

Good morning!

1. "Here"
2. Discuss DeltaMath from yesterday
3. Notes on Polynomial Operations
4. Practice will be uploaded to CTLS

DeltaMath has been extended to Monday as well as new assignment



To be a polynomial,

- x is not exponent
- x is not denominator
- x is not $\sqrt{\text{radical}}$
- The exponent is a whole number
(0, 1, 2, 3, 4, 5, ...)

Is it a polynomial?

$$\sqrt{x} + 3 - x \quad \text{No, } \sqrt{x}$$

$$x^2 + 3x - 2 \quad \text{Yes, quadratic trinomial}$$

$$5x^{12} - 17x^3 + \frac{1}{4}x^1 + 1 \quad \text{Yes, 12th degree polynomial}$$

$$2x^{\frac{1}{2}} - 6 \quad \text{No, exponent is fraction}$$

$$7x^5 + 2x^{-2} - 6 \quad \text{No, exponent is negative}$$

$$\frac{1}{x} + 2x \quad \text{No, } x \text{ is denominator}$$

$$5x^1 + 1x^0 \quad \text{Yes, Linear Binomial}$$

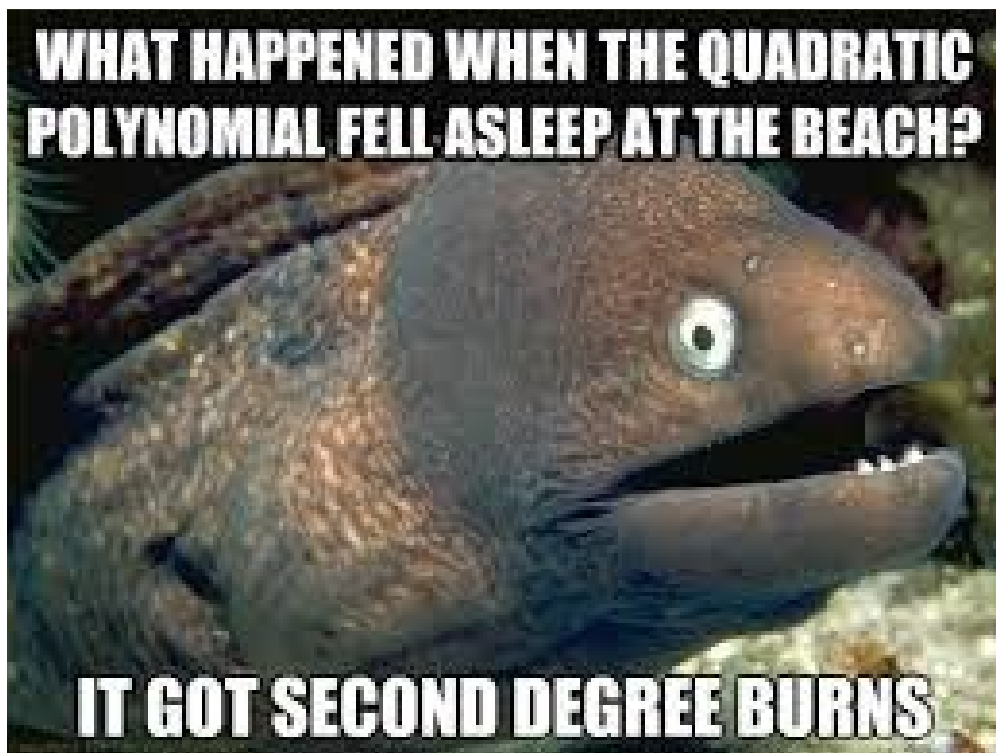
$$2^x + 10 \quad \text{No, } x \text{ is exponent}$$

Polynomials

The **degree**, or **order**, of a polynomial is given by the highest power of the variable.

- A polynomial of degree 1 is called **linear** and has the general form $ax + b$.
- A polynomial of degree 2 is called **quadratic** and has the general form $ax^2 + bx + c$.
- A polynomial of degree 3 is called **cubic** and has the general form $ax^3 + bx^2 + cx + d$.
- A polynomial of degree 4 is called **quartic** and has the general form $ax^4 + bx^3 + cx^2 + dx + e$.





