

CHAPTER 2

Introduction to Algebra

CHAPTER LEARNING OBJECTIVES

- 1. Identify and understand all the components (literal terms, constants, and variables) that make up algebra.**
- 2. Add and subtract algebraic expressions and identify groups using symbols like parentheses and brackets.**
- 3. Complete operations using integral exponents and remove groups of symbols in algebraic expressions.**
- 4. Complete operations with algebraic expressions using multiplication.**
- 5. Complete operations with algebraic expressions using division.**

1. How many terms are in the following expression? $(y - 5)(2y + 3) - 8$

Answer: 2

Difficulty: E

Learning Objective: Identify and understand all the components (literal terms, constants, and variables) that make up algebra.

Section Reference: Algebraic Expressions

2. How many terms are in the following expression? $4x^2 + 6(x^3 - 3)$

Answer: 2

Difficulty: E

Learning Objective: Identify and understand all the components (literal terms, constants, and variables) that make up algebra.

Section Reference: Algebraic Expressions

3. How many terms are in the following expression? $(-3x)12y + y^4 - 12x(-2y) + xy$

Answer: 4

Difficulty: E

Learning Objective: Identify and understand all the components (literal terms, constants, and variables) that make up algebra.

Section Reference: Algebraic Expressions

4. How many terms are in the following expression? $\frac{3}{4}(x - 2) - \frac{1}{3}(x^2 + 3)$

Answer: 2

Difficulty: E

Learning Objective: Identify and understand all the components (literal terms, constants, and variables) that make up algebra.

Section Reference: Algebraic Expressions

5. Write the coefficient of each term in the expression: $4x^4 - 6(2x)$

Answer: coefficient of x^4 : 4, coefficient of x : -12

Difficulty: E

Learning Objective: Identify and understand all the components (literal terms, constants, and variables) that make up algebra.

Section Reference: Algebraic Expressions

6. Write the coefficient of each term. Assume that the letter x is the variable and all other letters are constants.

(a) $\frac{ax^4}{4}$

(b) $2a(5bx^4)$

(c) $\frac{6bx^7}{2ac}$

Answer: (a) $a/4$

(b) $10ab$

(c) $\frac{3b}{ac}$

Difficulty: E

Learning Objective: Identify and understand all the components (literal terms, constants, and variables) that make up algebra.

Section Reference: Algebraic Expressions

7. Write the coefficient of each term in the expression. Assume that the letter x is the variable and all other letters are constants: $5ax^5 + 2x^2 - kax$

Answer: coefficient of x^5 : $5a$, coefficient of x^2 : 2 , coefficient of x : $-ka$

Difficulty: E

Learning Objective: Identify and understand all the components (literal terms, constants, and variables) that make up algebra.

Section Reference: Algebraic Expressions

8. Identify the factors in each of the following expressions.

(a) $16xy$

(b) $(x + 2)(3y - z)$

(c) $2x$

(d) $x(yz)$

Answer: (a) $16, x, y$

(b) $x + 2, 3y - z$

(c) $2, x$

(d) x, y, z

Difficulty: E

Learning Objective: Identify and understand all the components (literal terms, constants, and variables) that make up algebra.

Section Reference: Algebraic Expressions

9. State the degree of each term.

- (a) x^5y^2
- (b) $14wxz^2$
- (c) $-x$

Answer: (a) seventh degree

(b) fourth degree

(c) first degree

Difficulty: E

Learning Objective: Identify and understand all the components (literal terms, constants, and variables) that make up algebra.

Section Reference: Algebraic Expressions

10. State the degree of each expression.

- (a) $3x^4 + 4y^6$
- (b) $7x^2 + 3x - 5$
- (c) $-9xy^2 + 4y^3$

Answer: (a) sixth degree

(b) second degree

(c) third degree

Difficulty: E

Learning Objective: Identify and understand all the components (literal terms, constants, and variables) that make up algebra.

Section Reference: Algebraic Expressions

11. Combine as indicated, and simplify: $3x - 4x + 2y - 4y$

Answer: $-x - 2y$

Difficulty: E

Learning Objective: Add and subtract algebraic expressions and identify groups using symbols like parentheses and brackets.

Section Reference: Addition and Subtraction of Algebraic Expressions

12. Combine as indicated, and simplify: $-5a + 5a + b + 6b$

Answer: $7b$

Difficulty: E

Learning Objective: Add and subtract algebraic expressions and identify groups using symbols like parentheses and brackets.

Section Reference: Addition and Subtraction of Algebraic Expressions

13. Combine as indicated, and simplify: $14x^2 + 2x + 12 - 4x + 2x^2$

Answer: $16x^2 - 2x + 12$

Difficulty: E

Learning Objective: Add and subtract algebraic expressions and identify groups using symbols like parentheses and brackets.

