2-1 Operations with Polynomials

(Book 6.1/6.2 pgs. 315-329)

Objectives:

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

Vocab term $10, 5x, 3x^2y^3$

Monomial $10, 5x, 3ab$

one term

Binomial $2x+1, 3x^2-y$

two terms

↳ +, −

Trinomial $3x^2+2x+1, y+z-10$

3 terms

Polynomial $4x^4-3x^3+5x^2-x-12$

many terms

Monomials pg. 315

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

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

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

exponent (variable)

constant degree 0

Identify the degree of each monomial.

Monomial	x^3	$a^2\, bc^{12}$	76
Degree	3	15	0

$2+1+12$

$76 \cdot x^0$

1

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.

in front of variable

Term	$1 \cdot y$	$3y^2$	$-5y^3$	$10 \cdot x^0$
Coefficient	1	3	-5	10

Identify the degree of each term.

exp. variable

Term	y	$3y^2$	$-5y^3$	$10 \cdot x^0$
Degree	1	2	3	0

Write the polynomial in standard form. $-5y^3 + 3y^2 + y + 10$

degree highest → lowest

What is the leading coefficient of the polynomial? -5

Coefficient highest degree

Adding Polynomials pg. 316

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

Standard form

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

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

standard form

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

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

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

Add the following polynomials pg. 316

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

$-9x^7 + 17x^4 + 9x^3 + 16$

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

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

Subtracting Polynomials pg. 317

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

Write in standard form. Stand.

Align like terms and add the opposite.

Add.

$$\begin{array}{rrrr} 12x^3 & -8x^2 & +5x & +19 \\ +18x^3 & -6x^2 & +9x & -3 \\ \hline 30x^3 & -14x^2 & +14x & +16 \end{array}$$

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

Write in standard form and add the opposite. $(-5x^5 + 8x^3 - 4x^2 + 19 + -10x^5 - 2x^2 - 9)$

Group like terms $= \left(-5x^5 - \square\right) + \left(\square\right) + \left(\square - 2x^2\right) + \left(\square - 9\right)$

Add $= \square + 8x^3 - \square + 10$

Subtract the following polynomials pg. 317

$(23x^7 - 9x^4 + 1) - (-9x^4 + 6x^2 - 31)$

$23x^7 - 9x^4 + 1 + 9x^4 - 6x^2 + 31$

$23x^7 - 6x^2 + 32$

$(7x^3 + 13x - 8x^5 + 20x^2) - (-2x^5 + 9x^2)$

$7x^3 + 13x - 8x^5 + 20x^2 + 2x^5 - 9x^2$

$-6x^5 + 7x^3 + 11x^2 + 13x$

Pg. 318

The data from the U.S. Census Bureau for 2005–2009 shows that the number of male students enrolled in high school in the United States can be modeled by the function $M(x) = -10.4x^3 + 74.2x^2 - 3.4x + 8320.2$, where x is the number of years after 2005 and $M(x)$ is the number of male students in thousands. The number of female students enrolled in high school in the United States can be modeled by the function $F(x) = -13.8x^3 + 55.3x^2 + 141x + 7880$, where x is the number of years after 2005 and $F(x)$ is the number of female students in thousands. Estimate the total number of students enrolled in high school in the United States in 2009.

In the equation $T(x) = M(x) + F(x)$, $T(x)$ is the total number of students in thousands.

Add the polynomials.

$$(-10.4x^3 + 74.2x^2 - 3.4x + 8320.2) + (-13.8x^3 + 55.3x^3 + 141x + 7880)$$

$$= (-10.4x^3 - 13.8x^3) + (74.2x^2 + 55.3x^2) + (-3.4x + 141x) + (8320.2 + 7880)$$

$$= -24.2x^3 + 129.5x^2 + 137.6x + 16{,}200.2$$

The year 2009 is 4 years after 2005, so substitute 4 for x.

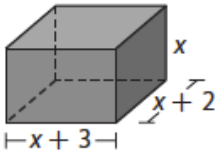
$$-24.2(4)^3 + 129.5(4)^2 + 137.6(4) + 16{,}200.2 \approx 17{,}274$$

About 17,274 thousand students were enrolled in high school in the United States in 2009.

Pg. 327

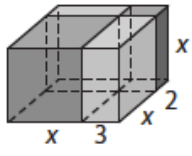
V = length × width × height

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



v_2 = volume of this piece

v_1 = volume of this piece



$v = v_1 + v_2 + v_3 + v_4$

v_4 = volume of this piece

v_3 = volume of this piece

Identify the volume of:

V_1 V_3

V_2 V_4

So the volume of the rectangular prism is the sum of the volumes of the four smaller regions.

$$V_1 + V_2 + V_3 + V_4 = \square + \square + \square + \square$$

$$= \square$$

Multiplying Polynomials pg. 328

$5x \cdot 6x^3 = 30x^{1+3}$ $\quad = 30x^4$

$-2x^2y^4z^1 \cdot 5y^2z^1 = -10x^2y^{4+2}z^{1+1}$ $\quad = -10x^2y^6z^2$

$x \cdot x^3$

$x \cdot x \cdot x \cdot x = x^4$

$$(2+3x)(1+x) = 2(1+x) + 3x(x+1)$$
$$= 2(1) + 2(x) + 3x(x) + 3x(1)$$
$$= 2 + 2x + 3x^{1+1} + 3x$$
$$= 2 + 5x + 3x^2$$

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

Standard: $3x^2 + 5x + 2$

Pg. 328

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

Find the product by multiplying horizontally.

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

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

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

$2x^3 - 7x + 2$

Therefore, $(x+2)(2x^2-4x+1) = 2x^3 - 7x + 2$.

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

Find the product by multiplying vertically.

$-7x^2 + x + 2$

$3x - 4$

$28x^2 - 4x - 8$

$-21x^3 + 3x^2 + 6x + 0$

$-21x^3 + 31x^2 + 2x - 8$

Write each polynomial in standard form.

Multipy -4 and $(-7x^2 + x + 2)$.

Multipy $\square$ and $(-7x^2 + x + 2)$.

Combine like terms.

Therefore, $(3x-4)(2+x-7x^2) =$ _____.

-712
x 34
-2848
-21360

Multiply the following polynomials pg. 329

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

	$2x$	3
$5x^2$	$10x^3$	$15x^2$
$-7x$	$-14x^2$	$-21x$
4	$8x$	12

Standard form!!

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

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

$3x-8x^2-4x^3$

$-18+48x+24x^2$

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

Multiplying with a table

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

Stand.

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

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

6.2 #1. $l \cdot w \cdot h = V$

#9. $R(x) = N(x) \cdot P(x)$

#10. $T(x) = b(y) \cdot l(y)$

#12. $(x+y+z)^2$

5^2

$5 \cdot 5$

x^2

$x \cdot x$

$(x+y+z)(x+y+z)$