

- A _____ is a number, a variable, or the product of a number and one or more variables with whole number exponents.

Examples: a. 9 b. x c. $7y^3$ d. $16a^4b^7$

- The _____ is the sum of the exponents of the variables in the monomial. The degree of a nonzero constant term is _____.

Examples: State the degree of each monomial for examples a – d above.

a. _____ b. _____ c. _____ d. _____

- A _____ is a monomial or a sum of monomials, each called a **term** of the polynomial. A polynomial has exponents that are **whole** numbers (exponents **CANNOT** be negative, fractions, or a variable in a polynomial!)

Examples: Tell whether or not the expression is a polynomial. If not, explain why.

e. $4^x + 2$

f. $-3x^{10} + 0.2$

g. $x^{\frac{1}{2}}$

- A polynomial with two terms is called a _____. Example: _____
- A polynomial with three terms is called a _____. Example: _____
- The _____ of the polynomial is the greatest degree of its terms.
- When a polynomial is written so that the exponents of a variable decrease from left to right, the coefficient of the first term is called the _____.

Rewrite the following polynomials so that the exponents decrease from left to right. Identify the degree and the leading coefficient of the polynomials.

h. $12x^3 - 15x + 13x^5$ _____ degree: _____ leading coefficient _____

i. $-11c + 14c^4 + 18c^6$ _____ degree: _____ leading coefficient _____

j. $9 - 2x^2$ _____ degree: _____ leading coefficient _____

Reasoning: How do you find the sums and differences of polynomials?

Methods for adding and subtracting polynomials:

- **Vertical format:** Align like terms in vertical columns.
- **Horizontal format:** Group like terms and simplify.

Examples:

k. $(3x^4 - 2x^3 + 5x^2) + (7x^2 + 9x^3 - 2x)$

Vertical format:

l. $(3x^2 - 9x) - (2x^2 - 5x + 6)$

Vertical format:

m. $2(7x^2 - 3x + 6) + (9x^2 + 6x - 11)$

Horizontal format:

n. $(11x^2 + 6x - 1) - (2x^2 - 7x + 5)$

Horizontal format:

Find the sum or difference (Simplify).

o. $3(x + 1) + (5x^3 - x^2 + x - 4)$

p. $(7x^3 - 1) - (15x^3 + 4x^2 - x + 3)$

q. $(10x - 3 + 7x^2) + (x^3 - 2x + 17)$

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

s. $(6x + 2) + 2(2x^2 - 3x + 1)$

t. $(x^2 + 3x - 1) - (2x^2 - x + 3)$

Simplify each expression:

1) $(2x^4 - 4x) + (3x^4 - 3x)$

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

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

4) $(1 + 4n^2) + (2 - 3n^2)$

5) $4(3n^3 + 2n) + (2n^3 + 2n)$

6) $(-n^3 + 6n^4 + 10) + (-6n^5 + n^3 + 5n^4)$

7) $(13 - 11n^2 - 10n) + (10 - n^3 + 9n)$

8) $(-2 - 11n^3 - 2n) - (7n^3 - 12n - 14n^4)$

$$9) (-10n^5 + 11n^2 - 6) + (5 + 2n^2 - 14n^5)$$

$$10) (-11x + 9x^3 - 9x^4) - (14x^3 + 7x^4 + 4x)$$

$$11) (2v^3 + 11v^5 - 3) + (-10 + 11v^5 + 2v^4)$$

$$12) (4x^2 + 4x^3 + 2x) + 13x + 10x^2 - 2x^3$$

$$13) (4x - 4x^3 - 13) - (-8x^4 - 8x^3 - x)$$

$$14) (-2n - 7n^3 + 6n^5) + (5 + 4n + 8n^3)$$

$$15) 2(-11n^2 - 14 + 7n^5) + (-8n^5 - 2 + 14n^2)$$

$$16) (9b - 5 + 5b^5) + (13b^2 + 12 + 6b)$$

Key

- A monomial is a number, a variable, or the product of a number and one or more variables with whole number exponents.

Examples: a. 9 b. x c. $7y^3$ d. $16a^4b^7$

- The degree of monomial is the sum of the exponents of the variables in the monomial. The degree of a nonzero constant term is zero.

Examples: State the degree of each monomial for examples a - d above.

a. 0 b. 1 c. 3 d. 11

- A polynomial is a monomial or a sum of monomials, each called a **term** of the polynomial. A polynomial has exponents that are **whole** numbers (exponents **CANNOT** be negative, fractions, or a variable in a polynomial!)

Examples: Tell whether or not the expression is a polynomial. If not, explain why.

e. $4^x + 2$ f. $-3x^{10} + 0.2$ g. $x^{\frac{1}{2}}$
 no exponent is a variable yes no exponent is a fraction.

- A polynomial with two terms is called a binomial. Example: $2x^3 + x^2$
- A polynomial with three terms is called a trinomial. Example: $2x^3 + 4x^2 + 2$
- The degree of the polynomial is the greatest degree of its terms.
- When a polynomial is written so that the exponents of a variable decrease from left to right, the coefficient of the first term is called the leading coefficient.

