

Adding and Subtracting Polynomials

by – Howard A Stern

Activity overview

In this activity, students will review basic terminology to describe polynomials, and will learn to add and subtract polynomials.

Concepts

Identification of monomials, classification of polynomials by degree, classification of polynomials by number of terms, addition of polynomials, subtraction of polynomials.

Teacher preparation

This activity is contains a review of the vocabulary of polynomials. Students should have seen these words at least once before.

Classroom management tips

This activity coordinates with Lesson 9-1 of Prentice Hall NY Integrated Algebra text

TI-Nspire Applications

Adding_Subtracting_Polynomials.tns

Step-by-step directions

Students begin with definitions of words related to monomials and polynomials.

A screenshot of a TI-Nspire application window. The title bar shows tabs for 1.1, 1.2, 1.3, and 1.4, with 1.4 selected. The text in the window reads: "A monomial is an expression that is a number, a variable, or the product of a number and one or more variables. Each of the following is a monomial. 12 y -5x²y".

Basic explanation of polynomial addition.

A screenshot of a TI-Nspire application window. The title bar shows tabs for 1.7, 2.1, 2.2, and 3.1, with 3.1 selected. The text in the window reads: "Adding Polynomials We can add polynomials by adding like terms. example: (4x²+6x+7)+(2x²-9x+1) Two methods are shown on the following pages."

Two techniques are shown. First is the vertical method. The vertical method involves lining up like terms vertically, and then adding.

2.1 2.2 3.1 3.2 RAD AUTO REAL

Vertical method -- Line up terms, then add the coefficients.

$$\begin{array}{r} 4x^2+6x+7 \\ +2x^2-9x+1 \\ \hline 6x^2-3x+8 \end{array}$$

Then the horizontal method is shown. This method involves grouping like terms (using the commutative property of addition), and then simplifying.

2.2 3.1 3.2 3.3 RAD AUTO REAL

Horizontal method -- Group like terms, then add coefficients.

$$\begin{aligned} &(4x^2+6x+7)+(2x^2-9x+1) \\ &=(4x^2+2x^2)+(6x-9x)+(7+1) \\ &=6x^2-3x+8 \end{aligned}$$

Followed by practice questions

3.1 3.2 3.3 3.4 RAD AUTO REAL

Simplify the sum:

$$(12m^2+4)+(8m^2+5)$$

Then an explanation of polynomial subtraction. Students are instructed to add the inverse, rather than subtract.

3.5 3.6 3.7 4.1 RAD AUTO REAL

Subtracting Polynomials

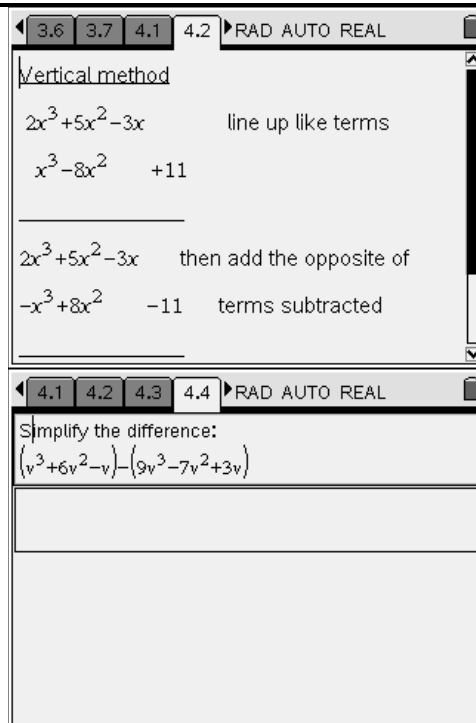
We subtract polynomials also by grouping like terms.

example:

$$(2x^3+5x^2-3x)-(x^3-8x^2+11)$$

Two methods are shown on the following pages.

Two methods are shown again – vertical and horizontal.



