

2-1 Operations with Polynomials

Objectives:

- I can identify the parts of a polynomial
- I can perform operations with polynomials including addition, subtraction, and multiplication

Vocab *Terms separated by +/-

Monomial → one term
one term
Ex: x^2 , $5a^2b$, 7

Binomial → two terms
term
Ex: $x+y$, $3a^2b+2b$

Trinomial → three terms
term

Polynomial → many terms (any # of terms)
term

Monomials pg. 315

Identify the monomials: x^3 , $y + 3y^2 - 5y^3 + 10$, $a^2 bc^{12}$, 76

Monomials: x^3 , $a^2 bc^{12}$, 76

Not monomials: $y + 3y^2 - 5y^3 + 10$

Identify the degree of
each monomial.

total exponents
on variables

| Monomial | x^3 | $a^2 bc^{12}$ | 76 |
|----------|-------|---------------|------|
| Degree | 3 | 15 | 0 |

2+1+12

no
variable!

Polynomials pg. 315

Identify the terms of the polynomial $y + 3y^2 - 5y^3 + 10$. $y, 3y^2, -5y^3, 10$

Identify the coefficient of each term. \uparrow
in front of variable(s)

| Term | y | $3y^2$ | $-5y^3$ | 10 |
|-------------|-----|--------|---------|------|
| Coefficient | 1 | 3 | -5 | 10 |

Identify the degree of each term. \uparrow
exponents

| Term | y | $3y^2$ | $-5y^3$ | 10 |
|--------|-----|--------|---------|------|
| Degree | 1 | 2 | 3 | 0 |

Write the polynomial in standard form. $-5y^3 + 3y^2 + y + 0$
highest degree to lowest degree \rightarrow leading term -5

What is the leading coefficient of the polynomial? -5

coefficient of 1st term when written in standard form

* Degree of a polynomial: 3

\uparrow
highest degree in the polynomial;
degree of 1st term in standard form

Adding Polynomials pg. 316

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

combine
like terms

$$\begin{array}{r} 5x^4 - x^3 + 4x^2 + 2 \\ + 3x^4 + 6x^2 - x \\ \hline 8x^4 - x^3 + 10x^2 - x + 2 \end{array}$$

Ex 2 $(10x^4 - 18x^3 + 6x^2 - 2) + (-7x^4 + 5 + x + 2x^3)$

$$-x^4 - 16x^3 + 11x + 3$$

Add the following polynomials pg. 316

$$\cancel{(17x^4 + 8x^2 - 9x^7 + 4 - 2x^3)} + \cancel{(11x^3 - 8x^2 + 12)}$$

$$\boxed{-9x^7 + 17x^4 + 9x^3 + 16}$$

$$+8x^2 - 8x^2 = 0x^2 = 0$$

$$\cancel{(-8x + 3x^{11} + x^6)} + \cancel{(4x^4 - x + 17)}$$

$$\boxed{3x^{11} + x^6 + 4x^4 - 9x + 17}$$

Subtracting Polynomials pg. 317

$$(12x^3 + 5x - 8x^2 + 19) - (6x^2 + 9x + 3 + 18x^3)$$

Write in standard form.

Align like terms and add the opposite.

Add.

$$\begin{array}{r} 12x^3 \quad -8x^2 \quad +5x \quad +19 \\ +18x^3 \quad -6x^2 \quad +9x \quad -3 \\ \hline \end{array}$$

$$\boxed{30x^3 - 14x^2 + 14x + 16}$$

$$(-4x^2 + 8x^3 + 19 - 5x^5) + (-9 - 2x^2 - 10x^5)$$

Write in standard form and add the opposite.

Group like terms

$$\boxed{-15x^5 + 8x^3 - 6x^2 + 10}$$

Add

Subtract the following polynomials pg. 317

$$\cancel{(23x^7 - 9x^4 + 1)} + \cancel{(+9x^4 - 6x^2 + 31)}$$

$$\boxed{23x^7 - 6x^2 + 32}$$

$$-9x^4 + 9x^4 = 0x^4 = 0$$

$$\underline{\underline{0x^4 \neq x^4}}$$

$$\cancel{(7x^3 - 13x - 8x^5 + 20x^2)} + \cancel{(+2x^3 - 9x^2)}$$

$$\boxed{-6x^5 + 7x^3 + 11x^2 + 13x}$$

Multiplying Polynomials pg. 328

$$\begin{aligned} \underline{5x} \cdot \underline{6x^3} &= 30x^{1+3} \\ 5 \cdot 6 \cdot x \cdot x^3 & \\ 30 \cdot \underline{x \cdot x \cdot x \cdot x} & \\ \underline{30x^4} & \end{aligned}$$

$$\begin{aligned} \underline{-2x^2y^4z} \cdot \underline{5y^2z} &= -10x^2y^{4+2}z^{1+1} \\ -2 \cdot 5 \cdot x^2 \cdot y^4 \cdot y^2 \cdot z \cdot z & \\ = \boxed{-10x^2y^6z^2} & \end{aligned}$$

~~$(2 + 3x)(1 + x) = 2(1 + x) + 3x(1 + x)$~~

Ex 1 $(x + 2)(1 - 4x + 2x^2)$

Find the product by multiplying horizontally.

$$(x + 2)(2x^2 - 4x + 1)$$

$$\begin{array}{r} 2x^3 - 4x^2 + x \\ + 4x^2 - 8x + 2 \\ \hline \end{array}$$

$$\boxed{2x^3 - 7x + 2}$$

← standard form

← line up like terms

← standard form

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

Multiplying vertically

$$\begin{array}{r}
 -7x^2 + x + 2 \\
 \times \quad 3x - 4 \\
 \hline
 +28x^2 - 4x - 8 \\
 -21x^3 + 3x^2 + 6x \\
 \hline
 -21x^3 + 31x^2 + 2x - 8
 \end{array}$$

Multiply the following polynomials pg. 329

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

$$\begin{array}{r} 12 - 21x + 15x^2 \\ + 8x - 21x^2 + 10x^3 \end{array}$$

$$12 - 13x - 6x^2 + 10x^3 \rightarrow$$

Standard Form:

$$10x^3 - 6x^2 - 13x + 12$$

$$(x - 6)(3 - 8x - 4x^2)$$

$$(x - 6)(-4x^2 - 8x + 3)$$

$$\begin{array}{r} -4x^3 - 8x^2 + 3x \\ + 24x^2 + 48x - 18 \end{array}$$

$$-4x^3 + 16x^2 + 51x - 18$$

Multiplying with a table

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

| | x^2 | $-x$ | 1 |
|-------|---------|---------|-------|
| x^2 | x^4 | $-x^3$ | x^2 |
| $+3x$ | $3x^3$ | $-3x^2$ | $3x$ |
| -5 | $-5x^2$ | $5x$ | -5 |

$$x^4 + 2x^3 - 7x^2 + 8x - 5$$