Rewrite the following polynomials so that the exponents decrease from left to right. Identify the degree and the leading coefficient of the polynomials.

h. $12x^3 - 15x + 13x^5$ $13x^5 + 12x^3 - 15x$ degree: 5 leading coefficient 13

i. $-11c + 14c^4 + 18c^6$ $18c^6 + 14c^4 - 11c$ degree: 6 leading coefficient 18

j. $9 - 2x^2$ $-2x^2 + 9$ degree: 2 leading coefficient -2

Reasoning: How do you find the sums and differences of polynomials?

combine / Add like terms
 / subtract

Methods for adding and subtracting polynomials:

- **Vertical format:** Align like terms in vertical columns.
- **Horizontal format:** Group like terms and simplify.

Examples:

k. $(3x^4 - 2x^3 + 5x^2) + (7x^2 + 9x^3 - 2x)$

Vertical format:

$$\begin{array}{r} 3x^4 - 2x^3 + 5x^2 + 7x^2 + 9x^3 - 2x \\ \hline 3x^4 + 7x^3 + 12x^2 - 2x \end{array}$$

l. $(3x^2 - 9x) - (2x^2 - 5x + 6)$

Vertical format:

$$\begin{array}{r} 3x^2 - 9x - 2x^2 + 5x - 6 \\ \hline x^2 - 4x - 6 \end{array}$$

m. $2(7x^2 - 3x + 6) + (9x^2 + 6x - 11)$

Horizontal format:

$$14x^2 - 6x + 12 + 9x^2 + 6x - 11$$
$$\boxed{23x^2 + 1}$$

n. $(11x^2 + 6x - 1) - (2x^2 - 7x + 5)$

Horizontal format:

$$11x^2 + 6x - 1 - 2x^2 + 7x - 5$$
$$\boxed{9x^2 + 13x - 6}$$

Find the sum or difference (Simplify).

o. $3(x + 1) + (5x^3 - x^2 + x - 4)$

$$3x + 3 + 5x^3 - x^2 + x - 4$$
$$\boxed{5x^3 - x^2 + 4x - 1}$$

p. $(7x^3 - 1) - (15x^3 + 4x^2 - x + 3)$

$$7x^3 - 1 - 15x^3 - 4x^2 + x - 3$$
$$\boxed{-8x^3 - 4x^2 + x - 4}$$

q. $(10x - 3 + 7x^2) + (x^3 - 2x + 17)$

$$10x - 3 + 7x^2 + x^3 - 2x + 17$$
$$\boxed{x^3 + 7x^2 + 8x + 14}$$

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

$$x^2 - x - 3 - 4x^2 - 16x - 8$$
$$\boxed{-3x^2 - 17x - 11}$$

s. $(6x + 2) + 2(2x^2 - 3x + 1)$

$$6x + 2 + 4x^2 - 6x + 2$$
$$\boxed{4x^2 + 4}$$

t. $(x^2 + 3x - 1) - (2x^2 - x + 3)$

$$x^2 + 3x - 1 - 2x^2 + x - 3$$
$$\boxed{-x^2 + 4x - 4}$$

Simplify each expression:

Solutions

1) $(2x^4 - 4x) + (3x^4 - 3x)$

$$5x^4 - 7x$$

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

$$9x^4$$

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

$$6n^4$$

4) $(1 + 4n^2) + (2 - 3n^2)$

$$n^2 + 3$$

5) $4(3n^3 + 2n) + (2n^3 + 2n)$

$$14n^3 + 10n$$

6) $(-n^3 + 6n^4 + 10) + (-6n^5 + n^3 + 5n^4)$

$$-6n^5 + 11n^4 + 10$$

7) $(13 - 11n^2 - 10n) + (10 - n^3 + 9n)$

$$-n^3 - 11n^2 - n + 23$$

8) $(-2 - 11n^3 - 2n) - (7n^3 - 12n - 14n^4)$

$$14n^4 - 18n^3 + 10n - 2$$

$$9) (-10n^5 + 11n^2 - 6) + (5 + 2n^2 - 14n^5)$$

$$-24n^5 + 13n^2 - 1$$

$$10) (-11x + 9x^3 - 9x^4) - (14x^3 + 7x^4 + 4x)$$

$$-16x^4 - 5x^3 - 15x$$

$$11) (2v^3 + 11v^5 - 3) + (-10 + 11v^5 + 2v^4)$$

$$22v^5 + 2v^4 + 2v^3 - 13$$

$$12) (4x^2 + 4x^3 + 2x) + 13x + 10x^2 - 2x^3$$

$$2x^3 + 14x^2 + 15x$$

$$13) (4x - 4x^3 - 13) - (-8x^4 - 8x^3 - x)$$

$$8x^4 + 4x^3 + 5x - 13$$

$$14) (-2n - 7n^3 + 6n^5) + (5 + 4n + 8n^3)$$

$$6n^5 + n^3 + 2n + 5$$

$$15) 2(-11n^2 - 14 + 7n^5) + (-8n^5 - 2 + 14n^2)$$

$$6n^5 - 8n^2 - 30$$

$$16) (9b - 5 + 5b^5) + (13b^2 + 12 + 6b)$$

$$5b^5 + 13b^2 + 15b + 7$$