Section Reference: Addition and Subtraction of Algebraic Expressions

14. Combine as indicated, and simplify: $6ab + 4bc - 2bc - ab$

Answer: $5ab + 2bc$

Difficulty: E

Learning Objective: Add and subtract algebraic expressions and identify groups using symbols like parentheses and brackets.

Section Reference: Addition and Subtraction of Algebraic Expressions

15. Find the sum of $4x + 9p - 5y$, $-3p + 2p + 3x$, and $-4y + 7p - 9y$.

Answer: $7x - 18y + 15p$

Difficulty: E

Learning Objective: Add and subtract algebraic expressions and identify groups using symbols like parentheses and brackets.

Section Reference: Addition and Subtraction of Algebraic Expressions

16. Find the sum of $5 - x^2 + 3m$, $5x + 9 - 2x^2$, $9m + 7 + 3x^2 - x$, and $15x^3 + 2x^2 - 5$.

Answer: $16 + 2x^2 + 12m + 4x + 15x^3$

Difficulty: E

Learning Objective: Add and subtract algebraic expressions and identify groups using symbols like parentheses and brackets.

Section Reference: Addition and Subtraction of Algebraic Expressions

17. Add $3p^2 - 3a(y - z^2)$, $9a(y - z^2) - 6p$, and $12pc - 7a(y - x^2)$.

Answer: $3p^2 - ay - 6az^2 - 6p + 12pc + 7ax^2$

Difficulty: E

Learning Objective: Add and subtract algebraic expressions and identify groups using symbols like parentheses and brackets.

Section Reference: Addition and Subtraction of Algebraic Expressions

18. Add $11a - b + 4ab$, $2a + 13b - 6ab$, and $-4a - 8b + 2ab$.

Answer: $9a + 4b$

Difficulty: E

Learning Objective: Add and subtract algebraic expressions and identify groups using symbols like parentheses and brackets.

Section Reference: Addition and Subtraction of Algebraic Expressions

19. Subtract $10(x^2 - y) + 20$ from $-5 - 2(x^2 - y)$.

Answer: $-12x^2 + 12y - 25$

Difficulty: E

Learning Objective: Add and subtract algebraic expressions and identify groups using symbols like parentheses and brackets.

Section Reference: Addition and Subtraction of Algebraic Expressions

20. Subtract $x^3 - 3x^2 + 11x$ from $4x^3 + x^2 - 9$.

Answer: $3x^3 + 4x^2 - 11x - 9$

Difficulty: E

Learning Objective: Add and subtract algebraic expressions and identify groups using symbols like parentheses and brackets.

Section Reference: Addition and Subtraction of Algebraic Expressions

21. Subtract $9a^2b - ab^2 - 3ab$ from $3ab^2 + a^2b + 4ab$.

Answer: $4ab^2 - 8a^2b + 7ab$

Difficulty: E

Learning Objective: Add and subtract algebraic expressions and identify groups using symbols like parentheses and brackets.

Section Reference: Addition and Subtraction of Algebraic Expressions

22. Subtract $5a - 12b - 3c$ from $10b - 6c + 4d$.

Answer: $-5a + 22b - 3c + 4d$

Difficulty: E

Learning Objective: Add and subtract algebraic expressions and identify groups using symbols like parentheses and brackets.

Section Reference: Addition and Subtraction of Algebraic Expressions

23. Remove the symbols of grouping (i.e., brackets, braces, parentheses) and collect terms: $2(5x - 2) - 3$

Answer: $10x - 7$

Difficulty: E

Learning Objective: Add and subtract algebraic expressions and identify groups using symbols like

parentheses and brackets.

Section Reference: Addition and Subtraction of Algebraic Expressions

24. Remove the symbols of grouping (i.e., brackets, braces, parentheses) and collect terms: $21a^2 + 2b^2 - 6(ab + 3a^2 - 5b^2)$

Answer: $3a^2 + 32b^2 - 6ab$

Difficulty: E

Learning Objective: Add and subtract algebraic expressions and identify groups using symbols like parentheses and brackets.

Section Reference: Addition and Subtraction of Algebraic Expressions

25. Remove the symbols of grouping (i.e., brackets, braces, parentheses) and collect terms: $5p + 8q - 4r - (9q + 6r) + (30p - 9q)$

Answer: $35p - 10q - 10r$

Difficulty: E

Learning Objective: Add and subtract algebraic expressions and identify groups using symbols like parentheses and brackets.

Section Reference: Addition and Subtraction of Algebraic Expressions

26. Remove the symbols of grouping (i.e., brackets, braces, parentheses) and collect terms: $-2c - [(2a + 3b) - 2b] - [(6d + b) - 3c] - (10d + 9a)$

Answer: $-11a - 2b + c - 16d$

Difficulty: E

Learning Objective: Add and subtract algebraic expressions and identify groups using symbols like parentheses and brackets.

