



## Calculations with Polynomials

### ADDITION AND SUBTRACTION OF POLYNOMIALS

1. If any of the polynomials have a coefficient in front of them or a minus sign, distribute it into the polynomial first. Remove the parentheses.
2. Rearrange the terms so that the terms with the same exponents on the variable are together. Add or subtract the coefficients on the terms. This is called **collecting like terms**.
3. Terms that have different exponents cannot be added together.

*Example 1:*  $(4x + 5) - (3x + 6) + 5(x - 7)$

*Solution:*

$$(4x + 5) - (3x + 6) + 5(x - 7)$$

Distribute minus signs and coefficients.

$$= 4x + 5 - 3x - 6 + 5x - 35$$

$$= (4x) + 5(-3x) - 6(+5x) - 35$$

Find similar terms and move them closer.

$$= 4x - 3x + 5x + 5 - 6 - 35$$

$$= 6x - 36$$

Collect the like terms by adding and subtracting.

### MULTIPLICATION OF POLYNOMIALS

1. Multiply each term in the first polynomial by the terms in the second polynomial. This process is called **foiling out** after the mnemonic used with two binomials:  
**F**irst times first, **O**utside times outside, **I**nside times inside, **L**ast times last.
2. Collect any like terms, just as you did with adding polynomials.
3. It doesn't matter how many polynomials you have, or how many terms they have, make sure you multiply every combination of terms from the polynomials.



*Example 2:*  $(2x + 5)(x - 4)$

*Solution:* Use the FOIL method to remember what to do:

$$\begin{aligned} & (2x + 5)(x - 4) \\ &= 2x \cdot x + 2x(-4) + 5 \cdot x + 5 \cdot (-4) \quad \text{Multiply each term in the first} \\ & \quad \text{first} \quad \text{outside} \quad \text{inside} \quad \text{last} \quad \text{by each term in the second.} \\ &= 2x^2 - 8x + 5x - 20 \\ &= 2x^2 - 3x - 20 \quad \text{Collect like terms} \end{aligned}$$

## EXERCISES

A. Add and subtract:

1)  $(2x + 5) + (3x - 7)$

4)  $(2x^2 + 3x - 5) - (6x^2 - x - 1)$

2)  $(-x - 5) + (8x - 5)$

5)  $(-x^2 - x - 3) - (-3x^2 - 2x - 5)$

3)  $(2x + 6) - 2(-x + 3)$

6)  $(-x - 1) - (-2x - 3) + (2x - 5)$

B. Multiply:

1)  $(x + 1)(x - 3)$

4)  $(2x)(3x + 7)(x - 9)$

2)  $(2x - 1)(3x + 1)$

5)  $(2x^2 + 3x - 2)(3x - 4)$

3)  $2(5x - 4)(x - 2)$

6)  $(x + 1)(x + 4)(2x - 5)$

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## SOLUTIONS

A. (1)  $5x - 2$  (2)  $7x - 10$  (3)  $4x$  (4)  $-4x^2 + 4x - 4$  (5)  $2x^2 + x + 2$  (6)  $3x - 3$

B. (1)  $x^2 - 2x - 3$  (2)  $6x^2 - x - 1$  (3)  $10x^2 - 28x + 16$  (4)  $6x^3 - 40x^2 - 126x$

(5)  $6x^3 + x^2 - 18x + 8$  (6)  $2x^3 + 5x^2 - 17x - 20$

