - 1) + (3r - 2)$

2. Simplify

- a) $(3x + 5) - (2x + 3)$
- b) $(7m + 4) + (3m + 3)$
- c) $(5s - 2) - (3s + 5)$
- d) $(4d - 5) + (2d - 3)$
- e) $(3r + 7) - (2r - 5)$
- f) $(6t - 5) + (3t + 7)$

3. Simplify.

- a) $(3x + 5) + (4x - 3)$
- b) $(5y - 4) + (7y - 3)$
- c) $(4p^2 + 8p + 2) + (2p^2 - 3p - 4)$
- d) $(6m^2 - 5mn - 5n^2) - (m^2 + mn - 4n^2)$
- e) $(4a + 5b) + (2a - 3b) - (3a - b)$
- f) $(3p^2 - 2p) + (3p + 5q) - (2q - 2p^2)$

B

4. A soccer team gives each player a bonus on top of his or her base salary for every goal the player scores. Data for some of the team's players are given.

Player	Base Salary (\$1000s)	Goals
Gerros	60	70
Makaros	50	20
Smith	70	80

- a) Find a simplified expression for the total earnings for these three players if b represents the bonus, in dollars.
- b) Find the total earnings for these three players when $b = \$300$.

5. Winson is building a dock at his cottage. The length of the dock is twice the width, plus 3 m.

- a) Draw a diagram of the dock and label the width and length with algebraic expressions.
- b) Find a simplified algebraic expression for the perimeter of the dock.
- c) Find an algebraic expression for the area of the dock.
- d) If the width of the dock is 2 m, find the perimeter and area of the dock.

3.7 The Distributive Property

Principles of Mathematics 9, pages 160–169

Part 1

2

A

1. Expand, using the distributive property.

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

2. Expand, using the distributive property.

- a) $4(2a + 3)$
- b) $6(3b - 4)$
- c) $-(6m + 5)$
- d) $-(4r - 3)$

3. Expand.

- a) $x(x + 4)$
- b) $a(a - 5)$
- c) $z(-z + 3)$
- d) $b(-2b + 1)$

4. Expand.

- a) $-w(3w + 5)$
- b) $-m(3m - 2)$
- c) $4q(3q + 7)$
- d) $-7d(-2d - 5)$

5. Expand, using the distributive property.

- a) $(m + 2) \times 3$
- b) $(d - 3) \times 5$
- c) $(3h + 5) \times (-2)$
- d) $(4r - 1) \times (-3)$

6. Expand, using the distributive property.

- a) $(q - 4) \times 5$
- b) $(b - 6) \times 7$
- c) $(5t + 7) \times (-4)$
- d) $(7c - 3) \times (-5)$

7. Expand.

- a) $3(x^2 + 5x + 4)$
- b) $5(x^2 - 3x + 2)$
- c) $4m(m^2 + 3m + 5)$
- d) $5a(a^2 + a - 4)$
- e) $(x^2 + 7x + 3)(3)$

8. Expand.

- a) $(x^2 + x - 1)(-4)$
- b) $(a^2 - a + 4)(5)$
- c) $(r^2 + r - 5)(-1)$
- d) $5[x + 3(x + 2)]$
- e) $-4[5(b - 3) - b]$

B

9. Expand and simplify.

- a) $5(x + 4) + 3(x - 6)$
- b) $3(a - 5) - 2(a + 4)$
- c) $0.3(c + 2) + 0.5(2c - 5)$
- d) $-4(4d - 3) - 2(3d + 4)$
- e) $3k(k + 5) + 4k(k - 3)$

10. An electrician charges \$75 per visit plus \$25/h for house calls.

- a) Write an algebraic expression that describes the service charge for one household visit.
- b) Use your expression to find the total service charge for a 3.5-h repair job.
- c) Suppose all charges are double for evenings, weekends, and holidays. Write a simplified expression for these service charges.
- d) Use your simplified expression from part c) to calculate the cost for a 3.5-h repair job on the weekend. Does this answer make sense?

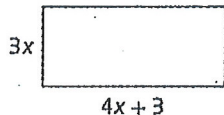
The Distributive Property Part 2

2

11. Expand and simplify.

- a) $-0.4h(3h - 2) - 0.3h(2h + 3)$
- b) $3(a + 2) + 5(a - 3) - 2(a + 4)$
- c) $4(r - 3) - 3(r + 2) + 2(r - 5)$
- d) $3a(2a + 3) + 4(a^2 + 2a - 4)$
- e) $5g(2g - 3) - 3(2g^2 - 4g + 3)$

12. A room has dimensions as shown.



- a) Find a simplified expression for the perimeter.
- b) Find a simplified expression for the area.
- c) Repeat parts a) and b) if both the length and width are doubled.
- d) Has this doubled the perimeter? Justify your answer.
- e) Has this doubled the area? Justify your answer.

13. The formula for the surface area of a rectangular prism is $SA = 2(lw + hw + lh)$. Apply the distributive property to write this formula in another way.

14. Expand and simplify.

- a) $\frac{1}{4}(8x + 3) + \frac{1}{3}(6x + 2)$
- b) $\frac{1}{5}(-5a + 2b) - \frac{3}{4}(4a - b)$
- c) $\frac{2}{3}(3m + 5) + \frac{2}{5}(5m - 4)$
- d) $\frac{1}{2}(6a - 5c) - \frac{1}{3}(6a + 4c)$

C

15. Expand and simplify.

- a) $3x[x + 4(x + 2)]$
- b) $4m[3m - 2(m - 5)]$
- c) $2a[3a(a + 4) - a(2a - 3)]$
- d) $4[3 - 2(b + 1)] + 3[4 - 2(b + 1)]$
- e) $-2[4 - (y - 4)] - 3[2 + (y - 3)]$
- f) $-3[2c + (c + 3)] + 2[3c - (c - 2)]$

16. Expand and simplify.

- a) ~~$(x + 3)(x + 4)$~~
- b) ~~$(a + 5)(a + 6)$~~
- c) ~~$(b + 7)(b + 3)$~~
- d) ~~$(w + 2)(w + 8)$~~
- e) ~~$(d + 5)(d - 2)$~~

17. Expand and simplify.

- a) ~~$(z + 3)(z - 6)$~~
- b) ~~$(m - 4)(m + 5)$~~
- c) ~~$(y - 5)(y + 3)$~~
- d) ~~$(h - 4)(h - 8)$~~
- e) ~~$(p - 3)(p - 3)$~~

18. Expand and simplify.

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