Practice - Polynomial Operations and Factoring

Math 10 · Mr. Merrick · October 22, 2025

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1. Review of Exponents

1. Simplify each expression using exponent laws.
   a) $x^3 \cdot x^5$ x^8
   b) $(a^4)^3$ a^{12}
   c) $\dfrac{y^7}{y^2}$ y^5
   d) $(2x^3)^2$ $4x^6$
   e) $\dfrac{3x^5y^3}{9x^2y}$ $\frac{1}{3}x^3y^2$
2. Evaluate for $x = 2$.
   a) $2x^3 - x^2$ 12
   b) $5x^2 - 3x + 4$ 18

2. Understanding Polynomials

1. State the degree, number of terms, and leading coefficient.
   a) $4x^3 - 2x^2 + 7$ *Degree 3, 3 terms, LC 4*
   b) $-3y^5 + y^4 - 2y$ *Degree 5, 3 terms, LC −3*
   c) 6 *Degree 0, monomial, LC 6*
2. Classify each as monomial, binomial, or trinomial.
   a) $5x^2$ *Monomial*
   b) $2a + 9$ *Binomial*
   c) $3x^2 - x + 4$ *Trinomial*
3. Write each in standard form.
   a) $7x - 4x^3 + 3x^2$ $-4x^3 + 3x^2 + 7x$
   b) $5a^2 - 9 + 8a^3$ $8a^3 + 5a^2 - 9$

3. Evaluating Polynomials

1. Evaluate each polynomial for $x = 2$.
   a) $x^2 + 3x - 4$ 6
   b) $2x^3 - x + 5$ 19
   c) $x^4 - 5x^2 + 2$ -2
2. Evaluate for $a = -3$.
   a) $a^2 + 4a - 1$ -4
   b) $-2a^3 + a^2 - 5$ 58

4. Adding and Subtracting Polynomials

1. Simplify.
   a) $(3x^2+5x-4)+(4x^2-7x+2)$ $7x^2-2x-2$
   b) $(5a^3-2a+7)-(3a^3+4a-5)$ $2a^3-6a+12$
   c) $(6m^2+m-2)+(3m^2-4m+7)$ $9m^2-3m+5$
2. Combine like terms and simplify.
   a) $4x^3 + 3x^2 - x + 8 + 2x^3 - 7x^2 + 4$ $6x^3 - 4x^2 - x + 12$
   b) $(x^2 + 5x - 6) - (2x^2 - x + 3)$ $-x^2 + 6x - 9$
3. Application: The area of one rectangle is $(3x + 2)$ m by $(x + 4)$ m, and another rectangle has area $(2x + 3)(x + 1)$ m^2. Find the total area of both rectangles. $(3x^2 + 14x + 8) + (2x^2 + 5x + 3) = 5x^2 + 19x + 11$

5. Multiplying by a Monomial

1. Expand and simplify.
   a) $3x(x^2+5x-2)$ $3x^3+15x^2-6x$
   b) $-2a(4a^2-3a+6)$ $-8a^3+6a^2-12a$
   c) $5y^2(y-4)$ $5y^3-20y^2$
2. Expand and collect like terms.
   a) $4x(x^2-x+2)+2x(x^2+3)$ $6x^3-4x^2+14x$
   b) $-3a(2a^2-5)+2a(a^2+4)$ $-4a^3+23a$

6. Multiplying Binomials and Trinomials

1. Expand each.
   a) $(x+4)(x+3)$ $x^2+7x+12$
   b) $(2a-5)(a+1)$ $2a^2-3a-5$
   c) $(y-6)(y+2)$ $y^2-4y-12$
2. Expand.
   a) $(x+2)(x^2+3x+4)$ $x^3+5x^2+10x+8$
   b) $(2a-3)(a^2+4a+1)$ $2a^3+5a^2-10a-3$
3. Simplify and collect like terms.
   a) $(x+2)(x+3)-(x+1)(x+4)$ 2
   b) $(a-5)(a+2)-(a-3)(a+4)$ $-4a+2$

7. Special Products

1. Expand and simplify.
   a) $(x+5)^2$ $x^2+10x+25$
   b) $(3y-4)^2$ $9y^2-24y+16$
   c) $(2a+7)(2a-7)$ $4a^2-49$
   d) $(5x-1)(5x+1)$ $25x^2-1$
2. Simplify and write in standard form.
   a) $(x-4)^2-(x-2)^2$ $-4x+12$
   b) $(2a+3)^2-(a+5)^2$ $3a^2+2a-16$

