

## Warm Up

Rewrite each expression by combining like terms.

1.  $-3x + 4y - 9x - 5y$

2.  $2xy^2 + 5x^2y - 7xy + xy^2$

3.  $6 - m^2 + 5m^2$

4.  $-8 - (-4k) + 7 + 1 - 4k$

## Key Terms

- polynomial
- monomial
- binomial
- trinomial
- degree of a polynomial
- closed, closure
- difference of two squares
- perfect square trinomial

You are familiar with many types of mathematical expressions. Cut out the 12 expressions located at the end of this lesson. Analyze and sort them into groups based upon common characteristics.

- 1. Summarize the groups you formed by listing the expressions that you grouped together and your description for each group. Use mathematical terms in your descriptions.**
- 2. Compare your groups of expressions to your classmates' groups. Describe any similarities and differences.**



3. Jimmy and Andrew agree that  $4x - 6x^2$  and  $25 - 18m^2$  belong in the same group. They each are adding the expressions shown to the group. Who is correct? Explain your reasoning.

Jimmy

$$\begin{aligned} &5 - 7h \\ &78j^3 - 3j \\ &-13s + 6 \end{aligned}$$

Andrew

$$\begin{aligned} &y^2 - 4y + 10 \\ &-3 + 7n + n^2 \end{aligned}$$

Previously, you worked with linear expressions in the form  $ax + b$  and quadratic expressions in the form  $ax^2 + bx + c$ . Each is also part of a larger group of expressions known as *polynomials*.

A **polynomial** is a mathematical expression involving the sum of powers in one or more variables multiplied by coefficients. A polynomial in one variable is the sum of terms of the form  $ax^k$ , where  $a$  is any real number and  $k$  is a non-negative integer. In general, a polynomial is of the form  $a_1x^k + a_2x^{k-1} + \dots + a_nx^0$ . Within a polynomial, each product is a term, and the number being multiplied by a power is a coefficient.

## Worked Example

The polynomial  $m^3 + 8m^2 - 10m + 5$  has four terms. Each term is written in the form  $ax^k$ .

- The first term is  $m^3$ .
- The power is  $m^3$ , and its coefficient is 1.
- In this term, the variable is  $m$  and the exponent is 3.



The polynomial  $m^3 + 8m^2 - 10m + 5$  has four terms.

1. Write each term from the worked example and identify the coefficient, power, and exponent. The first term has already been completed for you.

	1st	2nd	3rd	4th
Term	$m^3$			
Coefficient	1			
Variable	$m$			
Power	$m^3$			
Exponent	3			

**2. Identify the terms and coefficients in each polynomial.**

**a.  $-2x^2 + 100x$**

**b.  $4m^3 - 2m^2 - 5$**

**c.  $y^5 - y + 3$**



Polynomials are named according to the number of terms they have. Polynomials with only one term are **monomials**. Polynomials with exactly two terms are **binomials**. Polynomials with exactly three terms are **trinomials**.

The degree of a term in a polynomial is the exponent of the term. The greatest exponent in a polynomial determines the **degree of the polynomial**. In the polynomial  $4x + 3$ , the greatest exponent is 1, so the degree of the polynomial is 1.



3. Khalil says that  $3x^{-2} + 4x - 1$  is a trinomial with a degree of 1 because 1 is the greatest exponent. Jazmin disagrees and says that this is not a polynomial at all because the power on the first term is not a whole number. Who is correct? Explain your reasoning.

4. Determine whether each expression is a polynomial.  
Explain your reasoning.

$$5^x + 4^{x-1} + 3^{x-2}$$

$$x^2 + \sqrt{x}$$

$$x^4y + x^3y^2 + x^2y$$

A polynomial is written in general form when the terms are in descending order, starting with the term with the largest degree and ending with the term with the smallest degree.

**5. Revisit the cards you sorted in the Getting Started.**

- a. Identify any polynomial not written in general form and rewrite it in general form on the card.**
- b. Identify the degree of each polynomial and write the degree on the card.**
- c. Glue each card in the appropriate column based on the number of terms in each polynomial. Write your own polynomial to complete any empty boxes.**

Monomial	Binomial	Trinomial