

4.3

Dividing Polynomials

For use with Exploration 4.3

Essential Question How can you use the factors of a cubic polynomial to solve a division problem involving the polynomial?

1 EXPLORATION: Dividing Polynomials

Go to *BigIdeasMath.com* for an interactive tool to investigate this exploration.

Work with a partner. Match each division statement with the graph of the related cubic polynomial $f(x)$. Explain your reasoning. Use a graphing calculator to verify your answers.

a. $\frac{f(x)}{x} = (x - 1)(x + 2)$

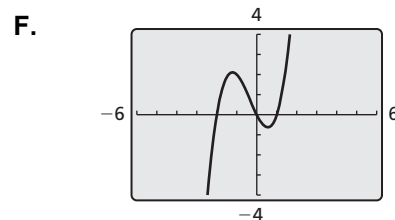
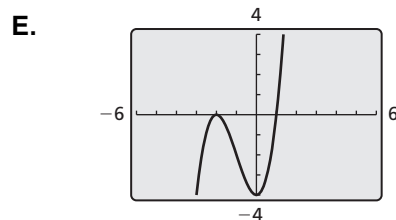
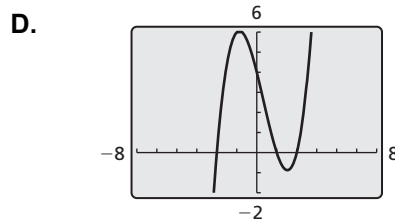
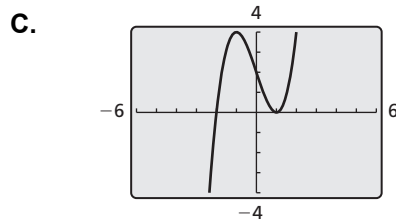
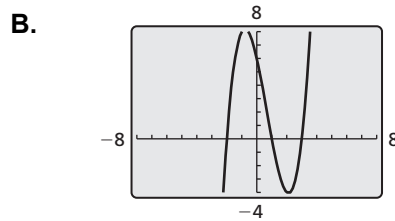
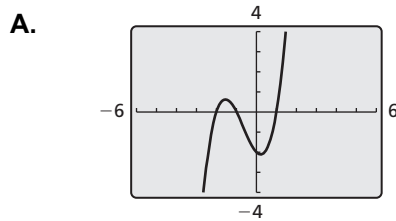
b. $\frac{f(x)}{x - 1} = (x - 1)(x + 2)$

c. $\frac{f(x)}{x + 1} = (x - 1)(x + 2)$

d. $\frac{f(x)}{x - 2} = (x - 1)(x + 2)$

e. $\frac{f(x)}{x + 2} = (x - 1)(x + 2)$

f. $\frac{f(x)}{x - 3} = (x - 1)(x + 2)$



4.3 Dividing Polynomials (continued)**2** **EXPLORATION:** Dividing Polynomials

Work with a partner. Use the results of Exploration 1 to find each quotient. Write your answers in standard form. Check your answers by multiplying.

a. $(x^3 + x^2 - 2x) \div x$

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

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

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

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

f. $(x^3 - 2x^2 - 5x + 6) \div (x - 3)$

Communicate Your Answer

3. How can you use the factors of a cubic polynomial to solve a division problem involving the polynomial?

4.3

Notetaking with Vocabulary

For use after Lesson 4.3

In your own words, write the meaning of each vocabulary term.

polynomial long division

synthetic division

Core Concepts

The Remainder Theorem

If a polynomial $f(x)$ is divided by $x - k$, then the remainder is $r = f(k)$.

Notes:

4.3 Notetaking with Vocabulary (continued)**Extra Practice**

In Exercises 1–4, divide using polynomial long division.

1. $(x^2 + 6x + 12) \div (x - 3)$

2. $(x^3 - 4x^2) \div (x^2 - 16)$

3. $(4x^3 + 13x^2 + 27x + 6) \div (4x + 1)$

4. $(x^4 + 2x^3 + 5x^2 + 3x) \div (x^2 - x)$

In Exercises 5–8, divide using synthetic division.

5. $(x^2 - 10x + 2) \div (x - 2)$

6. $(x^3 + 4x^2 + 6x + 4) \div (x + 2)$

7. $(2x^3 - 54) \div (x + 3)$

8. $(2x^4 - 11x^3 + 11x^2 + 4x + 4) \div (x - 4)$

4.3 Notetaking with Vocabulary (continued)

In Exercises 9–12, match the equivalent expressions. Justify your answers.

9. $(x^2 - x - 8) \div (x - 4)$

A. $x + 3 + \frac{4}{x - 4}$

10. $(x^2 - x + 8) \div (x - 4)$

B. $x + 5 + \frac{12}{x - 4}$

11. $(x^2 + x - 8) \div (x - 4)$

C. $x + 5 + \frac{28}{x - 4}$

12. $(x^2 + x + 8) \div (x - 4)$

D. $x + 3 + \frac{20}{x - 4}$

In Exercises 13–16, use synthetic division to evaluate the function for the indicated value of x .

13. $f(x) = -3x^3 + 4x^2 - 17x - 6; x = 2$

14. $f(x) = -x^4 + x^2 + 4; x = -1$

15. $f(x) = x^3 - 10x^2 + 31x - 30; x = -5$

16. $f(x) = x^3 + 8x + 27; x = 3$

17. What is the value of k such that $(-x^4 + 5x^2 + kx - 8) \div (x - 4)$ has a remainder of 0?