

Combining and Multiplying Polynomials

Grade 9 – Algebra 1 math · Worksheet Answer Key · Standards: A-APR.A.1, A-SSE.A.2

Each solution shows the distribution step, the like terms that combine and the final polynomial in bold. Check your signs first when an answer differs, because sign slips are the most common error with subtraction and with negative factors.

Standards: A-APR.A.1, A-SSE.A.2 · **Level:** Grade 9 Algebra 1

Problem 1 Standard Form and Degree

Order the powers from highest to lowest: $-4x^3 + 7x + 2$. The highest power is 3.

$-4x^3 + 7x + 2$; degree 3; leading coefficient -4

Problem 2 Name Each Polynomial

- a. One term: monomial, degree 4.
- b. Two terms: binomial, degree 2.
- c. Three terms: trinomial, degree 3.

(a) monomial, 4; (b) binomial, 2; (c) trinomial, 3

Problem 3 Evaluate a Polynomial

$$P(-2) = (-2)^2 - 3(-2) + 5 = 4 + 6 + 5 = 15.$$

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Problem 4 Add Two Trinomials

x^2 terms: $4 + 1 = 5$. x terms: $3 - 6 = -3$. Constants: $-1 + 9 = 8$.

$5x^2 - 3x + 8$

Problem 5 Subtract Two Trinomials

Distribute the minus sign: $7x^2 - 2x + 6 - 3x^2 - 5x + 1$.

x^2 : $7 - 3 = 4$. x : $-2 - 5 = -7$. Constants: $6 + 1 = 7$.

$$4x^2 - 7x + 7$$

Problem 6 Multiply Monomials

- a. Coefficients: $3 \times (-5) = -15$. Powers: $x^2 \cdot x^4 = x^6$. Result $-15x^6$.
 b. Coefficients: $6 \times (-2) = -12$. Powers: $a^3 \cdot a = a^4$ and $b \cdot b^4 = b^5$. Result $-12a^4b^5$.

(a) $-15x^6$; (b) $-12a^4b^5$

Problem 7 Distribute a Monomial

$$4x \cdot 2x^2 = 8x^3. \quad 4x \cdot (-3x) = -12x^2. \quad 4x \cdot 7 = 28x.$$

$8x^3 - 12x^2 + 28x$

Problem 8 Multiply Two Binomials

First: x^2 . Outer: $-3x$. Inner: $8x$. Last: -24 .

Combine: $-3x + 8x = 5x$.

$x^2 + 5x - 24$

Problem 9 Binomials with Coefficients

First: $24x^2$. Outer: $54x$. Inner: $-28x$. Last: -63 .

Combine: $54x - 28x = 26x$.

$24x^2 + 26x - 63$

Problem 10 Trinomial Times Binomial

Row x: $x^3, -4x^2, 6x$. Row 3: $3x^2, -12x, 18$.

	x^2	$-4x$	6
x	x^3	$-4x^2$	$6x$
3	$3x^2$	$-12x$	18

$$x^3 - 4x^2 + 6x + 3x^2 - 12x + 18 = x^3 - x^2 - 6x + 18$$

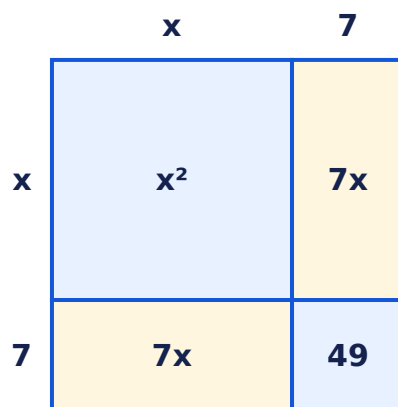
Combine: $-4x^2 + 3x^2 = -x^2$ and $6x - 12x = -6x$.

$$x^3 - x^2 - 6x + 18$$

Problem 11 Square a Binomial

a. $(x)^2 + 2(x)(7) + 7^2 = x^2 + 14x + 49$.

b. $(3x)^2 - 2(3x)(2) + 2^2 = 9x^2 - 12x + 4$.



$$(x + 7)^2 = x^2 + 14x + 49$$

(a) $x^2 + 14x + 49$; (b) $9x^2 - 12x + 4$

Problem 12 Difference of Squares

The outer and inner products cancel: $-99k + 99k = 0$.

