Activity

# 3-4 Dividing Polynomials

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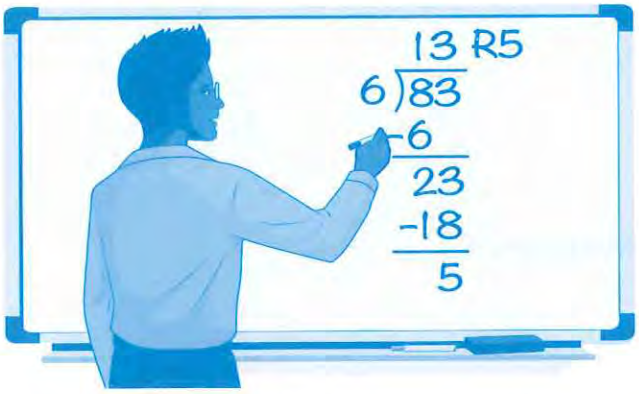
## EXPLORE & REASON

**Benson recalls how to divide whole numbers by solving a problem with 6 as the divisor and 83 as the dividend. He determines that the quotient is 13 with remainder 5.**




A. Explain the process of long division using Benson's example.

B. How can you express the remainder as a fraction?

C. **Use Structure** Use the results of the division problem to write two expressions for 83 that include the divisor, quotient, and remainder. MP.7

**HABITS OF MIND**

**Look for Relationships** If the remainder in a division problem is zero, what can you say about the dividend? MP.7

**EXAMPLE 1** **Try It! Use Long Division to Divide Polynomials**

1. Use long division to divide the polynomials.

   a. $x^3 - 6x^2 + 11x - 6$ divided by $x^2 - 4x + 3$

   b. $16x^4 - 85$ divided by $4x^2 + 9$

**EXAMPLE 2** **Try It! Use Synthetic Division to Divide by $x - a$**

2. Use synthetic division to divide $3x^3 - 5x + 10$ by $x - 1$.

**HABITS OF MIND**

Communicate Precisely Which method would you use to divide a polynomial by $x^2 + 5$? Why? MP.6

**EXAMPLE 3** **Try It! Relate $P(a)$ to the Remainder of $P(x) \div (x - a)$**

3. Use synthetic division to show that the remainder of $f(x) = x^3 + 8x^2 + 12x + 5$ divided by $x + 2$ is equal to $f(-2)$.

Assess

**EXAMPLE 4** **Try It! Use the Remainder Theorem to Evaluate Polynomials**

4. A technology company uses the function $R(x) = -x^3 + 12x^2 + 6x + 80$ to model expected annual revenue, in thousands of dollars, for a new product, where $x$ is the number of years after the product is released. Use the Remainder Theorem to estimate the revenue in year 5.

**EXAMPLE 5** **Try It! Use the Factor Theorem**

5. Use the Remainder and Factor Theorems to determine whether the given binomial is a factor of $P(x)$.

   a. $P(x) = x^3 - 10x^2 + 28x - 16$; binomial: $x - 4$

   b. $P(x) = 2x^4 + 9x^3 - 2x^2 + 6x - 40$; binomial: $x + 5$

**HABITS OF MIND**

**Make Sense and Persevere** Is $x - 2$ a factor of $x^5 + x^4 - 6x^3 + 2x^2 - 11x + 15$? If not, what is the remainder? MP.1

## Do You UNDERSTAND?

1. ESSENTIAL QUESTION How can you divide polynomials?

2. **Error Analysis** Ella said the remainder of $x^3 + 2x^2 - 4x + 6$ divided by $x + 5$ is 149. Is Ella correct? Explain. MP.3

3. **Look for Relationships** You divide a polynomial $P(x)$ by a linear expression $D(x)$. You find a quotient $Q(x)$ and a remainder $R(x)$. How can you check your work? MP.7

## Do You KNOW HOW?

4. Use long division to divide $x^4 - 4x^3 + 12x^2 - 3x + 6$ by $x^2 + 8$.

5. Use synthetic division to divide $x^3 - 8x^2 + 9x - 5$ by $x - 3$.

6. Use the Remainder Theorem to find the remainder of $2x^4 + x^2 - 10x - 1$ divided by $x + 2$.

7. Is $x + 9$ a factor of the polynomial $P(x) = x^3 + 11x^2 + 15x - 27$? If so, write the polynomial as a product of two factors. If not, explain how you know.