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## Classifying Polynomials

Polynomial - The sum or difference of terms (monomials).

How to classify by TERM:

Monomial - One term
Binomial - Two-term
Trinomial - Three-term
Polynomial - more than 3 terms
ex: 4 or -x
ex: $\mathbf{3} \mathbf{x}^{\mathbf{3}} \mathbf{- 1}$
ex: $\mathbf{x}^{\mathbf{3}}+\mathbf{x} \mathbf{- 2}$
ex: $\mathbf{x}^{\mathbf{3}}+\mathbf{2} \mathbf{x}^{2}+\mathbf{x}+\mathbf{1}$

Degree of a polynomial - The largest exponent of its terms.
How to classify by DEGREE:

| Linear - $1^{\text {st }}$ degree | ex: 3x |
| :---: | :---: |
| Quadratic - $2^{\text {nd }}$ degree | ex: $\mathbf{3 x}^{\mathbf{2}}$ |
| Cubic - $3^{\text {rd }}$ degree | ex: $\mathbf{2 x}^{\mathbf{3}}$ |
| Quartic $-4^{\text {th }}$ degree | ex: $\mathbf{2 x}^{4}$ |
| Constant Term - Number | ex: 5 |

(a constant term has a degree of zero)

| Polynomial | Leading Coefficient | Classify by Degree | Classify by Term |
| :---: | :---: | :---: | :---: |
| $5 x$ | $\mathbf{5}$ | Linear | Monomial |
| $-x^{3}+2$ | $-\mathbf{1}$ | Cubic | Binomial |
| $7 x^{4}+2 x^{3}-3 x+1$ | $\mathbf{7}$ | Quartic | Polynomial |
| -12 | $\mathbf{- 1 2}$ | Constant | Monomial |
| $2 x^{2}-3 x+1$ | $\mathbf{2}$ | Quadratic | Trinomial |

## Standard Form \& Coefficients

Standard form of a polynomial - terms written in decreasing order according to exponents.

$$
-4 x^{2}+x^{3}+3 \longrightarrow \text { in standard form is: } \longrightarrow x^{3}-4 x^{2}+3
$$

The coefficients are 1, -4, and 3.1 is the leading coefficient.
The leading coefficient will be first when the polynomial is written in standard form.

Practice:
Write the polynomial: $x-4 x^{3}+x^{4}+3$ in standard form. List the coefficients and the leading coefficient.

Rewrite the polynomials in standard form (if necessary). Identify the leading coefficient, and classify the polynomial by degree and by number of terms.
Ex1) $4-x+2 x^{2}$
Ex2) $2 x+4-x^{3}$

St. Form $\quad \mathbf{2 x} \mathbf{2} \mathbf{x}+\mathbf{4}$
$-x^{3}+2 x+4$
L. Coeff. 2
$-1$

By degree Quadratic
Cubic

By Terms Trinomial
Trinomial

$$
\text { Ex3) }-5
$$

Ex4) $-x^{2}+3 x^{4}-8+2 x^{3}$
St. Form -5
$3 x^{4}+2 x^{3}-x^{2}-8$
L. Coeff. -5

3
By degree Constant

## Quartic

By Terms
Monomial
Polynomial

## Combining Like Terms

When combining like terms, add or subtract the coefficients, leaving the exponents the same. Make sure when writing out your answer that it is in standard form.
Ex5) $-4 x^{3}+7 x-8+2 x^{3}-11 x$
Ex6) $8 x-4 x^{2}+1+4 x^{2}-8 x$

$$
-4 x^{2}+4 x^{2}+8 x-8 x+1
$$

1

Ex7) $4 x^{4}-6 x+11 x+x^{4}-10$

$$
\begin{gathered}
4 x^{4}+x^{4}-6 x+11 x-10 \\
5 x^{4}+5 x
\end{gathered}
$$

Ex8) $-x+7 x^{2}+x-2$

$$
\begin{gathered}
7 x^{2}-x+x-2 \\
7 x^{2}-2
\end{gathered}
$$

## Adding Polynomials without Grouping

When adding polynomials combine like terms and write your answer in standard form.

Ex9) $\left(3 x+7 x^{2}+1\right)+\left(1+2 x-5 x^{2}\right)$

$$
-5 x^{3}+7 x^{2}+5 x+2
$$

Ex11) $\left(6 a+6 a^{4}+a^{3}\right)+\left(3 a^{3}-5 a^{4}-6 a\right)$

$$
a^{4}+4 a^{3}
$$

Ex10) $\left(6 \mathrm{x}^{2}-3 \mathrm{x}^{3}-2 \mathrm{x}^{2}\right)+\left(\mathrm{x}^{3}+2 \mathrm{x}^{2}+1\right)$
$-2 x^{3}+6 x^{2}+1$

Ex12) $\left(x^{4}+2 x^{3}+3\right)+\left(8-2 x^{3}+2 x^{4}\right)$
$3 x^{4}+11$

Note: If the coefficients combine to be zero, you do not write the variable ( 0 multiplied by a variable is 0 )

## Distributing Practice

Ex13) $-(x+4)$
$-x-4$
ex14) $-2(x+3)$
$-2 x-6$
ex15) $-(-x+6)$
$x-6$

When subtracting polynomials it is important to remember to distribute the negative to all terms in the proceeding set of parenthesis. When working a subtraction problem, we will distribute the negative first and then combine like terms.

Ex16) $\left(2 x^{3}+3 x-4\right)-\left(5-6 x+3 x^{3}\right)$
Distribute the negative to the $2^{\text {nd }}$ set of parenthesis

$\left(2 x^{3}+3 x-4\right)+\left(-5+6 x-3 x^{3}\right)$
$-x^{3}+9 x-9$

Switch the signs for all terms in the $\mathbf{2}^{\text {nd }}$ set of parenthesis

Note: The problem becomes an addition problem

Combine like terms for your answer

Find the difference. Write the answer in standard form.

Ex17) $\left(4 x^{2}-3\right)-\left(2 x^{2}+6\right)$

$$
\text { Ex18) }\left(-3 x^{3}+7\right)-\left(5 x^{2}-x^{3}\right)
$$

$$
\begin{aligned}
& \left(4 x^{2}-3\right)+\left(-2 x^{2}-6\right) \\
& 2 x^{2}-9
\end{aligned}
$$

$$
\begin{aligned}
& \left(-3 x^{3}+7\right)+\left(-5 x^{2}+x^{3}\right) \\
& -2 x^{3}-5 x^{2}+7
\end{aligned}
$$

Ex19) $\left(9 x^{3}-3 x^{2}-1\right)-\left(9 x^{4}+5 x^{2}+19\right)$

$$
\begin{aligned}
& \left(9 x^{3}-3 x^{2}-1\right)+\left(-9 x^{4}-5 x^{2}-19\right) \\
& -9 x^{4}+9 x^{3}-8 x^{2}-20
\end{aligned}
$$

Ex20) $\left(6 x-4 x^{2}+17 x^{3}\right)-\left(-8 x^{3}+5 x^{2}-11 x\right)$
$\left(6 x-4 x^{2}+17 x^{3}\right)+\left(8 x^{3}-5 x^{2}+11 x\right)$
$25 x^{3}-9 x^{2}+17 x$