Section Reference: Addition and Subtraction of Algebraic Expressions

27. Remove the symbols of grouping (i.e., brackets, braces, parentheses) and collect terms: $2 - 3[2a - (5 - 3x)] + 4(3x - 5)$

Answer: $3x - 6a - 3$

Difficulty: E

Learning Objective: Add and subtract algebraic expressions and identify groups using symbols like parentheses and brackets.

Section Reference: Addition and Subtraction of Algebraic Expressions

28. Remove the symbols of grouping (i.e., brackets, braces, parentheses) and collect terms: $\frac{3}{4}(x - 2) - \frac{1}{2}(x^2 + 3)$

Answer: $\frac{3}{4}x - \frac{1}{2}x^2 - 3$

Difficulty: E

Learning Objective: Add and subtract algebraic expressions and identify groups using symbols like parentheses and brackets.

Section Reference: Addition and Subtraction of Algebraic Expressions

29. Remove the symbols of grouping (i.e., brackets, braces, parentheses) and collect terms: $3(x - y) + \{5y - [3x - (2x - y)] + 4(x - y)\}$

Answer: $6x - 3y$

Difficulty: E

Learning Objective: Add and subtract algebraic expressions and identify groups using symbols like parentheses and brackets.

Section Reference: Addition and Subtraction of Algebraic Expressions

30. Remove the symbols of grouping (i.e., brackets, braces, parentheses) and collect terms: $5(a + b) - \{2ab - [2(a^2 - 5ab) - 3(5ab - 5b^2)]\}$

Answer: $5a + 5b - 27ab + 2a^2 + 15b^2$

Difficulty: E

Learning Objective: Add and subtract algebraic expressions and identify groups using symbols like parentheses and brackets.

Section Reference: Addition and Subtraction of Algebraic Expressions

31. The surface area of a cylinder with radius r and perpendicular height $3r$ is given by $2\pi(r^2 + 3r^2)$. Simplify this expression, keeping π in your answer.

Answer: $8\pi r^2$

Difficulty: E

Learning Objective: Add and subtract algebraic expressions and identify groups using symbols like parentheses and brackets.

Section Reference: Addition and Subtraction of Algebraic Expressions

32. To maintain proper humidity, a crawl space that is x metres by $2x$ metres should have $\frac{2}{27}x^2(900) + 60[2(2x) + 2x]$ cm² of ventilation. Simplify this expression. (Use fractions for the coefficients, if necessary.)

Answer: $\frac{200}{3}x^2 + 360x$

Difficulty: M

Learning Objective: Add and subtract algebraic expressions and identify groups using symbols like parentheses and brackets.

Section Reference: Addition and Subtraction of Algebraic Expressions

33. A simply-supported beam has a uniformly-distributed load. The deflection at the point x metres from the left end of the beam is given by $y = \frac{\omega}{24k}(L^3x - 2Lx^3 + x^4)$ where L is the length of the beam in metres, ω is the load in N/m, and k is a constant. What is the coefficient of x for a 2.00-metre beam if the load is 6000 N/m and k is 4.00×10^7 ?

Answer: 0.0000500 or 5.00×10^{-5}

Difficulty: M

Learning Objective: Add and subtract algebraic expressions and identify groups using symbols like parentheses and brackets.

Section Reference: Addition and Subtraction of Algebraic Expressions

34. Multiply: $x \cdot x^3$

Answer: x^4

Difficulty: E

Learning Objective: Complete operations using integral exponents and remove groups of symbols in algebraic expressions.

Section Reference: Integral Exponents

35. Multiply: $x^{2a} \cdot x^{a+4}$

Answer: x^{3a+4}

Difficulty: E

Learning Objective: Complete operations using integral exponents and remove groups of symbols in algebraic expressions.

Section Reference: Integral Exponents

36. Multiply: $a^2 \cdot a^3 \cdot a^{-4}$

Answer: a

Difficulty: E

Learning Objective: Complete operations using integral exponents and remove groups of symbols in algebraic expressions.

Section Reference: Integral Exponents

37. Multiply: $c^{x+4} \cdot c^{x+5}$

Answer: c^{2x+9}

Difficulty: E

Learning Objective: Complete operations using integral exponents and remove groups of symbols in algebraic expressions.

Section Reference: Integral Exponents

38. Divide. Write your answer without a negative exponent: $\frac{x^4}{x^{-2}}$

Answer: x^6

Difficulty: E

Learning Objective: Complete operations using integral exponents and remove groups of symbols in algebraic expressions.

Section Reference: Integral Exponents

39. Divide. Write your answer without a negative exponent: $\frac{4^{10}}{4^6}$

Answer: 256

Difficulty: E

Learning Objective: Complete operations using integral exponents and remove groups of symbols in algebraic expressions.

