Elementary Algebra / Module 9 - Factoring

Module 9 - Factoring - Part 1

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Topic 1: Factors

Problem 1: Find all factors of 24. List them in ascending order.

$$24$$

1, 24
2, 12
3, 8
4, 6
5

1, 2, 3, 4, 6, 8, 13 24

Problem 2: Determine the factors of 108. Express them as a set.

$$108$$

1, 108
2, 54
3, 36
4, 27
5
6, 18
7,

$$\frac{\cancel{8}}{9,\ 12}$$
$$\cancel{10}$$
$$\cancel{11}$$

Topic 2: Factoring a linear binomial
Problem 1: Factor 6x - 12 completely. Identify the greatest common factor and write the factored form.

$$\frac{6x}{6} - \frac{12}{6}$$

$$6(x-2)$$

* Distribute back through to
check your answer

Problem 2: Factor 8x + 16. Find the GCF and express the result as a product.

$$8x + 16$$

$$8(x+2)$$

$$8x + 16$$
$$4(2x+4)$$
$$2 \cdot 4 (x+2)$$
$$8(x+2)$$

Topic 3: Introduction to the GCF of two monomials
Problem 1: Find the greatest common factor of 12x^3 and 18x^2. Show the steps to determine the GCF.

$$\frac{12x^3}{6x^2} \qquad \frac{18x^2}{6x^2}$$

to check:

can't divide
anything else out $2x$ 3
so we're good

$$6x^2$$

Variable
smallest exponent

Problem 2: Determine the GCF of 15y^4 and 25y^2. Explain the process and provide the result.

$$15y^4 \qquad 25y^2$$

$$5y^2$$

$$\frac{72x^5}{8} \qquad \frac{24x^3}{8}$$

$$24 \begin{cases} \dfrac{9}{3} & \dfrac{3}{3} \\[2mm] 3 & 1 \end{cases}$$

$$24x^3$$

Topic 4: Greatest common factor of three univariate monomials
Problem 1: Find the GCF of 6x^2, 9x^3, and 12x^5. Break down each term and identify the common factor.

$$6x^{②} \qquad 9x^3 \qquad 12x^5$$

$$3x^2$$

Problem 2: Determine the GCF of 10y^3, 20y^5, and 30y^2. Show the factorization and the GCF.

Topic 5: Greatest common factor of two multivariate monomials
Problem 1: Find the GCF of 8x^2y^3 and 12x^4y. Factor each monomial and determine the common factor.

$$8x^{②}y^3 \qquad 12x^4y^{①}$$

$$4x^2y$$

Problem 2: Compute the GCF of 15a^3b^2 and 9a^2b^4. Show the steps and provide the GCF.

Topic 6: Factoring out a monomial from a polynomial: Univariate
Problem 1: Factor 4x^3 - 8x^2 + 12x by factoring out the GCF. Write the factored form.

$$4x^3 - 8x^2 + 12x^1$$

$$4x\left(x^2 - 2x + 3\right)$$

※ to check your answer distribute it back through

Problem 2: Factor 9x^4 + 6x^3 - 3x^2 using the GCF. Provide the simplified factored expression.

Topic 7: Factoring out a monomial from a polynomial: Multivariate
Problem 1: Factor 6x^2y - 9xy^2 + 3xy by factoring out the GCF. Write the factored form.
Problem 2: Factor 12a^2b^3 - 8ab^2 + 4a^3b using the GCF. Simplify and express the result.

$$\frac{12a^2b^3}{4ab} - \frac{8ab^2}{4ab} + \frac{4a^3b^1}{4ab}$$

$$4ab\left(3ab^2 - 2b + a^2\right)$$

Topic 8: Factoring out a binomial from a polynomial: GCF factoring, basic
Problem 1: Factor (x + 2)^2 + 3(x + 2). Identify the common binomial and write the factored form.

$$\left(x+2\right)^2 + 3\left(x+2\right)$$

$$\left(x+2\right)\left[\left(x+2\right) + 3\right]$$

Problem 2: Factor 5(x - 1) - 2x(x - 1). Find the common binomial and express the factored result.

$$5\left(x-1\right) - 2x\left(x-1\right)$$

$$\left(x-1\right)\left(5 - 2x\right)$$

Topic 9: Factoring a univariate polynomial by grouping: Problem type 1
Problem 1: Factor x^3 + 2x^2 - 3x - 6 by grouping. Group terms appropriately and factor completely.

Problem 2: Factor 2x^3 - x^2 + 4x - 2 by grouping. Show the steps and provide the factored form.

Topic 10: Factoring a univariate polynomial by grouping: Problem type 2
Problem 1: Factor x^3 - 3x^2 - 4x + 12 by grouping. Pair terms and factor completely.

Problem 2: Factor 3x^3 + 6x^2 - x - 2 by grouping. Show the grouping and final factored expression.

Topic 11: Factoring a multivariate polynomial by grouping: Problem type 1
Problem 1: Factor xy + 2x - 3y - 6 by grouping. Group terms and write the factored form.

Problem 2: Factor ab - 4a + 2b - 8 by grouping. Show the steps and provide the factored result.

Topic 12: Factoring a quadratic with leading coefficient 1

Problem 1: Factor $x^2 + 5x + 6$. Find two numbers that multiply to 6 and add to 5, and write the factored form.

Problem 2: Factor $x^2 - 7x + 12$. Identify the factors and express the quadratic in factored form.

