5-1 Operations with Polynomials

- *multiply, divide, and simplify monomials and expressions involving powers.*
- *add, subtract, and mulitply polynomials*
- *A.APR.1*

monomial: an expression that is a **number**, a **variable**, or the **product** of **numbers** and **variables**.

monomials	not monomials
x 5 $5x$ x^2yz $\frac{x}{5} = \frac{1}{5}x$	$x+5$ $x-5$ $\frac{x}{4}$

constants: monomials that contain no variables.

coefficient: the numerical factor of the monomial.

degree: the sum of the exponents of its variables.

- degree of non-zero constants is zero.
- zero does not have a degree.

monomial	coefficient	variable(s)	exponent(s)	degree
$1m^1$	1	m	1	1
$-7a^2$	-7	a	2	2
x^3y^2	1	x y	3,2	5
-4	-4	—	—	0
$\frac{n^3p^4r}{3}$	1/3	n,p,r	3,4,1	8

$\frac{n^3p^4r}{3}$

Property of Powers

Property	Definition	Example
Product of Powers	$a^m \cdot a^n = a^{m+n}$	$x^2 \cdot x^3 = x^{2+3} = x^5$ $x \cdot x \cdot x \cdot x \cdot x = x^5$
Quotient of Powers	$\frac{a^m}{a^n} = a^{m-n}$	$\frac{x^5}{x^2} = x^{5-2} = x^3$
Power of a Power	$(a^m)^n = a^{m \cdot n}$	$(x^3)^2 = x^6$ $x^3 \cdot x^3 = x^6$
Power of a Product	$(a^m b^n)^p = a^{mp} b^{np}$	$(x^2 y^3)^4 = x^8 y^{12}$
Power of a Quotient	$\left(\frac{n}{d}\right)^p = \frac{n^p}{d^p}$	$\left(\frac{x^3}{y^2}\right)^2 = \frac{x^6}{y^4}$
Negative Power	$x^{-m} = \frac{1}{x^m}$ $\frac{1}{a^{-m}} = \frac{a^m}{1}$	$\frac{x^2}{x^5} = x^{-3}$ $\frac{1}{x^{-3}}$
Zero Power	$a^0 = 1$	$\left(\frac{x^2}{y^3}\right)^0 = 1$ $\frac{(x^2)^0}{y^3} = \frac{1}{y^3}$

$10^2 = 100$
$10^1 = 10$
$10^0 = 1$
$10^{-1} = \frac{1}{10}$
$10^{-2} = \frac{1}{100}$

0-9
1234567890

Simplifying Monomials:

- no powers of powers $(x^3)^2 = x^6$
- each base appears exactly once $(2x)(3x^2y) = 6x^3y$
- fractions are in simplest form $\frac{x^4y^3}{xyz} = \frac{x^3y^2}{z}$
- no negative exponents

$\left(\frac{2}{3}\right)^{-3} = \frac{2^{-3}}{3^{-3}} = \frac{3^3}{2^3} = \frac{27}{8}$

$\frac{a^{-3}b^4}{a^1b^{-2}} = \frac{b^4b^2}{a^3a} = \frac{b^6}{a^4}$

Examples: Simplify.

1. $(a^{-3})(a^2b^4)(c^{-1})$

$a^{-1}b^4c^{-1}$

$\frac{b^4}{ac}$ $\frac{a^2b^4}{a^8c}$

2. $\frac{n^2}{n^{10}}$

$n^{2-10} = n^{-8} = \frac{1}{n^8}$

$\frac{1}{n^8}$

$\frac{9a^6}{b^8}$

3. $\left(\frac{3a^3}{b^4}\right)^2$

$\left(\frac{3a^3}{b^4}\right)\left(\frac{3a^3}{b^4}\right)$

$\frac{3\cdot 3a^3a^3}{b^4b^4} = \frac{9a^6}{b^8}$

5-2 Polynomials

previous assignment:
Page 226, 18-34 all

- *adding and subtracting polynomials*
- *multiplying polynomials*
- *No CCSS*

polynomial: a monomial or a sum or difference of monomials.

polynomials	not polynomials
$x+5$	$\frac{x}{y}$
x^2-3x+7	$\sqrt{x} = x^{1/2}$

terms: the monomials that make up the polynomials.
like terms: same variables raised to the same degree.

binomial: made up of two terms.
trinomial: made up of three terms.

degree of polynomials: the highest degree of the monomial within the polynomial.