Vertical method

$$\begin{array}{r} 2x^3 + 5x^2 - 3x \\ - (x^3 - 8x^2 + 11) \\ \hline 2x^3 + 5x^2 - 3x - x^3 + 8x^2 - 11 \end{array}$$

line up like terms

then add the opposite of terms subtracted

Simplify the difference:
 $(v^3 + 6v^2 - v) - (9v^3 - 7v^2 + 3v)$

Followed by practice exercises.

Assessment and evaluation

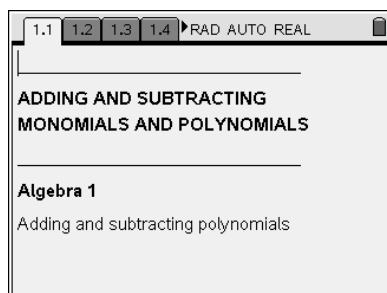
- *This activity could be followed by a worksheet on polynomial addition and subtraction operations.*

Activity extensions

- *Ask students to write in their own words an explanation of the process of subtracting polynomials.*

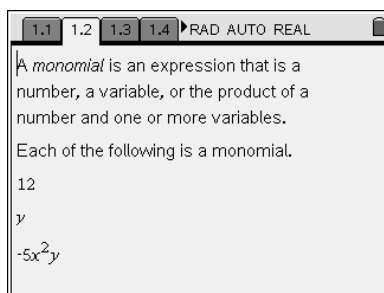
Student TI-Nspire Document

Adding_Subtracting_Polynomials.tns



**ADDING AND SUBTRACTING
MONOMIALS AND POLYNOMIALS**

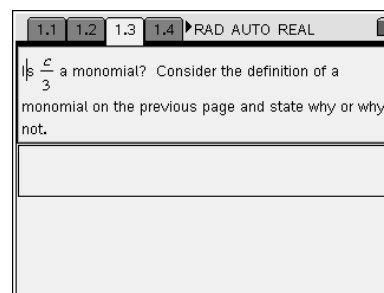
Algebra 1
Adding and subtracting polynomials



A *monomial* is an expression that is a number, a variable, or the product of a number and one or more variables.

Each of the following is a monomial.

12
 y
 $-5x^2y$



Is $\frac{c}{3}$ a monomial? Consider the definition of a monomial on the previous page and state why or why not.

