Activity

3-2 Adding, Subtracting, and Multiplying Polynomials

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EXPLORE & REASON

Let S be the set of expressions that can be written as $ax + b$, where a and b are real numbers.

A. Describe the Associative Property, the Commutative Property, and the Distributive Property. Then, explain the role of each in simplifying the sum $(3x + 2) + (7x - 4)$ and identify the leading coefficient and the constant term in the result.

B. Is the sum you found in part A a member of S? Explain.

C. **Construct Arguments** Is the product of two expressions in S also a member of S? Explain why or produce a counterexample. **MP.3**

HABITS OF MIND

Construct Arguments Is the quotient of two expressions in S also a member of S? Explain why or produce a counterexample. **MP.3**

EXAMPLE 1 **Try It! Add and Subtract Polynomials**

1. Add or subtract the polynomials.

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

   b. $(2a^2b^2 + 3ab^2 - 5a^2b) - (3a^2b^2 - 9a^2b + 7ab^2)$

HABITS OF MIND

Generalize When can you combine two terms using addition or subtraction? MP.8

EXAMPLE 2 **Try It! Multiply Polynomials**

2. Multiply the polynomials.

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

   b. $(mn + 1)(m^2n - 1)(mn^2 + 2)$

EXAMPLE 3 **Try It! Understand Closure**

3. Is the set of monomials closed under multiplication? Explain.

HABITS OF MIND

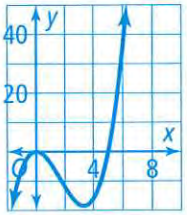
Construct Arguments Is the set of polynomials closed under multiplication? Explain. MP.3

EXAMPLE 4 **Try It! Write a Polynomial Function**

4. The cost of Carolina's materials changes so that her new cost function is $c(x) = 4x + 42$. Find the new profit function. Then find the quantity that maximizes profit and calculate the profit.

EXAMPLE 5 **Try It! Compare Two Polynomial Functions**

5. Compare the profit functions of two additional market sellers modeled by the graph of f and the equation $g(x) = (x + 1)(5 - x)$. Compare and interpret the y-intercepts of these functions and their end behavior.



HABITS OF MIND

Make Sense and Persevere Find the quantity that maximizes profit for $g(x) = (x + 1)(5 - x)$. Calculate the profit. MP.1

Do You UNDERSTAND?

1. **ESSENTIAL QUESTION** How do you add, subtract, and multiply polynomials?

2. **Error Analysis** Chen subtracted two polynomials as shown. Explain Chen's error. MP.3

$p^2 + 7mp + 4 - (-2p^2 - mp + 1)$

$p^2 + 2p^2 + 7mp - mp + 4 + 1$

$3p^2 + 6m + 5$ ✗

3. **Construct Arguments** Why do we often write the results of polynomial calculations in standard form? MP.3

4. **Reason** Is the set of whole numbers closed under subtraction? Explain why you think so, or provide a counterexample. MP.2

Do You KNOW HOW?

Add or subtract the polynomials.

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

6. $(7x^2y^2 - 6x^3 + xy) - (5x^2y^2 - x^3 + xy + x)$

Multiply the polynomials.

7. $(7a + 2)(2a^2 - 5a + 3)$

8. $(xy - 1)(xy + 6)(xy - 8)$

9. The length of a rectangular speaker is three times its width, and the height is four more than the width. Write an expression for the volume V of the rectangular prism in terms of its width, w.