



Algebra

Workbook

Name:

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INTRODUCTION

This workbook is designed to strengthen your understanding of essential algebra skills and build a solid foundation for more advanced mathematical topics. Throughout the workbook, you will learn how to recognise and work with algebraic expressions, including variables, coefficients, constants, and terms. You will develop the ability to simplify expressions by combining like terms, substitute given values into expressions, and apply the correct order of operations to find solutions.

You will also practise expanding brackets, factorising expressions by identifying common factors, and solving linear equations using appropriate inverse operations. In addition, you will learn how to solve and interpret inequalities using mathematical symbols such as $<$, $>$, $\leq$, and $\geq$. Each topic includes clear definitions, learning objectives, worked examples, and practice questions to help you build confidence and improve your algebraic problem-solving skills. By completing this workbook, you will develop a stronger understanding of algebra and be better prepared to apply these skills to more challenging mathematical problems.

LEARNING GOALS

By the end of this workbook, I can:

- Understand key algebraic terms and expressions.
- Simplify and evaluate algebraic expressions.
- Substitute values into expressions.
- Expand and factorise simple expressions.
- Solve linear equations and inequalities.
- Apply algebraic skills accurately and confidently.

ALGEBRAIC TERMS AND EXPRESSIONS

Definition of Terms

Variable – A letter or symbol representing an unknown or changing value.

Example: x in $5x$

Coefficient – A number multiplied by a variable.

Example: 5 in $5x$

Constant – A number without a variable.

Example: 7 in $3x + 7$

Term – A single number, variable, or product of numbers and variables.

Example: $4x$, -3 , and $2y$

Expression – A combination of numbers, variables, and operations without an equals sign.

Example: $3x + 5$

Example:

Identify the parts of:

$$6x - 9$$

- Variable: x
- Coefficient: 6
- Constant: -9
- Terms: $6x$ and -9

1. Identify the coefficient of y in $-5y + 9$.

.....

2. Identify the constant in $3a - 11$.

.....

3. How many terms are in $4x + 7y - 2$?

.....

4. Write an algebraic expression for a number decreased by 8.

.....

5. Write an algebraic expression for five times a number.

.....

6. Write an algebraic expression for the sum of a number and 12.

.....

SIMPLIFYING ALGEBRAIC EXPRESSIONS

Definition of Terms

Like Terms - Terms with the same variable raised to the same power.

Examples: $3x$ and $7x$, or $4a^2$ and $-2a^2$

Simplify - To write an expression in its simplest form by combining like terms.

Worked Example

Simplify:

$$4x + 7x - 3$$

Combine the like terms:

$$4x + 7x = 11x$$

Therefore:

$$11x - 3$$

Answer:

$$11x - 3$$

7. Simplify: $9a - 3a$

.....

8. Simplify: $5y + 7 - 2y + 4$

.....

9. Simplify: $8m - 3 + 5m + 9$

.....

10. Simplify: $4x + 6y - 2x + 3y$

.....

11. Simplify: $10a - 4a + 7 - 12$

.....

12. Simplify: $3p + 8q - p - 2q$

.....

SUBSTITUTION

Definition of Terms

Substitution – Replacing a variable with its given numerical value.

Worked Example

Find the value of:

$$3x + 4, \text{ when } x = 5$$

Substitute 5 for x:

$$\begin{aligned} & 3(5) + 4 \\ &= 15 + 4 \\ &= 19 \end{aligned}$$

Answer:

19

13. Find the value of $4a - 7$ when $a = 6$.

.....

14. Find the value of $2y^2$ when $y = 4$.

.....

15. Find the value of $x^2 + 3x$ when $x = 2$.

.....

16. Find the value of $5m + 2n$ when $m = 3$ and $n = 4$.

.....

17. Find the value of $a^2 - b$ when $a = 5$ and $b = 7$.

.....

18. Find the value of $3p - 2q$ when $p = 8$ and $q = 5$.

.....

EXPANDING BRACKETS

Definition of Terms

Expand – To remove brackets by multiplying every term inside the brackets by the term outside.

Worked Example

Expand:

$$4(x + 3)$$

Multiply 4 by each term inside the bracket:

$$\begin{aligned}4 \times x + 4 \times 3 \\= 4x + 12\end{aligned}$$

Answer:

$$4x + 12$$

19. Expand: $5(x - 2)$

.....

20. Expand: $3(2y + 4)$

.....