8. Applications: Area and Perimeter Models

1. A rectangle has length $(3x+2)$ and width $(x+4)$. Find its area and perimeter. *Area* $= 3x^2+14x+8$, *Perimeter* $= 8x+12$
2. The side of a square is $(x+5)$ cm. Find the area and perimeter. *Area* $= x^2+10x+25$, *Perimeter* $= 4x+20$
3. The length of a rectangle is $(2x+3)$ and width is $(x-1)$. The area is increased by adding a border 1 m wide all around. Write an expression for the new total area. *New side lengths* $(2x+5)$ *and* $(x+1)$ $\rightarrow$ *Area* $= 2x^2+7x+5$

9. Factoring Out a Common Factor

1. Factor each expression completely.
   a) $8x^3+12x^2-4x$ $4x(2x^2+3x-1)$
   b) $15a^4-10a^3+20a^2$ $5a^2(3a^2-2a+4)$
   c) $-9y^3+6y^2-3y$ $-3y(3y^2-2y+1)$
2. Factor each polynomial with a numerical GCF.
   a) $24x^2+36x$ $12x(2x+3)$
   b) $18a^3-27a^2+9a$ $9a(2a^2-3a+1)$

10. Factoring Simple Trinomials ($a=1$)

1. Factor completely.
   a) $x^2+8x+15$ $(x+3)(x+5)$
   b) $x^2-7x+12$ $(x-3)(x-4)$
   c) $a^2+9a+20$ $(a+4)(a+5)$
   d) $m^2+2m-15$ $(m+5)(m-3)$
2. Application: The area of a rectangle is $x^2+9x+20$. Factor to find two possible expressions for its length and width. $(x+4)(x+5)$

11. Factoring Complex Trinomials ($a \neq 1$)

1. Factor completely.
   a) $2x^2 + 7x + 3$ $(2x+1)(x+3)$
   b) $3a^2 - 5a - 2$ $(3a+1)(a-2)$
   c) $4y^2 + 12y + 5$ $(2y+1)(2y+5)$
   d) $5m^2 - 13m - 6$ $(5m+2)(m-3)$

12. Factoring by Grouping and Special Forms

1. Factor by grouping.
   a) $3x^3 + 6x^2 + x + 2$ $(3x^2+1)(x+2)$
   b) $2a^3 - 4a^2 + 3a - 6$ $(a-2)(2a^2+3)$
2. Factor as a difference of squares.
   a) $x^2 - 9$ $(x-3)(x+3)$
   b) $4a^2 - 25$ $(2a-5)(2a+5)$
   c) $9y^2 - 16$ $(3y-4)(3y+4)$
3. Factor as a perfect square trinomial.
   a) $x^2 + 10x + 25$ $(x+5)^2$
   b) $9a^2 - 24a + 16$ $(3a-4)^2$

13. Applications of Factoring

1. The area of a rectangle is given by $A = x^2 + 7x + 10$. Factor to find expressions for its dimensions. $(x+2)(x+5)$
2. The area of a garden is $6x^2 + 9x$. Factor to determine one possible set of dimensions. $3x(2x+3)$
3. The area of a square tile is $x^2 + 10x + 25$. Find the side length. $x+5$
4. The product of two consecutive integers is 72. Write and solve a polynomial equation. $x(x+1) = 72 \Rightarrow x^2 + x - 72 = 0 \Rightarrow x = 8, -9$

14. Mixed Review – Practice Test

1. Simplify: $(2x^2 + 5x - 3) - (x^2 - 4x + 7)$ $x^2 + 9x - 10$
2. Expand: $(3x-2)(x+5)$ $3x^2 + 13x - 10$
3. Expand: $(x+4)^2$ $x^2 + 8x + 16$
4. Factor: $x^2 + 7x + 10$ $(x+5)(x+2)$
5. Factor: $4x^2 - 25$ $(2x-5)(2x+5)$
6. Expand: $(x-3)(x^2+4x-1)$ $x^3 + x^2 - 13x + 3$
7. Factor: $3x^3 - 12x$ $3x(x^2-4) = 3x(x-2)(x+2)$
8. $(2x+3)^2 - (x+5)^2$ $3x^2 + 2x - 16$
9. Factor: $x^2 - 6x + 9$ $(x-3)^2$
10. $(x-2)(x+3) + (x+1)(x-4)$ $2x^2 - 2x - 10$