

Algebra - Algebraic Expressions

Name: _____

Date: _____

Concepts

- Algebra - Algebraic Expressions
- Dividing an Algebraic Expression by a Monomial
- Exponentiation in Algebraic Expressions
- Factoring Out a Greatest Common Factor
- Factoring Polynomials (theory)
- Factoring a Monomial
- Factoring by Grouping
- From Monomials to Polynomials
- Multiplying Algebraic Expressions - Secondary 3 and 4
- Operations on Algebraic Expressions (theory)
- Subtracting algebraic expressions

Algebra - Algebraic Expressions

1. A snow-clearing contractor in Sherbrooke charges by the storm. For a storm needing n passes of the plough and h hours of hand shovelling, the charge in dollars is

$$85n + 40h + 120.$$

- a) Name the variables, give the constant term, and give the coefficient of h .
- b) State the degree of the expression and say whether it is a monomial, a binomial or a trinomial.
- c) Find the charge for a storm needing 3 passes and 2.5 hours of shovelling.

Dividing an Algebraic Expression by a Monomial

2. Simplify each quotient.

a) $\frac{45m^6n^2}{9m^2n}$

b) $\frac{28a^4b - 12a^3b^2 + 4a^2b}{4a^2b}$

c) The deck of a skatepark ramp is a rectangle of area $54p^4q \text{ m}^2$ and width $6p^2q \text{ m}$. Find its length.

Exponentiation in Algebraic Expressions

3. Simplify, leaving no brackets and no negative exponents.

a) $(3x^4)^3$

b) $\frac{(2a^3b)^2}{4a^2b}$

c) $\left(\frac{m^5}{m^2}\right)^4$

d) A storage cube has an edge of $4t^3 \text{ cm}$. Write its volume.

Factoring Out a Greatest Common Factor

4. Factor each expression by taking out the greatest common factor.

a) $12x^3 + 18x^2$

b) $20a^2b - 35ab^2 + 15ab$

c) A rectangular banner has an area of $(24n^2 + 40n)$ cm², and its width in centimetres is the greatest common factor of the two terms. Find the width and the length.

Factoring Polynomials

5. Answer each part.

a) Explain what it means to say a polynomial is written in factored form, and say why $3x + 12x^2$ is not in factored form.

b) For each factoring below, name the technique used — taking out a common factor, or grouping — and say whether the factoring is complete.

i) $7x^2 + 21x = 7x(x + 3)$

ii) $ax + ay + bx + by = (x + y)(a + b)$

iii) $4m^3 - 6m^2 = 2m(2m^2 - 3m)$

Factoring a Monomial

6. Answer each part.

- a) Write $36x^5y^2$ as a product of two monomials, one of which is $9x^2y$.
- b) Find the missing monomial: $(-5a^3)(\text{————}) = 40a^7b$.
- c) A cube-shaped crate has a volume of $27k^9 \text{ cm}^3$. Find the length of one edge.

Factoring by Grouping

7. Factor each polynomial by grouping.

- a) $x^3 + 4x^2 + 3x + 12$
- b) $6ab + 9a + 10b + 15$
- c) $12mn - 8m + 15n - 10$

From Monomials to Polynomials

8. For each polynomial, give the number of terms, its name (monomial, binomial, trinomial or polynomial), its degree, and the coefficient of its term of highest degree. Then rewrite it in decreasing order of degree.

a) $5 - 3x^2 + 8x$

b) $7m^3n^2$

c) $4y - y^4$

d) -6

Multiplying Algebraic Expressions - Secondary 3 and 4

9. Expand and simplify.

a) $(x + 7)(x - 3)$

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

c) $(3m + 2n)(4m - n)$

d) A rectangular herb garden measures $(x + 6)$ m by $(x + 2)$ m. Write its area in expanded form and its perimeter in simplified form.

Operations on Algebraic Expressions

10. Decide whether each statement is true for every value of the variable that lets both sides be worked out. If it is true, name the rule or property that makes it work. If it is false, give a value of the variable that shows it fails and write the correct right-hand side.

a) $x^4 \cdot x^3 = x^{12}$

b) $(2x^3)^2 = 4x^6$

c) $\frac{9x^5 + 6x^2}{3x^2} = 3x^3 + 2$

d) $5x^2 + 3x^2 = 8x^4$

e) $6x + 9 = 3(2x + 3)$

Subtracting algebraic expressions

11. Answer both parts.

a) Simplify $(9x^3 - 2x + 7) - (4x^3 + 5x^2 - 2x - 1)$.

b) Ordering j jerseys costs Team Nord $32j + 250$ dollars and Team Sud $27j + 400$ dollars. Write a simplified expression for how much more Team Nord pays, then evaluate it for $j = 40$.

Synthesis — drawing on several sheets in this topic

- 12.** A rectangular loading platform has an area of $(18x^3 + 30x^2)$ m² and a width of $6x^2$ m.
- a) Find its length by dividing.
 - b) Factor $18x^3 + 30x^2$ completely, and say how the factoring confirms your answer to part (a).
 - c) The platform is rebuilt 2 m wider and 4 m longer. Write the new area in expanded form.
 - d) Evaluate the new area for $x = 2$, and check your value from the actual dimensions.

Want the harder problems and the worked solutions?

The *Challenge Problems* set and the *Answer Keys* for Algebra - Algebraic Expressions — with the reasoning written out in full — are available at tutorinmontreal.ca.