



1.2 Factoring Polynomials

FOCUS Use the remainder theorem and factor theorem to factor polynomials.

Get Started

Factor each polynomial.

$$\begin{array}{lll}
 6x^2 + 7x - 3 & 2x^3 - 3x^2 - 14x & 49x^2 - 36y^4 \\
 \begin{array}{l}
 \text{Pencil icon} \\
 = 6x^2 + 9x - 2x - 3 \\
 = 3x(2x + 3) - (2x + 3) \\
 = (2x + 3)(3x - 1)
 \end{array} & \begin{array}{l}
 = x(2x^2 - 3x - 14) \\
 = x(2x^2 + 4x - 7x - 14) \\
 = x[2x(x + 2) - 7(x + 2)] \\
 = x(x + 2)(2x - 7)
 \end{array} & \begin{array}{l}
 = (7x)^2 - (6y)^2 \\
 = (7x - 6y^2)(7x + 6y^2)
 \end{array}
 \end{array}$$

Construct Understanding

For each polynomial below, divide to determine whether the given binomial is a factor. Each binomial has the form $x - a$. Evaluate each polynomial when $x = a$.

- $3x^2 - 2x - 1$ $x - 1$
- $3x^3 - 8x^2 - x - 2$ $x - 3$
- $2x^4 - x^3 - 17x^2 - 11x + 6$ $x + 2$

How might you tell whether the binomial is a factor without dividing?

Pencil icon Sample response:

Let each polynomial be represented by $P(x)$.

$$\begin{array}{r}
 3x + 1 \\
 x - 1 \overline{) 3x^2 - 2x - 1} \\
 \underline{3x^2 - 3x} \\
 x - 1 \\
 \underline{x - 1} \\
 0
 \end{array}$$

The remainder is 0, so $x - 1$ is a factor.

$$\begin{array}{l}
 P(1) = 3 - 2 - 1 \\
 = 0
 \end{array}$$

$$\begin{array}{r}
 3x^2 + x + 2 \\
 x - 3 \overline{) 3x^3 - 8x^2 - x - 2} \\
 \underline{3x^3 - 9x^2} \\
 x^2 - x \\
 \underline{x^2 - 3x} \\
 2x - 2 \\
 \underline{2x - 6} \\
 4
 \end{array}$$

The remainder is 4, so $x - 3$ is not a factor.

$$\begin{array}{l}
 P(3) = 3(27) - 8(9) - 3 - 2 \\
 = 4
 \end{array}$$

Lesson Organizer

60 – 75 min

Key Math Concepts

The remainder theorem and factor theorem can be used to determine whether a binomial of the form $x - a$ is a factor of a polynomial. These theorems can then be used to express a polynomial as a product of its factors.

Curriculum Focus

SO	AI
RF11	11.4, 11.5

Processes: C, CN, ME

Teacher Materials

- scientific calculator (optional)

Student Materials

- Master 1.1a (optional)
- scientific calculator

Vocabulary

remainder theorem, factor theorem, factor property

TEACHER NOTE

DI: Common Difficulties

If students use synthetic division, they may need to be reminded that the binomial must be in the form $x - a$. This means that $x + 2$ needs to be written as $x - (-2)$ before dividing.