M9

Adding and Subtracting Polynomials

4.3

Adding Polynomials

- There are two methods for adding polynomials: A horizontal method and a vertical method.
- Final answer is always put in **standard form.** *(highest to lowest form)*

Horizontal method

Example: Simplify the given polynomials by adding them. Use the horizontal method.
- Remove the brackets.
- Identify and collect like terms.
- Express in standard form.

a)
$(8x - 2x^2) + (x^2 - 9x + 10)$

$8x - 2x^2 + x^2 - 9x + 10$

$-(2x^2 + 1x^2) + 8x - 9x + 10$

$-1x^2 \quad - \quad 1x \quad +10 \quad = \quad \boxed{-x^2 - x + 10}$

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

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

$(2x^4 - 5x^4) + 5x + 3x - 1x - 7 + 2 + 10$

$\boxed{-3x^4 + 7x + 5}$

1

Vertical method

Example: Simplify the given polynomials by adding them. Use the vertical method.
- Remove the brackets.
- Write the given polynomials underneath each in such a way that like terms are below each other.
- Express in standard form.

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

$$
\begin{aligned}
&6x^3 - x^2 + 4x - 7 \\
&-5x^3 + 3x^2 + 2x \\
&\qquad\quad -4x + 5 \\
\hline
&1x^3 + 2x^2 + 2x - 2
\end{aligned}
$$

$\rightarrow \boxed{x^3 + 2x^2 + 2x - 2}$

Distributing the negative sign

Recall: a negative sign in front of a variable can be written as a negative one. Similarly, we can rewrite an entire polynomial that has a negative sign in front of it as a polynomial that was multiplied by negative one.

Example: Rewrite the given polynomial by distributing the negative sign.

a)

$-(3x^2 - 5x^3 + 2x + 5) = \quad -3x^2 + 5x^3 - 2x - 5$

Standard Form: $5x^3 - 3x^2 - 2x - 5$

b)

$-(-x^2 + 4x^7 - 12x - 3) = \quad x^2 - 4x^7 + 12x + 3$

Standard Form: $-4x^7 + x^2 + 12x + 3$

2

Subtracting Polynomials

- Remove brackets from polynomials that do not have a negative sign in front of them.
- Distribute the negative sign to every term of a polynomial that has a negative sign in front of it. Once you distributed the negative sign you do not need to write the brackets.
- Collect like terms and simplify.
- Express in standard form.

Example: Simplify the given polynomials by subtracting them. Express final answer in standard form.

a)

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

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

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

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

b)

$$-(5x^2 + x - 9) - (x^2 - 2x + 5) =$$

$$-5x^2 - x + 9 - x^2 + 2x - 5$$

$$-5x^2 - x^2 - x + 2x + 9 - 5$$

$$6x^2 + x + 4$$