Section Reference: Integral Exponents

40. Divide: $\frac{x^a}{x^{a-7}}$

Answer: x^7

Difficulty: E

Learning Objective: Complete operations using integral exponents and remove groups of symbols in algebraic expressions.

Section Reference: Integral Exponents

41. Divide: $\frac{a^{5-x}}{a^{3+x}}$

Answer: a^{2-2x}

Difficulty: E

Learning Objective: Complete operations using integral exponents and remove groups of symbols in algebraic expressions.

Section Reference: Integral Exponents

42. Simplify: $(a^2)^{-5}$

Answer: a^{-10}

Difficulty: E

Learning Objective: Complete operations using integral exponents and remove groups of symbols in algebraic expressions.

Section Reference: Integral Exponents

43. Simplify: $(x^{2m})^n$

Answer: x^{2mn}

Difficulty: E

Learning Objective: Complete operations using integral exponents and remove groups of symbols in algebraic expressions.

Section Reference: Integral Exponents

44. Simplify: $(7^4)^{x+2}$

Answer: 7^{4x+8}

Difficulty: E

Learning Objective: Complete operations using integral exponents and remove groups of symbols in algebraic expressions.

Section Reference: Integral Exponents

45. Simplify: $(x^3)^{2a+5}$

Answer: x^{6a+15}

Difficulty: E

Learning Objective: Complete operations using integral exponents and remove groups of symbols in algebraic expressions.

Section Reference: Integral Exponents

46. Raise to the power indicated: $(5xy^2)^2$

Answer: $25x^2y^4$

Difficulty: E

Learning Objective: Complete operations using integral exponents and remove groups of symbols in algebraic expressions.

Section Reference: Integral Exponents

47. Raise to the power indicated: $-\left(\frac{2b}{a}\right)^5$

Answer: $-\frac{32b^5}{a^5}$

Difficulty: E

Learning Objective: Complete operations using integral exponents and remove groups of symbols in algebraic expressions.

Section Reference: Integral Exponents

48. Raise to the power indicated: $(4y^6)^{-2}$

Answer: $0.0625y^{-12}$ or $\frac{1}{16y^{12}}$

Difficulty: E

Learning Objective: Complete operations using integral exponents and remove groups of symbols in algebraic expressions.

Section Reference: Integral Exponents

49. Raise to the power indicated: $\left(\frac{2xy^3}{z^2}\right)^3$

Answer: $\frac{8x^3y^9}{z^6}$

Difficulty: E

Learning Objective: Complete operations using integral exponents and remove groups of symbols in algebraic expressions.

Section Reference: Integral Exponents

50. Write with positive exponents only: $\left(\frac{a}{5}\right)^{-2}$

Answer: $\frac{25}{a^2}$

Difficulty: E

Learning Objective: Complete operations using integral exponents and remove groups of symbols in algebraic expressions.

Section Reference: Integral Exponents

51. Write with positive exponents only: $\left(-\frac{2x}{y}\right)^{-2}$

Answer: $\frac{y^2}{4x^2}$

Difficulty: E

Learning Objective: Complete operations using integral exponents and remove groups of symbols in algebraic expressions.

Section Reference: Integral Exponents

52. Write with positive exponents only: $\left(\frac{2xy^3}{3z^2}\right)^{-3}$

Answer: $\frac{27z^6}{8x^3y^9}$

Difficulty: M

Learning Objective: Complete operations using integral exponents and remove groups of symbols in algebraic expressions.

Section Reference: Integral Exponents

53. Write with positive exponents only: $\left(\frac{3a^4b}{5c^2d^3}\right)^{-2}$

Answer: $\frac{25c^4d^6}{9a^8b^2}$

Difficulty: M

Learning Objective: Complete operations using integral exponents and remove groups of symbols in algebraic expressions.

Section Reference: Integral Exponents

54. Write with positive exponents only: $3x^{-5}y + 12y^{-4}$

Answer: $\frac{3y}{x^5} + \frac{12}{y^4}$

Difficulty: E

Learning Objective: Complete operations using integral exponents and remove groups of symbols in algebraic expressions.

Section Reference: Integral Exponents

55. Express without fractions, using negative exponents where needed: $\frac{2}{a}$

Answer: $2a^{-1}$

Difficulty: E

Learning Objective:

Section Reference: Learning Objective: Complete operations using integral exponents and remove groups of symbols in algebraic expressions.

Section Reference: Integral Exponents

56. Express without fractions, using negative exponents where needed: $\frac{a^{-2}b^3}{c^4}$

Answer: $a^{-2}b^3c^{-4}$

Difficulty: E

Learning Objective: Complete operations using integral exponents and remove groups of symbols in algebraic expressions.