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: right; margin: 0;">1.1 1.2 1.3 1.4 ▸ RAD AUTO REAL</p> <p>The <i>degree of a monomial</i> is the sum of the degrees of its exponents. A nonzero constant is degree 0. Zero has no degree.</p> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: right; margin: 0;">1.4 1.5 1.6 1.7 ▸ RAD AUTO REAL</p> <p>Find the degree of the monomial.</p> <p>Question</p> $\frac{2}{3}x$ <p>Answer ⬆</p> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: right; margin: 0;">1.7 2.1 2.2 3.1 ▸ RAD AUTO REAL</p> <p>Adding Polynomials</p> <p>We can add polynomials by adding like terms.</p> <p>example:</p> $(4x^2 + 6x + 7) + (2x^2 - 9x + 1)$ <p>Two methods are shown on the following pages.</p> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: right; margin: 0;">3.1 3.2 3.3 3.4 ▸ RAD AUTO REAL</p> <p>Simplify the sum:</p> $(12m^2 + 4) + (8m^2 + 5)$ </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: right; margin: 0;">3.4 3.5 3.6 3.7 ▸ RAD AUTO REAL</p> <p>Simplify the sum:</p> $(2p^3 + 6p^2 + 10) + (9p^3 + 11p^2 + 3p)$ </div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: right; margin: 0;">1.2 1.3 1.4 1.5 ▸ RAD AUTO REAL</p> <p>Find the degree of the monomial.</p> <p>Question</p> $\frac{2}{3}x$ <p>Answer ⬆</p> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: right; margin: 0;">1.5 1.6 1.7 2.1 ▸ RAD AUTO REAL</p> <p>A <i>polynomial</i> is a monomial or the sum or difference of two or more monomials. Each monomial that makes up a polynomial is called a <i>term</i>.</p> <p>The <i>degree of a polynomial</i> in one variable is the degree of its highest degree term.</p> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: right; margin: 0;">2.1 2.2 3.1 3.2 ▸ RAD AUTO REAL</p> <p><u>Vertical method</u> -- Line up terms, then add the coefficients.</p> $\begin{array}{r} 4x^2 + 6x + 7 \\ + 2x^2 - 9x + 1 \\ \hline 6x^2 - 3x + 8 \end{array}$ </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: right; margin: 0;">3.2 3.3 3.4 3.5 ▸ RAD AUTO REAL</p> <p>Simplify the sum:</p> $(2 - 6) + (3r^2 + 11)$ </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: right; margin: 0;">3.5 3.6 3.7 4.1 ▸ RAD AUTO REAL</p> <p>Subtracting Polynomials</p> <p>We subtract polynomials also by grouping like terms.</p> <p>example:</p> $(2x^3 + 5x^2 - 3x) - (x^3 - 8x^2 + 11)$ <p>Two methods are shown on the following pages.</p> </div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: right; margin: 0;">1.3 1.4 1.5 1.6 ▸ RAD AUTO REAL</p> <p>Find the degree of the monomial.</p> <p>Question</p> $7x^2y^3$ <p>Answer ⬆</p> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: right; margin: 0;">1.6 1.7 2.1 2.2 ▸ RAD AUTO REAL</p> <p>Question</p> <p><i>Standard form</i> of a polynomial means that it is simplified and the degrees of terms are decreasing from left to right.</p> <p>Place the following polynomial in standard form:</p> <p>Answer ⬆</p> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: right; margin: 0;">2.2 3.1 3.2 3.3 ▸ RAD AUTO REAL</p> <p><u>Horizontal method</u> -- Group like terms, then add coefficients.</p> $\begin{aligned} &(4x^2 + 6x + 7) + (2x^2 - 9x + 1) \\ &= (4x^2 + 2x^2) + (6x - 9x) + (7 + 1) \\ &= 6x^2 - 3x + 8 \end{aligned}$ </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: right; margin: 0;">3.3 3.4 3.5 3.6 ▸ RAD AUTO REAL</p> <p>Simplify the sum:</p> $(9w^3 + 8w^2) + (7w^3 + 4)$ </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: right; margin: 0;">3.6 3.7 4.1 4.2 ▸ RAD AUTO REAL</p> <p><u>Vertical method</u></p> $\begin{array}{r} 2x^3 + 5x^2 - 3x \\ - x^3 - 8x^2 + 11 \\ \hline 2x^3 + 5x^2 - 3x \\ - x^3 + 8x^2 - 11 \end{array}$ <p style="text-align: right; margin: 0;">line up like terms</p> <p style="text-align: right; margin: 0;">then add the opposite of terms subtracted</p> </div>
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3.7 4.1 4.2 4.3 RAD AUTO REAL

Horizontal method

$$(2x^3 + 5x^2 - 3x) - (x^3 - 8x^2 + 11)$$

$$= 2x^3 + 5x^2 - 3x - x^3 + 8x^2 - 11$$

write the opposite of each subtracted term

$$= (2x^3 - x^3) + (5x^2 + 8x^2) - 3x - 11$$

group like terms

$$= x^3 + 13x^2 - 3x - 11$$

simplify

4.3 4.4 4.5 4.6 RAD AUTO REAL

Simplify the difference:

$$(4x^2 + 5x + 1) - (6x^2 + x + 8)$$

4.1 4.2 4.3 4.4 RAD AUTO REAL

Simplify the difference:

$$(v^3 + 6v^2 - v) - (9v^3 - 7v^2 + 3v)$$

4.2 4.3 4.4 4.5 RAD AUTO REAL

Simplify the difference:

$$(30a^3 - 29a^2 - 3a) - (2a^3 + a^2)$$