Examples: ***Determine whether or not the following are polynomials, then determine its degree.***

1. $c^4 - 4\sqrt{c} + 18$

not a poly

2. $-16p^5 + \frac{3}{4}p^2q^7$

degree: 9

3. $x + \frac{y^2}{z}$

not a poly

4. $-2x^3 + 4x^2y^3 - 8xz$

degree: 5

Adding and Subtracting Polynomials

- add or subtract the coefficients of the like terms.
- exponents of the variables remain the same.

Examples: ***Add or subtract the following polynomials.***

1) $(2a^3 + 5a - 7) + (a^3 - 3a + 2)$

$2a^3+5a-7+a^3-3a+2$

$3a^3+2a-5$

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

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

$2x^2-6x+5$

Multiplying Polynomials - distributive property

- multiply the coefficients, multiply the variables *(add the exponents)*
- combine like terms, if necessary.

Examples:

1. $y(4y^2 + 2y - 3)$

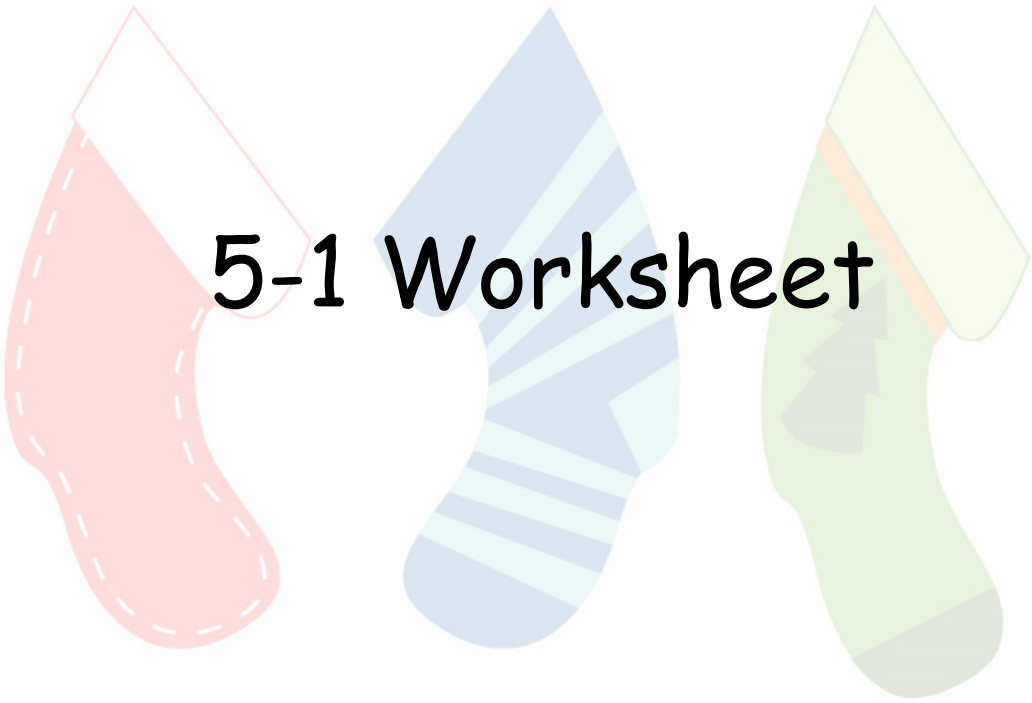
2. $3x(2x^2y - 5x^3y^2)$

$6x^3y-15x^4y^2$

3. $(a + 2)(a^2 - 3a + 5)$

a^3-3a^2+5a
$+2a^2-6a+10$

a^3-a^2-a+10



5-1 Worksheet