

Section 5.3: Adding and Subtracting Polynomials

Learning Targets - day 3:

Add and subtract polynomials vertically by:

- lining up like terms
- adding in zero terms for missing terms
- combining like terms vertically
- writing our answers in descending degree, omitting any terms whose coefficients become zero

Adding Polynomials

In the second approach, the polynomials can be added together in a **vertical** fashion, where polynomials are written in such a way that their like terms line up vertically:

$$\begin{array}{r} 6x^2 + 3x - 7 \\ + 8x^2 - 4x + 2 \\ \hline 14x^2 - x - 5 \end{array}$$

Adding Polynomials

If a question presents the polynomials in a **horizontal** fashion, we can change the problem to the **vertical** fashion. We must be careful to make sure the like terms line up.

If both polynomials have the same kinds of terms, lining up the terms is pretty easy and straightforward. But if one polynomial doesn't have the same kinds of terms the other one has, we need to make sure we add in "**zero terms**" to one or both so that we can line up like terms everywhere.

$$\text{Ex: } (2x^2 - 7) + (-6x + 2)$$

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$$\text{Ex: } (2x^2 - 7) + (-6x + 2) \longrightarrow \begin{array}{r} 2x^2 + 0x - 7 \\ + 0x^2 - 6x + 2 \\ \hline 2x^2 - 6x - 5 \end{array}$$

Practice

Re-write vertically, line up like terms, write the answer in descending degree

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

$$\begin{array}{r} + \quad -2x^2 + 5x - 1 \\ \quad \quad 3x^2 - 2x + 6 \\ \hline \quad \quad x^2 + 3x + 5 \end{array}$$

Practice

Re-write vertically, line up like terms, write the answer in descending degree

$$2. (4x - 8) + (5x^2 - 6x - 5)$$

$$\begin{array}{r} + \quad 0x^2 + 4x - 8 \\ \quad 5x^2 - 6x - 5 \\ \hline 5x^2 - 2x - 13 \end{array}$$

Practice

Re-write vertically, line up like terms, write the answer in descending degree

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

$$\begin{array}{r} -2a^2 + a - 3 \\ + \quad a^2 - 2a + 7 \\ \hline -a^2 - a + 4 \end{array}$$

Practice

Re-write vertically, line up like terms, write the answer in descending degree

$$4. (-p + 10p^2 - 3) + (-2p^2 + 3p + 3)$$

$$\begin{array}{r} 10p^2 - p - 3 \\ + \quad -2p^2 + 3p + 3 \\ \hline 8p^2 + 2p + 0 \end{array} \longrightarrow 8p^2 + 2p$$

You Try:

Add the following polynomials vertically. Write your answers in descending degree:

1) $(5 - 11a) + (6a - 4a^2)$

2) $(4x^2 - x + 13) + (-2x^2 + 6x - 1)$

You Try:

Add the following polynomials vertically. Write your answers in descending degree:

$$1) \quad (5 - 11a) + (6a - 4a^2)$$

$$\begin{array}{r} 0a^2 - 11a + 5 \\ + \quad -4a^2 + 6a + 0 \\ \hline -4a^2 - 5a + 5 \end{array}$$

$$2) \quad (4x^2 - x + 13) + (-2x^2 + 6x - 1)$$

$$\begin{array}{r} 4x^2 - x + 13 \\ + \quad -2x^2 + 6x - 1 \\ \hline 2x^2 + 5x + 12 \end{array}$$

Subtracting Polynomials

Polynomials can be subtracted in this **vertical** fashion also. We will still employ the "**adding the opposite**" strategy in order to subtract in this fashion.

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

Subtracting Polynomials

Polynomials can be subtracted in this **vertical** fashion also. We will still employ the "**adding the opposite**" strategy in order to subtract in this fashion.

$$\begin{array}{r} 6x^2 + 2x - 4 \\ - \underline{3x^2 - 4x - 6} \end{array} \quad \rightarrow \quad \begin{array}{r} 6x^2 + 2x - 4 \\ + \underline{-3x^2 + 4x + 6} \end{array} \quad \text{every term is now the opposite}$$
$$3x^2 + 6x + 2$$

Practice

Add the opposite, re-write vertically, line up like terms, write the answer in descending degree

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

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

Practice

Add the opposite, re-write vertically, line up like terms, write the answer in descending degree

$$2. (x^2 - x) - \cancel{(-3x^2 + 2)} \\ + (3x^2 - 2)$$

$$\begin{array}{r} x^2 - x \\ + 3x^2 + 0x - 2 \\ \hline 4x^2 - x - 2 \end{array}$$

Practice

Add the opposite, re-write vertically, line up like terms, write the answer in descending degree

$$3. (5a^2 + 5a - 8) - (2a + 5a^2 - 8)$$

$$+(-2a - 5a^2 + 8)$$

$$+ \begin{array}{r} 5a^2 + 5a - 8 \\ -5a^2 - 2a + 8 \\ \hline \end{array}$$

$$\underline{0a^2} + 3a + \underline{0} \Rightarrow 3a$$

Practice

Add the opposite, re-write vertically, line up like terms, write the answer in descending degree

$$4. (m^2 + 2m) - (3 - 21m)$$

$$+ (-3 + 21m)$$

$$\begin{array}{r} + \quad m^2 + 2m + 0 \\ 0m^2 + 21m - 3 \\ \hline m^2 + 23m - 3 \end{array}$$

You Try:

Subtract the following polynomials vertically. Write your answers in descending degree:

1) $(7 + 18n) - (6n - 3n^2)$

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

You Try:

Subtract the following polynomials vertically. Write your answers in descending degree:

$$\begin{array}{r} 1) \quad (7 + 18n) - (6n - 3n^2) \\ \quad \quad \quad + (-6n + 3n^2) \\ \quad \quad \quad 0n^2 + 18n + 7 \\ + \quad 3n^2 - 6n + 0 \\ \hline \quad 3n^2 + 12n + 7 \end{array}$$

$$\begin{array}{r} 2) \quad (3x^2 - 3x + 10) - (-x^2 + 2x - 8) \\ \quad \quad \quad + (x^2 - 2x + 8) \\ \quad \quad \quad 3x^2 - 3x + 10 \\ + \quad x^2 - 2x + 8 \\ \hline \quad 4x^2 - 5x + 18 \end{array}$$

Check your understanding:

Adding and Subtracting Polynomials

Worksheet - #1 - 20