Section Reference: Integral Exponents

57. Express without fractions, using negative exponents where needed: $\frac{2xy^{-3}}{x^{-2}y^4}$

Answer: $2x^3y^{-7}$

Difficulty: E

Learning Objective: Complete operations using integral exponents and remove groups of symbols in algebraic expressions.

Section Reference: Integral Exponents

58. Express without fractions, using negative exponents where needed: $\frac{3a^4b^{-1}}{a^2b^{-3}}$

Answer: $3a^2b^2$

Difficulty: E

Learning Objective: Complete operations using integral exponents and remove groups of symbols in algebraic expressions.

Section Reference: Integral Exponents

59. Evaluate: $\frac{7a^2}{b^0}$

Answer: $7a^2$

Difficulty: E

Learning Objective: Complete operations using integral exponents and remove groups of symbols in algebraic expressions.

Section Reference: Integral Exponents

60. Evaluate: $(3x - 4y^2)^0$

Answer: 1

Difficulty: E

Learning Objective: Complete operations using integral exponents and remove groups of symbols in algebraic expressions.

Section Reference: Integral Exponents

61. Evaluate: $\frac{x^{3a} \cdot x^{-4}}{x}$

Answer: x^{3a-5}

Difficulty: E

Learning Objective: Complete operations using integral exponents and remove groups of symbols in algebraic expressions.

Section Reference: Integral Exponents

62. The volume of a cylinder of radius $3r$ and perpendicular height $4r$ is given by $\pi(3r)^2(4r)$. Simplify this expression.

Answer: $36\pi r^3$

Difficulty: E

Learning Objective: Complete operations using integral exponents and remove groups of symbols in algebraic expressions.

Section Reference: Integral Exponents

63. The volume of a cone of radius $2r$ and perpendicular height $3r$ is given by $\frac{\pi}{3}(2r)^2(3r)$. Simplify this expression.

Answer: $4\pi r^3$

Difficulty: E

Learning Objective: Complete operations using integral exponents and remove groups of symbols in algebraic expressions.

Section Reference: Integral Exponents

64. The density of a block is given by $\frac{7.20}{(3x)(2x)^2} \text{ g/cm}^3$. Express the density without fractions, using negative exponents where needed.

Answer: $0.600x^{-3}$

Difficulty: E

Learning Objective: Complete operations using integral exponents and remove groups of symbols in algebraic expressions.