Adding and subtracting polynomials

When two or more polynomials are added, subtracted or multiplied, the result is another polynomial.

Polynomials are added and subtracted by **combining like terms**.

For example: $f(x) = 2x^2 - 5x + 4$ and $g(x) = 2x - 4$

Find: a) $f(x) + g(x)$
b) $f(x) - g(x)$

a) $f(x) + g(x)$

$$= 2x^2 - 5x + 4 + 2x - 4$$

$$= 2x^2 - 3x$$

b) $f(x) - g(x)$

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

$$= 2x^2 - 5x + 4 - 2x + 4$$

$$= 2x^2 - 7x + 8$$



Subtract

$$\text{☺} - (\text{☺}) \rightarrow \text{☺} + \text{☹}$$

- ① Distribute the negative
(change signs to the right)
- ② Combine like terms

Adding and Subtracting Polynomials

Adding Polynomials:

$$(4x^2 + 8x - 9) + (-2x^2 + 11)$$

$$2x^2 + 8x + 2$$

Subtracting Polynomials:

$$(4x^2 + 8x - 9) - (-2x^2 + 11)$$

$$6x^2 + 8x - 20$$

Let $f(y) = 4y^3 + 5y - 2$, $g(y) = -5y + 12$, $h(y) = -y^2 + 7y - 1$, and $j(y) = 4y^2 + 6y + 5$.

Find the following:

1) $f(y) + h(y)$

$$(4y^3 + 5y - 2) + (-y^2 + 7y - 1)$$

$$4y^3 - y^2 + 12y - 3$$

2) $j(y) - f(y)$

$$(4y^2 + 6y + 5) - (4y^3 + 5y - 2)$$

$$-4y^3 + 4y^2 + y + 7$$

3) $g(y) + f(y)$

$$4y^3 + 10$$

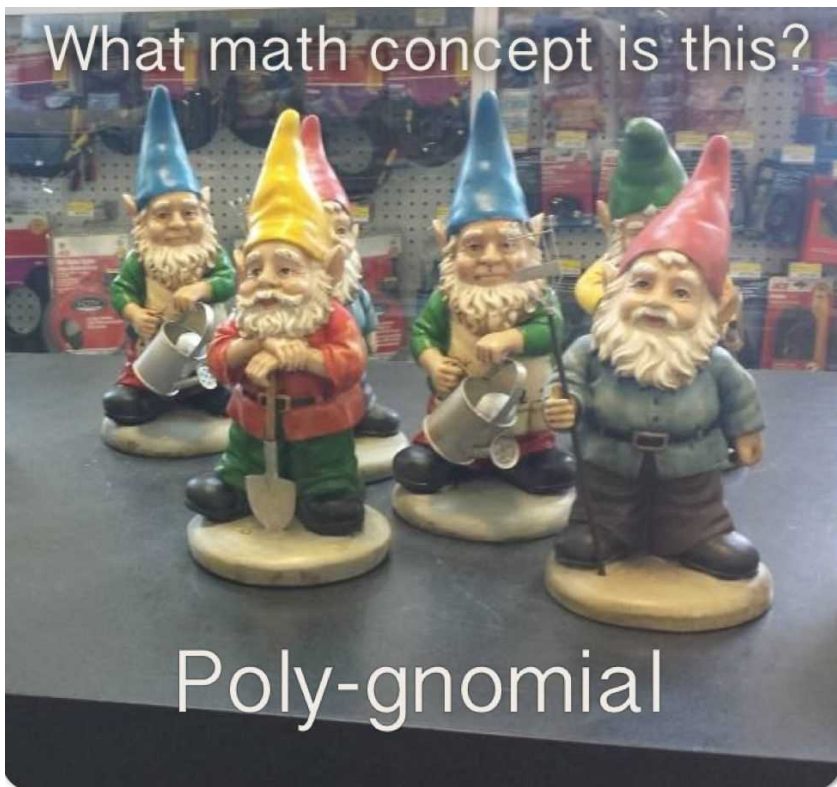
4) $h(y) + j(y)$

$$3y^2 + 13y + 4$$

More Examples:

1) Find the sum of $(2x^3 + 8x)$ and $(-7x^3 + 3x^2 + 11x)$.