Topic 13: Factoring a quadratic in two variables with leading coefficient 1
Problem 1: Factor $x^2 + xy - 6y^2$. Find the factors and write the factored expression.

Problem 2: Factor $a^2 - 2ab - 3b^2$. Determine the factors and provide the factored form.

Topic 14: Factoring out a constant before factoring a quadratic
Problem 1: Factor $2x^2 + 4x - 6$ completely. Factor out the GCF and then factor the quadratic.

Problem 2: Factor $3x^2 - 6x - 72$. Factor out the GCF and then factor the resulting quadratic.

Topic 15: Factoring a quadratic with leading coefficient greater than 1: Problem type 1
Problem 1: Factor $2x^2 + 7x + 3$. Use trial and error or another method to find the factors.

Problem 2: Factor $3x^2 - 5x - 2$. Determine the factors and write the factored form.

Topic 16: Factoring a quadratic with leading coefficient greater than 1: Problem type 2
Problem 1: Factor $6x^2 + 11x - 10$.

Problem 2: Factor $4x^2 - 4x - 15$. Use an appropriate method and provide the factored expression.

Topic 17: Factoring a quadratic in two variables with leading coefficient greater than 1
Problem 1: Factor $2x^2 + 5xy + 3y^2$. Find the factors and write the factored form.

Problem 2: Factor $3a^2 - 2ab - 5b^2$. Determine the factors and express the factored result.

Topic 18: Factoring a quadratic with a negative leading coefficient
Problem 1: Factor $-x^2 + 4x - 3$. Factor out the negative and then factor the quadratic.

Problem 2: Factor -2x^2 - 5x + 3. Factor out the negative and find the factors of the quadratic.

Topic 19: Factoring a product of a quadratic trinomial and a monomial

Topic 20: Factoring a perfect square trinomial with leading coefficient 1
Problem 1: Factor x^2 + 6x + 9. Recognize it as a perfect square trinomial and write the factored form.

Problem 2: Factor x^2 - 8x + 16. Identify the perfect square trinomial and express it in factored form.

Topic 21: Factoring a perfect square trinomial with leading coefficient greater than 1
Problem 1: Factor 4x^2 + 12x + 9. Verify it as a perfect square trinomial and write the factored form.

Problem 2: Factor 9x^2 - 30x + 25. Confirm it is a perfect square trinomial and provide the factored expression.

Topic 22: Factoring a perfect square trinomial in two variables
Problem 1: Factor x^2 + 2xy + y^2. Recognize the perfect square trinomial and write the factored form.
Problem 2: Factor a^2 - 4ab + 4b^2. Identify it as a perfect square trinomial and express it in factored form.

Topic 23: Factoring a difference of squares in one variable: Basic
Problem 1: Factor x^2 - 16. Use the difference of squares formula and write the factored form.

Problem 2: Factor y^2 - 25. Apply the difference of squares formula and provide the factored result.

Topic 24: Factoring a difference of squares in one variable: Advanced
Problem 1: Factor 4x^2 - 9. Recognize the difference of squares and write the factored expression.
Problem 2: Factor 25x^2 - 36. Use the difference of squares formula and simplify.

Topic 25: Factoring a difference of squares in two variables
Problem 1: Factor x^2 - y^2. Apply the difference of squares formula and write the factored form.

Problem 2: Factor 9a^2 - 16b^2. Use the difference of squares formula and provide the factored result.

Topic 26: Factoring a polynomial involving a GCF and a difference of squares: Univariate

Problem 1: Factor $3x^3 - 12x$. Factor out the GCF and then factor the difference of squares.

Problem 2: Factor $5x^4 - 20x^2$. Factor out the GCF and apply the difference of squares formula.

Topic 27: Solving an equation written in factored form

Problem 1: Solve $(x - 3)(x + 2) = 0$. Use the zero product property to find the solutions.

Problem 2: Solve $(2x + 1)(x - 5) = 0$. Apply the zero product property and provide the solutions.

Topic 28: Finding the roots of a quadratic equation of the form $ax^2 + bx = 0$

Problem 1: Find the roots of $2x^2 + 6x = 0$. Factor and use the zero product property to solve.

Problem 2: Solve $3x^2 - 9x = 0$. Factor the equation and find the roots.

Topic 29: Finding the roots of a quadratic equation with leading coefficient 1

Problem 1: Solve $x^2 + 7x + 10 = 0$. Factor the quadratic and find the roots.

Problem 2: Find the roots of $x^2 - 5x + 6 = 0$. Factor and use the zero product property.

Topic 30: Finding the roots of a quadratic equation with leading coefficient greater than 1

Problem 1: Solve $2x^2 + 5x - 3 = 0$. Factor the quadratic and find the roots.

Problem 2: Find the roots of $3x^2 - 10x = -8$. Factor and solve using the zero product property.

Topic 31: Introduction to the Pythagorean Theorem

Problem 1: In a right triangle, the legs are 3 cm and 4 cm. Use the Pythagorean Theorem to find the length of the hypotenuse.

Problem 2: A right triangle has legs of lengths 5 m and 12 m. Apply the Pythagorean Theorem to calculate the hypotenuse.

Topic 32: Word problem involving the Pythagorean Theorem

Problem 1: A ladder is 10 ft long and reaches 8 ft up a wall. How far is the base of the ladder from the wall? Use the Pythagorean Theorem.

Problem 2: A rectangle has a diagonal of 13 cm and a width of 5 cm. Find the length using the Pythagorean Theorem.