Section Reference: Integral Exponents

65. Multiply these monomials, and simplify: $a^4(a)$

Answer: a^5

Difficulty: E

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

66. Multiply these monomials, and simplify: $(-5x)(3xy^2z)(-2x^2z)(-xy^3)$

Answer: $-30x^5y^5z^2$

Difficulty: E

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

67. Multiply these monomials, and simplify: $(4a^3)(5ab^2)(abc^4)$

Answer: $20a^5b^3c^4$

Difficulty: E

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

68. Multiply the polynomial by the monomial, and simplify: $-15xy^2(y^3 - 2xy + 3x^2 - x^2y)$

Answer: $-15xy^5 + 30x^2y^3 - 45x^3y^2 + 15x^3y^3$

Difficulty: E

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

69. Multiply the polynomial by the monomial, and simplify: $3a^2b(ab^2 - 3a + 4a^2b - 5b)$

Answer: $3a^3b^3 - 9a^3b + 12a^4b^2 - 15a^2b^2$

Difficulty: E

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

70. Multiply these binomials, and simplify: $(5a + 2b)(-3a + b)$

Answer: $-15a^2 - ab + 2b^2$

Difficulty: E

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

71. Multiply these binomials, and simplify: $(y^2 + 13)(y^3 - 2)$

Answer: $y^5 + 13y^3 - 2y^2 - 26$

Difficulty: E

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

72. Multiply these binomials, and simplify: $(7ab^2 + 3b^2)(2ab^3 - 5a^2)$

Answer: $14a^2b^5 - 35a^3b^2 + 6ab^5 - 15a^2b^2$

Difficulty: E

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

73. Multiply these binomials, and simplify: $(2a^2b^3 - 8mn^2)(a^2b^3 + 3mn^2)$

Answer: $2a^4b^6 - 2a^2b^3mn^2 - 24m^2n^4$

Difficulty: E

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

74. Multiply the binomial and trinomial, and simplify: $(a - 2b)(3a + 5b + 6)$

Answer: $3a^2 + 6a - ab - 12b - 10b^2$

Difficulty: E

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

75. Multiply the binomial and trinomial, and simplify: $(c - d)(c^2 - 2cd + d^2)$

Answer: $c^3 - 3c^2d + 3cd^2 - d^3$

Difficulty: E

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

76. Multiply the binomial and trinomial, and simplify: $(2x + 5a^2)(4x^2 - 10xa^2 + 25a^4)$

Answer: $8x^3 + 125a^6$

Difficulty: E

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

77. Multiply these binomials, and simplify: $(c - 3)(c + 5)(c + 5)$

Answer: $c^3 + 7c^2 - 5c - 75$

Difficulty: M

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

78. Multiply these binomials, and simplify: $(x - 3y)(x + 3y)(3y - 2x)$

Answer: $3x^2y - 2x^3 - 27y^3 + 18xy^2$

Difficulty: M

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

79. Multiply these binomials, and simplify: $(3x + 2)(x - 2y)(x + y)$

Answer: $3x^3 - 3x^2y - 6xy^2 + 2x^2 - 2xy - 4y^2$

Difficulty: M

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

80. Multiply these binomials, and simplify: $(5p - 1)(p + 1)(p - 2)(p + 2)$

Answer: $5p^4 + 4p^3 - 21p^2 - 16p + 4$

Difficulty: H

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

81. Multiply the monomial and binomials, and simplify: $(4x - 5y)(x + 3y)x$

Answer: $4x^3 + 7x^2y - 15xy^2$

Difficulty: M

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

82. Multiply these trinomials, and simplify: $(a^2 + 3ab - 9b)(a - 3ab - b^2)$

Answer: $a^3 - 3a^3b - 10a^2b^2 + 3a^2b - 3ab^3 - 9ab + 27ab^2 + 9b^3$

Difficulty: M

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

83. Multiply these trinomials, and simplify: $(2x - 3y + 5z)(-x + 2y - 4z)$

Answer: $-2x^2 + 7xy - 13xz + 22yz - 6y^2 - 20z^2$

Difficulty: M

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

84. Multiply these polynomials, and simplify: $[x^2 - 2x(y + z) + (y + z)^2](y + z)$

Answer: $x^2y + x^2z - 4xyz - 2xy^2 - 2xz^2 + 3y^2z + 3yz^2 + y^3 + z^3$

Difficulty: H

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

85. Multiply these polynomials, and simplify: $(5m^2 + 2 - 3m)(6m^3 - 4m^2 + 4 + 2m)$

Answer: $30m^5 - 38m^4 + 34m^3 + 6m^2 - 8m + 8$

Difficulty: M

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

86. Multiply these polynomials, and simplify: $(x^3 + 5x^2 - 3x + 4)(4x^3 - 4x^2 + x - 1)$

Answer: $4x^6 + 16x^5 - 31x^4 + 32x^3 - 24x^2 + 7x - 4$

Difficulty: H

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

87. Square this binomial: $(x - y)$

Answer: $x^2 - 2xy + y^2$

Difficulty: E

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

88. Square this binomial: $(2a - 3.5)$

Answer: $4a^2 - 14a + 12.25$

Difficulty: E

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

89. Square this binomial: $(y^3 - y)$

Answer: $y^6 - 2y^4 + y^2$

Difficulty: E

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

90. Square this binomial: $(a^4 - b^n)$

Answer: $a^8 - 2a^4 b^n + b^{2n}$

Difficulty: E

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

91. Square this trinomial: $(x^6 - x^3 y^3 + y^6)$

Answer: $x^{12} - 2x^9 y^3 + 3x^6 y^6 - 2x^3 y^9 + y^{12}$

Difficulty: M

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

92. Square this trinomial: $(y^8 - 2y^4 + y^2)$

Answer: $y^{16} - 4y^{12} + 2y^{10} + 4y^8 - 4y^6 + y^4$

Difficulty: M

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

93. Square this trinomial: $(2x + xy - y^2)$

Answer: $4x^2 + 4x^2y - 4xy^2 + x^2y^2 - 2xy^3 + y^4$

Difficulty: M

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

94. Cube this binomial: $(3a - 2)$