$$(9k)^2 - 11^2 = 81k^2 - 121.$$

$$81k^2 - 121$$

Problem 13 Three Polynomials at Once

Remove parentheses: $5x^2 - 3x + 8 - 2x^2 - x + 6 + x^2 - 4$.

x^2 : $5 - 2 + 1 = 4$. x : $-3 - 1 = -4$. Constants: $8 + 6 - 4 = 10$.

$$4x^2 - 4x + 10$$

Problem 14 Closure Check

$$2x \cdot x^2 = 2x^3; 2x \cdot (-3) = -6x; 1 \cdot x^2 = x^2; 1 \cdot (-3) = -3.$$

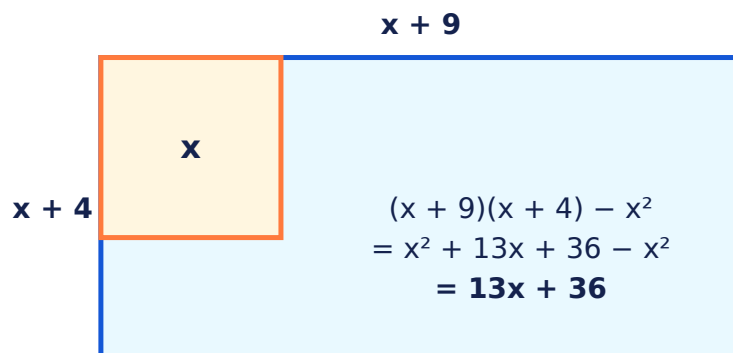
Standard form: $2x^3 + x^2 - 6x - 3$. It is a polynomial of degree 3, because the degrees add: $1 + 2 = 3$.

$2x^3 + x^2 - 6x - 3$; degree 3

Problem 15 Patio with a Pond

Patio: $(x + 9)(x + 4) = x^2 + 13x + 36$. Pond: x^2 .

Difference: $x^2 + 13x + 36 - x^2 = 13x + 36$.



Rectangle area minus square area.

$(13x + 36)$ square feet

Problem 16 Ticket Revenue

Revenue = $(40 - 2x)(30 + 5x) = 1200 + 200x - 60x - 10x^2 = -10x^2 + 140x + 1200$.

At $x = 3$: $-10(9) + 140(3) + 1200 = -90 + 420 + 1200 = 1530$.

Check: price $40 - 6 = 34$, tickets $30 + 15 = 45$, and $34 \times 45 = 1,530$.

$-10x^2 + 140x + 1200$; \$1,530

Problem 17 Profit from Revenue and Cost

$P(x) = (-3x^2 + 90x) - (12x + 250) = -3x^2 + 90x - 12x - 250 = -3x^2 + 78x - 250$.

$P(10) = -300 + 780 - 250 = 230$.

Check: $R(10) = 600$, $C(10) = 370$, and $600 - 370 = 230$.

$P(x) = -3x^2 + 78x - 250$; \$230

Problem 18 Cube of a Binomial

$$(x + 2)^2 = x^2 + 4x + 4.$$

$$(x + 2)(x^2 + 4x + 4) = x^3 + 4x^2 + 4x + 2x^2 + 8x + 8.$$

$$\text{Combine: } x^3 + 6x^2 + 12x + 8.$$

$$\mathbf{x^3 + 6x^2 + 12x + 8}$$

Problem 19 Arithmetic with Special Products

$$47 \times 53 = (50 - 3)(50 + 3) = 50^2 - 3^2 = 2500 - 9 = 2491.$$

$$62^2 = (60 + 2)^2 = 3600 + 240 + 4 = 3844.$$

$$\mathbf{2,491 \text{ and } 3,844}$$

Problem 20 Find the Error

First: wrong. Squaring means $(x - 4)(x - 4)$, which has the middle term $-8x$. Correct: $x^2 - 8x + 16$.

Second: wrong. The outer and inner products $-3x$ and $+3x$ cancel, so there is no x term. Correct: $x^2 - 9$.

$$\mathbf{(x - 4)^2 = x^2 - 8x + 16; (x + 3)(x - 3) = x^2 - 9}$$