

## Lesson 5.2 Adding & Subtracting Polynomials

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MCA Lesson  
5.2

# 5 Exponents and Polynomials



## 5.2 Adding and Subtracting Polynomials

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### What You Will Learn

- ▶ Identify the degrees and leading coefficients of polynomials.
- ▶ Add polynomials using a horizontal or vertical format.
- ▶ Subtract polynomials using a horizontal or vertical

format.

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## Basic Definitions 2

A polynomial with only **one** term is called a **monomial**.

A polynomial with **two** unlike terms is called a **binomial**, and a polynomial with **three** unlike terms is called a **trinomial**.

For example,  $3x^2$  is a monomial,  $-3x + 1$  is a binomial, and  $4x^3 - 5x + 6$  is a trinomial.



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## Example 1 – Identifying Polynomials

- The expression  $3x^4 - 8x + x^{-1}$  is **not a polynomial** because the third term,  $x^{-1}$ , has a negative exponent.
- The expression  $x^2 - 3x + 1$  is a polynomial of **degree 2** with integer coefficients. *trinomial*
- The expression  $x^3 + 3x^{1/2}$  is **not a polynomial** because the exponent in the second term,  $3x^{1/2}$ , is not an integer.

the exponent in the second term,  $5x^{-2}$ , is not an integer.

- d. The expression  $-\frac{1}{3}x + \frac{x^3}{4}$  is a polynomial of degree

3 with rational coefficients.  $\frac{x^3}{4} - \frac{1}{3}x$  binomial



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## Example 2 – Determining Degrees and Leading Coefficients

Polynomial	Standard Form	Degree	Leading Coefficient
a. $4x^2 - 5x^7 - 2 + 3x$	$-5x^7 + 4x^2 + 3x - 2$	7	-5
b. $4 - 9x^2$	$-9x^2 + 4$	2	-9
c. $2 + x^3 - 5x^2$	$1x^3 - 5x^2 + 2$	3	1



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## Example 3 – Adding Polynomials Horizontally

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

Original polynomials

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

Original polynomials

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



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## Example 6 – Subtracting Polynomials Horizontally

a.  $(2x^2 + 3) - 1(3x^2 - 4) =$

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

-1 coeff.

Distributive Property

degree 2

Combine like terms.

binomial

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

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

Original polynomials

Distributive Property

deg. 3  
L.C. = 2

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## Example 7 – Subtracting Polynomials Vertically

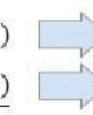
a.  $(3x^2 + 7x - 6)$   
 $-(3x^2 + 7x)$



$-6$

Change signs and add.

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



Change signs and add.



$$5x^2 - 6x^2 + 4x - 2$$

c.  $(4x^4 - 2x^3 + 5x^2 - 1x + 8)$

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

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



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## Example 8 – Combining Polynomials Horizontally

a.  $(x^2 - 2x + 1) - [(x^2 + x - 3) + (-2x^2 - 4x)]$

Original polynomials

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

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

$$2x^2 + x + 4$$



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## Example 8 – Combining Polynomials Horizontally cont'd

b.  $(3x^2 - 7x + 2) - (4x^2 + 6x - 1) + (-x^2 + 4x + 5)$

$$3x^2 - 7x + 2 - 4x^2 - 6x + 1 - x^2 + 4x + 5$$

$$-2x^2 - 9x + 8$$

c.  $(-2x^2 + 4x - 3) - [(4x^2 - 5x + 8) - 2(-x^2 + x + 3)]$

$$\begin{aligned}
 & (x^2 + 4x - 3) - (4x^2 - 5x + 8) - (2x^2 - 2x - 6) \\
 & -2x^2 + 4x - 3 - 4x^2 + 5x - 8 - 2x^2 + 2x + 6 \\
 & -8x^2 + 11x - 5
 \end{aligned}$$



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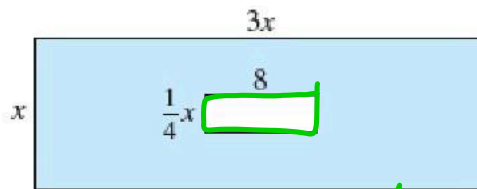
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## Example 9 – Geometry: Area of a Region

Find an expression for the area of the shaded region.

Perimeter

$$3x + 3x + x + x = 8x$$



Area

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

$$8\left(\frac{1}{4}x\right) = 2x$$

$$3x^2 - 2x$$



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