Answer: $27a^3 - 54a^2 + 36a - 8$

Difficulty: M

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

95. Cube this binomial: $(4x - 3y)$

Answer: $64x^3 - 144x^2y + 108xy^2 - 27y^3$

Difficulty: M

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

96. Cube this binomial: $(x + 5yz)$

Answer: $x^3 + 15x^2yz + 75xy^2z^2 + 125y^3z^3$

Difficulty: M

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

97. Remove the symbols of grouping, and simplify: $[(a - 3b) - (5a + 6b)][(4a + b) + (-2a + 3b)]$

Answer: $-8a^2 - 34ab - 36b^2$

Difficulty: M

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

98. Remove the symbols of grouping, and simplify: $(2x + 3)(4x^2 - 6y + 9) - (2x - 3)(4x^2 + 6y + 9)$

Answer: $24x^2 - 24xy + 54$

Difficulty: M

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

99. Remove the symbols of grouping, and simplify: $(2x + 3yz^2)^2 + (2x - 3yz^2)^2 - 2(4x^2 + 15y^2z^4)$

Answer: $-12y^2z^4$

Difficulty: M

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

100. Remove the symbols of grouping, and simplify: $(2x - 5y^2)(4x^2 + 25y^4 + 10xy^2) - (2x - 5y^2)^3$

Answer: $-150xy^4 + 60x^2y^2$

Difficulty: M

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

101. Remove the symbols of grouping, and simplify: $[(x + 5y)3x + 2y^2][(4x + 5y) - (3 - 2x)]$

Answer: $18x^3 + 105x^2y - 9x^2 + 87xy^2 - 45xy + 10y^3 - 6y^2$

Difficulty: M

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

102. The surface area of a cylinder with radius r and perpendicular height h is given by $2\pi(r^2 + rh)$. If the radius is increased by 3.00 and the height is doubled, write an expression for the surface area of the new cylinder, and multiply it out.

Answer: $2\pi r^2 + 12\pi r + 4\pi rh + 12\pi h + 18\pi$

Difficulty: M

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

103. The area of a circle with radius r is given by πr^2 . If the radius is increased by 3.00, by how much does the area increase?

Answer: $6\pi r + 9\pi$

Difficulty: E

Learning Objective: Complete operations with algebraic expressions using multiplication.

Section Reference: Multiplication of Algebraic Expressions

104. Divide $16a^2b$ by $4ab$.

Answer: $4a$

Difficulty: E

Learning Objective: Complete operations with algebraic expressions using division.

Section Reference: Division of Algebraic Expressions

105. Divide x^a by x^b .

Answer: x^{a-b}

Difficulty: E

Learning Objective: Complete operations with algebraic expressions using division.

Section Reference: Division of Algebraic Expressions

106. Divide $(x + 3y)^3$ by $(x + 3y)^2$.

Answer: $x + 3y$

Difficulty: E

Learning Objective: Complete operations with algebraic expressions using division.

Section Reference: Division of Algebraic Expressions

107. Divide $7x^8y^2z^3$ by $wxyz^4$.

Answer: $\frac{7x^7y}{wz}$

Difficulty: E

Learning Objective: Complete operations with algebraic expressions using division.

Section Reference: Division of Algebraic Expressions

108. Divide $-15m^5n^2$ by $-7m^4$.

Answer: $\frac{15}{7}mn^2$

Difficulty: E

Learning Objective: Complete operations with algebraic expressions using division.

Section Reference: Division of Algebraic Expressions

109. Divide $-12p^3w^4z$ by $-4p^3w$.

Answer: $3w^3z$

Difficulty: E

Learning Objective: Complete operations with algebraic expressions using division.

Section Reference: Division of Algebraic Expressions

110. Divide $-36m^2p^3x$ by $6m^2pxy$.

Answer: $-\frac{6p^2}{y}$

Difficulty: E

Learning Objective: Complete operations with algebraic expressions using division.

Section Reference: Division of Algebraic Expressions

111. Divide $x^{2n}y^{3n}z^{3n}$ by $(xyz)^{2n}$.

Answer: $y^n z^n$

Difficulty: E

Learning Objective: Complete operations with algebraic expressions using division.

Section Reference: Division of Algebraic Expressions

112. Divide $12abc$ by $0.5a^{10}bc^2$.

Answer: $\frac{24}{a^9c}$

Difficulty: E

Learning Objective: Complete operations with algebraic expressions using division.

Section Reference: Division of Algebraic Expressions

113. Divide the polynomial by the monomial: $21a^5 - 35a^2$ by $7a^2$

Answer: $3a^3 - 5$

Difficulty: E

Learning Objective: Complete operations with algebraic expressions using division.

Section Reference: Division of Algebraic Expressions

114. Divide the polynomial by the monomial: $m - m^2n - mn^2$ by $-m$

Answer: $-1 + mn + n^2$

Difficulty: E

Learning Objective: Complete operations with algebraic expressions using division.

Section Reference: Division of Algebraic Expressions

115. Divide the polynomial by the monomial: $-22pq^2 + 77p^3q^3 - 55p^3q^5$ by $-11q^2$

Answer: $2p - 7p^3q + 5p^3q^3$

Difficulty: E

Learning Objective: Complete operations with algebraic expressions using division.

Section Reference: Division of Algebraic Expressions

116. Divide the polynomial by the monomial: $15m^2np + 45mnp^2 - 35m^2n^2p^2$ by $-5mnp$

Answer: $-3m - 9p + 7mnp$

Difficulty: E

Learning Objective: Complete operations with algebraic expressions using division.

Section Reference: Division of Algebraic Expressions

117. Divide the polynomial by the monomial: $-a^3b^3 + 2a^5b^3 - 3a^3b^5$ by $-a^3b^2$

Answer: $b - 2a^2b + 3b^3$

Difficulty: E

Learning Objective: Complete operations with algebraic expressions using division.