21. Expand: $2(5a - 3)$

.....

22. Expand: $-3(x + 4)$

.....

23. Expand: $6(2m - 1)$

.....

24. Expand: $-2(3p - 5)$

.....

FACTORISING EXPRESSIONS

Definition of Terms

Factorise – To write an expression as a product of its factors.

Common Factor – A number or variable that divides exactly into every term.

Worked Example

Factorise:

$$6x + 12$$

The highest common factor is 6.

Take out 6:

$$6(x + 2)$$

Answer:

$$6(x + 2)$$

25. Factorise: $5y - 15$

.....

26. Factorise: $6a + 18$

.....

27. Factorise: $8x - 20$

.....

28. Factorise: $3x + 3y$

.....

29. Factorise: $10m - 5n$

.....

30. Factorise: $12a + 8$

.....

SOLVING LINEAR EQUATIONS

Definition of Terms

Equation – A mathematical statement showing that two expressions are equal.

Inverse Operations – Operations that undo each other, such as addition and subtraction or multiplication and division.

Worked Example

Solve:

$$3x + 5 = 20$$

Subtract 5 from both sides:

$$3x = 15$$

Divide both sides by 3:

$$x = 5$$

Answer:

$$x = 5$$

31. Solve: $x - 6 = 12$

.....

32. Solve: $5x = 35$

.....

33. Solve: $x \div 4 = 6$

.....

34. Solve: $3x + 5 = 20$

.....

35. Solve: $4x - 7 = 21$

.....

36. Solve: $2x + 9 = 19$

.....

SOLVING INEQUALITIES

Definition of Terms

Inequality - A mathematical statement comparing two quantities that may not be equal.

$>$ means greater than.

$<$ means less than.

$\geq$ means greater than or equal to.

$\leq$ means less than or equal to.

Worked Example

Solve:

$$x + 4 > 10$$

Subtract 4 from both sides:

$$x > 6$$

Answer:

$$x > 6$$

37. Solve: $x - 4 < 9$

.....

38. Solve: $3x > 18$

.....

39. Solve: $4x \leq 20$

.....

40. Solve: $2x + 3 > 11$

.....

41. Solve: $5x - 5 \leq 15$

.....

42. Solve: $3x + 7 < 19$

.....

WORD PROBLEMS

43. Sarah is 4 years older than her brother. If her brother's age is represented by x , write an expression for Sarah's age.

.....

44. A number multiplied by 5, then increased by 3, gives 28. Find the number.

.....

45. A shop sells notebooks for \$3 each. Maria buys x notebooks and pays an additional \$5 for a pen. Write an expression for the total cost.

.....

46. The length of a rectangle is 3 cm more than twice its width. If the width is x cm, write an expression for the length.

.....

47. John is 5 years older than his sister. If his sister's age is x , write an expression for John's age.

.....

48. A bookstore sells pens for \$4 each. Maria buys x pens and also pays \$6 for a notebook. Write an expression for the total cost.

.....

49. Three times a number, increased by 7, is equal to 25. Find the number.

.....

50. A student needs to score at least 70 points to pass a test. The student has already earned 42 points and can earn x more points. Write and solve an inequality to find the minimum value of x .

.....

Answer Key

1. -5

2. -11

3. 3 terms

4. $x - 8$

5. $5x$

6. $x + 12$

7. $6a$

8. $3y + 11$

9. $13m + 6$

10. $2x + 9y$

11. $6a - 5$

12. $2p + 6q$

13. 17

14. 32

15. 10

16. 23

17. 18

18. 14

19. $5x - 10$

20. $6y + 12$

21. $10a - 6$

22. $-3x - 12$

23. $12m - 6$

24. $-6p + 10$

25. $5(y-3)$

26. $6(a+3)$

27. $4(2x - 5)$

28. $3(x + y)$

29. $5(2m - n)$

30. $4(3a + 2)$

Answer Key

31. $x = 18$

41. $x \leq 4$

32. $x = 7$

42. $x < 4$

33. $x = 24$

43. $x + 4$

34. $x = 5$

44. 5

35. $x = 7$

45. $3x + 5$

36. $x = 5$

46. $2x + 3$

37. $x < 13$

47. $x + 5$

38. $x > 6$

48. $4x + 6$

39. $x \leq 5$

49. $x = 6$

40. $x > 4$

50. $42 + x \geq 70; x \geq 28$