2) Find the difference of $(8x^3 - 2x^2 + 14)$ and $(-y^3 + 4)$.



Adding and Subtracting Polynomials Practice

Simplify each expression.

1) $(2x^2 - 8x^4) - (4x^2 - 8)$

2) $(3 - 3b^4) + (8b^4 + 7b^2)$

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

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

5) $(6k^2 - 7k^3) - (k - 7k^3 + 4k^2)$

6) $(5x^3 + x) + (x - 3x^3 - 3)$

7) $(6x^4 - 4x + x^2) + (2x - 2x^2 - 8x^4)$

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

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

10) $(8 - 3x + 5x^3) + (8x^4 - 8x^3 - 6) - (8x + 3x^4 - 5)$

$$8 - 3x + 5x^3 + 8x^4 - 8x^3 - 6 - 8x - 3x^4 + 5$$

$$5x^4 - 3x^3 - 11x + 7$$

11) $(4a^4 + 4a^2 - 5a) + (2 + a^2 + a) - (6a - 5a^3 + 8a^4)$

Multiplying polynomials

When two polynomials are multiplied together, every term in the first polynomial must be distributed to every term in the second polynomial.

The distributive property is used to rewrite the expression without parentheses.

For example: $f(x) = 3x^2 - 2$ and $g(x) = x^2 + 5x - 1$

$$f(x)g(x) = (3x^2 - 2)(x^2 + 5x - 1)$$

$$= 3x^4 + 15x^3 - 3x^2 - 2x^2 - 10x + 2$$

$$= 3x^4 + 15x^3 - 5x^2 - 10x + 2$$



Constant (polynomial)

Distribute

$$4(2x+3) = 8x+12$$

monomial (polynomial)

$$4x(2x+3) = 8x^2 + 12x$$

(polynomial)(polynomial)

Double Distribute

$$(4x+1)(2x+3) = 8x^2 + 12x + 2x + 3$$

combine like terms

$$= \boxed{8x^2 + 14x + 3}$$

Box Method

	$2x$	$+3$	
$4x$	$8x^2$	$12x$.
$+1$	$2x$	3	

$8x^2 + 14x + 3$

Multiplying Polynomials

When multiplying polynomials, use the Distributive Method (or Box).
Remember, when multiplying Variables, you ADD the exponents.

$$x \cdot x = x^2$$

$$x^2 \cdot x^3 = x^5$$

Examples:

1) $5(x+6)$
 $5x + 30$

2) $x^2(x+6)$

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

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

5) $(x+9)(x-3)$
 $x^2 + 6x - 27$

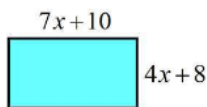
6) $(x+3)(x-3)$

7) $(2x+5)(x+6)$

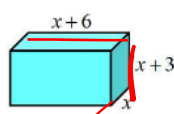
8) $(3x-1)(2x-4)$

9) $(5b-6)(3b^2-2b+5)$
 $15b^3 - 28b^2 + 37b - 30$

10) Find the area of the rectangle below.



11) Find the volume of the following rectangular prism.



$x(x^2 + 9x + 18)$
 $x^3 + 9x^2 + 18x$

Multiplying Polynomials Practice

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

2) $(x + 4)(x - 6)$

3) $(x + 9)(x - 9)$

4) $(3x + 1)(2x - 5)$

5) $(6x - 3)(4x - 1)$

6) $(8x + 7)(2x + 3)$

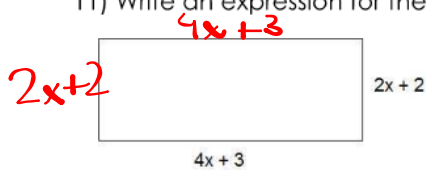
7) $(2x + 5)^2$

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

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

10) $(x - 3)(x^2 + 8x + 1)$

11) Write an expression for the perimeter and area of the following rectangle.



Perimeter:

Area:

© p. 7, 8, 9, evens ☺

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