Section Reference: Division of Algebraic Expressions

118. Divide the polynomial by the monomial: $25x^3y - 5xy^3 - 15x^2 + 20y^3$ by $5x^2y^2$

Answer: $\frac{5x}{y} - \frac{y}{x} - \frac{3}{y^2} + \frac{4y}{x^2}$

Difficulty: M

Learning Objective: Complete operations with algebraic expressions using division.

Section Reference: Division of Algebraic Expressions

119. Divide the polynomial by the binomial: $6a^2 - 6a - 12$ by $6a - 12$

Answer: $a + 1$

Difficulty: E

Learning Objective: Complete operations with algebraic expressions using division.

Section Reference: Division of Algebraic Expressions

120. Divide the polynomial by the binomial: $3a^2 + 5a + 6$ by $a - 2$

Answer: $3a + 11 + \frac{28}{a-2}$

Difficulty: M

Learning Objective: Complete operations with algebraic expressions using division.

Section Reference: Division of Algebraic Expressions

121. Divide the polynomial by the binomial: $a^3c^6 + a^2c^4 - ac^2 - 1$ by $ac^2 + 1$

Answer: $a^2c^4 - 1$

Difficulty: M

Learning Objective: Complete operations with algebraic expressions using division.

Section Reference: Division of Algebraic Expressions

122. Divide the polynomial by the binomial: $8x^4 - 3x^3 + 29x^2 - 9x + 15$ by $x^2 + 3$

Answer: $8x^2 - 3x + 5$

Difficulty: M

Learning Objective: Complete operations with algebraic expressions using division.

Section Reference: Division of Algebraic Expressions

123. Divide the polynomial by the binomial: $3y^3 + 5y^2 - 8y$ by $-y^2 + y$

Answer: $-3y - 8$

Difficulty: M

Learning Objective: Complete operations with algebraic expressions using division.

Section Reference: Division of Algebraic Expressions

124. Divide the polynomial by the binomial: $14x^2 + 5x - 11$ by $-2x + 1$

Answer: $-7x - 6 - \frac{5}{-2x + 1}$

Difficulty: M

Learning Objective: Complete operations with algebraic expressions using division.

Section Reference: Division of Algebraic Expressions

125. Divide the polynomial by the trinomial: $16x^4 + 12x^2 + 4x + 60$ by $x^2 + 2x + 1$

Answer: $16x^2 - 32x + 60 - \frac{156x}{x^2 + 2x + 1}$

Difficulty: M

Learning Objective: Complete operations with algebraic expressions using division.

Section Reference: Division of Algebraic Expressions

126. Divide the polynomial by the trinomial: $10(a - b)^2 + 34(a - b) + 12$ by $5(a - b) + 2$

Answer: $2(a - b) + 6$

Difficulty: M

Learning Objective: Complete operations with algebraic expressions using division.

Section Reference: Division of Algebraic Expressions

127. Divide the polynomial by the trinomial: $x^3 + 3x^2 + 5x$ by $x^2 + 3x + 1$

Answer: $x + \frac{4x}{x^2 + 3x + 1}$

Difficulty: M

Learning Objective: Complete operations with algebraic expressions using division.

Section Reference: Division of Algebraic Expressions

128. Divide the polynomial by the trinomial: $x^6 + 15x^4 + 24x^2 - 144$ by $x^4 + 3x^2 - 12$

Answer: $x^2 + 12$

Difficulty: M

Learning Objective: Complete operations with algebraic expressions using division.

Section Reference: Division of Algebraic Expressions

129. Nanoparticles are ideal for chemical reactions because they have a high surface-area-to-volume ratio. The surface-area-to-volume ratio for platinum-nickel nanoparticles in a hydrogen fuel cell is given by

$\frac{3.464x^2}{0.4714x^3}$, where x is the side length. Simplify this ratio.

Answer: $7.348x^{-1}$

Difficulty: E

Learning Objective: Complete operations with algebraic expressions using division.

Section Reference: Division of Algebraic Expressions

130. Divide the polynomial by the binomial: $6x^2 + 2x - 10$ by $-3x + 2$

Answer: $-2x - 2 - \frac{6}{-3x + 2}$

Difficulty: M

Learning Objective: Complete operations with algebraic expressions using division.

Section Reference: Division of Algebraic Expressions

LEGAL NOTICE

Copyright © 2016 by John Wiley & Sons Canada, Ltd. or related companies. All rights reserved.

WILEY

The data contained in these files are protected by copyright. This manual is furnished under licence and may be used only in accordance with the terms of such licence.

The material provided herein may not be downloaded, reproduced, stored in a retrieval system, modified, made available on a network, used to create derivative works, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, scanning, or otherwise without the prior written permission of John Wiley & Sons Canada, Ltd.