Section 4.1 – Adding and Subtracting Polynomials

A **polynomial** consists of constants and variables joined together by addition, subtraction, and/or multiplication. The constants and variables are grouped together in one or more terms, each of which can be an individual number, a single variable, or a product of numbers and/or variables with exponents that are non-negative integers.

Example 1.

a. $6a^2 + 14a - 9$
b. $200(7)^x + 1$
c. $7x^{-1}$

Polynomials with 1, 2, or 3 terms can be grouped into categories.

A _____ has 1 term, for example: _____

A _____ has 2 terms, for example: _____

A _____ has 3 terms, for example: _____

The degree of a polynomial is the highest power of any variable in the polynomial.

Polynomials can also be categorized by their **degree**. The degree of a monomial with one variable is equal to the value of the variable's exponent.

Degree	Name	Example
0		
1		
2		
3		
4		
5		
6 or more		

The **standard form** of a polynomial contains no like terms and its terms are written in descending order of degree. In other words, the exponents should go from greatest to least.

Example 2.

a. $4a - 2a^2 + 5a^3$
b. $3x + 2x^2 - x - 7$

Adding Polynomials – Adding polynomials involves combining like terms.

Example 3. Find the sum. Write the answer in standard form.

a. $(2x^2 + 5x - 7) + (3 - 4x^2 + 6x)$

b. $(3y + y^3 - 5) + (4y^2 - 4y + 2y^3 + 8)$

Application 1. Find the sum. Write the answer in standard form.

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

b. $(y^4 - 3y + 7) + (2y^3 + 2y - 2y^4 - 11)$

Subtracting Polynomials. You can subtract a polynomial by adding its **additive inverse**. To find the additive inverse of a polynomial, write the opposite of each term.

Example 4. Find each difference. Write the answer in standard form.

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

b. $(7p + 4p^3 - 8) - (3p^2 + 2 - 9p)$

Application 2. Find each difference. Write the answer in standard form.

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

2. $(8y - 10 + 5y^2) - (7 - y^3 + 12y)$

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Example 5. Simplify. Write final answer in standard form.

a. $(4x + 2y - 6z) + (5y - 2z + 7x) + (-9z - 2x - 3y)$

b. $(3n^2 + 3n - 10) - (4n^2 - 5n) + (4n^3 - 3n^2 - 9n + 4)$

Practice.

1. $(2c^2 + 6c + 4) + (5c^2 - 7)$

2. $(2x + 3x^2) - (7 - 8x^2)$

3. $(4a - 5b^2 + 3) + (6 - 2a + 3b^2)$

4. $(4rxt - 8r^2x + x^2) - (6rx^2 + 5rxt - 2x^2)$

5. Classify each polynomial according to its degree and number of terms.

a. $4x - 3x^2 + 5$

b. $11z^3$

c. $10x - 4x^2 + 6x^3$

8-1 Skills Practice

Adding and Subtracting Polynomials

Find each sum or difference.

1. $(2x + 3y) + (4x + 9y)$

2. $(6s + 5t) + (4t + 8s)$

3. $(5a + 9b) - (2a + 4b)$

4. $(11m - 7n) - (2m + 6n)$

5. $(m^2 - m) + (2m + m^2)$

6. $(x^2 - 3x) - (2x^2 + 5x)$

7. $(d^2 - d + 5) - (2d + 5)$

8. $(2h^2 - 5h) + (7h - 3h^2)$

9. $(5f + g - 2) + (-2f + 3)$

10. $(6k^2 + 2k + 9) + (4k^2 - 5k)$

Determine whether each expression is a polynomial. If it is a polynomial, find the degree and determine whether it is a *monomial, binomial,* or *trinomial*.

11. $5mt + t^2$

12. $4by + 2b - by$

13. -32

14. $\dfrac{3x}{7}$

15. $5x^2 - 3x^{-4}$

16. $2c^2 + 8c + 9 - 3$

Write each polynomial in standard form. Identify the leading coefficient.

17. $3x + 1 + 2x^2$

18. $5x - 6 + 3x^2$

19. $9x^2 + 2 + x^3 + x$

20. $-3 + 3x^3 - x^2 + 4x$

21. $x^2 + 3x^3 + 27 - x$

22. $25 - x^3 + x$

23. $x - 3x^2 + 4 + 5x^3$

24. $x^2 + 64 - x + 7x^3$

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