

Monomials & Polynomials

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WHAT'S COVERED

In this lesson, you will learn how to order the terms in a polynomial expression. Specifically, this lesson will cover:

1. Monomials

The prefix "mono" means "one." A monopoly is a market that is controlled by a single company. A monocle is eyewear that consists of only one lens. Someone who speaks in a monotone voice tends to put people to sleep because they speak with a singular tone, with no variation in pitch.

In mathematics, a **monomial** is a single-term expression. Recall that a term is made up of a combination of numbers, variables, and powers.

➞ **EXAMPLE** The following are examples of monomials:

- $3x^4$
- 8
- $-\frac{1}{2}xy$
- x^2y

Note that there can be several variables in a monomial, as well as no variable at all. Coefficients can be fractional, positive, or negative. The important thing to notice is that there is no addition or subtraction. Addition and subtraction separate terms, and since monomials only have one term, there is no need to separate multiple terms with addition or subtraction.



HINT

There are a few other special things to note about monomials:

- Variables must never be in the denominator. If there is a variable in the denominator, we are not dealing with a monomial.
- Exponents to the variables must not be negative. This is because variables with negative exponents can be written as fractions with the variable in the denominator, and this violates the previous statement that variables must not be in denominators.

- Exponents to the variables must not be fractional. For example, $2x^{\frac{1}{4}}$ is not a monomial.



TERM TO KNOW

Monomial

An expression containing a single term.

2. Polynomials

The prefix "poly" means "many." A polygon has many sides. A polytheistic religion believes in many deities. A polypeptide is a chain made up of several amino acids. A **polynomial**, then, is an expression with several terms.

➞ **EXAMPLE** The following are examples of polynomials:

- $2x + 3$
- $3x^2 - 7x + 6$
- $-\frac{1}{3}xy + 7x$
- $x^2y - 18x + 2$



HINT

Expressions containing two terms are called binomials and expressions with three terms are called trinomials. In the above example:

- $2x + 3$ and $-\frac{1}{3}xy + 7x$ are binomials because they each have two terms.
- $3x^2 - 7x + 6$ and $x^2y - 18x + 2$ are trinomials because they each have three terms.



TERM TO KNOW

Polynomial

An expression with several terms.

3. Degrees of a Term

Each term in a polynomial can be described by its **degree**, which is related to the exponent powers attached to variables in the term:

To find the degree of a term, simply find the sum of all exponents.

➞ **EXAMPLE** Find the degree of each term.

Term	Degree	Explanation
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$2x$	1	The degree is 1 because the variable x has an implied exponent of 1.
$3x^5$	5	The degree is 5 because the variable x has an exponent of 5.
x^2y	3	The degree is 3 because the variable x has an exponent of 2, and the variable y has an implied exponent of 1. The sum of 2 and 1 is 3.



TERM TO KNOW

Degree (of a Term)

The sum of all variable exponent powers in the term.

4. Ordering Terms in a Polynomial

It is standard to write terms in a polynomial by order of its degree, from highest to lowest. A reason for this is that we can also describe the degree of a polynomial. The degree of a polynomial is the same as the highest degree of all the terms. So when we have a polynomial written in order of descending degree, the first term also describes the **degree of the polynomial**.

➞ **EXAMPLE** Rewrite the following polynomial expression so that it is in proper order and also determine the degree:

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

Here, we see a first-degree term, followed by a second-degree term, followed by a third-degree term. We need to write the terms in order of descending degree (highest to lowest):

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

The degree of this polynomial is 3.



BIG IDEA

Notice that once a polynomial is written in standard order, we can name the degree of the entire polynomial simply by looking at the degree of the first term.



TERM TO KNOW

Degree (of a Polynomial)

Also called order, the highest degree of the terms in a polynomial expression.



SUMMARY

A term is a collection of numbers, variables, and powers. A **monomial** is an expression with one term, a binomial has two terms, and a trinomial has three terms, which are also all **polynomials**. The degree of a term is a sum of the powers in the term. The **degrees in polynomials** is the highest degree in all of the terms in the polynomial. It's also called the **ordering terms in a polynomial**. A polynomial is in

standard form when the terms are in order of a degree from highest to lowest.

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TERMS TO KNOW

Degree (of a Polynomial)

Also called order, the highest degree of the terms in a polynomial expression.

Degree (of a Term)

The sum of all variable exponent powers in the term.

Monomial

An expression containing a single term.

Polynomial

An expression containing several terms.