

# 5-4 Reteaching

## Dividing Polynomials

### Problem

What is the quotient and remainder? Use polynomial long division to divide  $2x^2 + 6x - 7$  by  $x + 1$ .

**Step 1** To find the first term of the quotient, divide the highest-degree term of  $2x^2 + 6x + 7$  by the highest-degree term of the divisor,  $x + 1$ . Circle these terms before dividing.

$$\textcircled{x} + 1 \overline{) \textcircled{2x^2} + 6x + 7}$$

**Step 2** Multiply  $x + 1$  by the new term,  $2x$ , in the quotient.  $2x(x + 1) = 2x^2 + 2x$ . Align like terms.

$$\begin{array}{r} 2x \\ x + 1 \overline{) 2x^2 + 6x + 7} \\ \underline{2x^2 + 2x} \phantom{+ 7} \end{array}$$

**Step 3** Subtract to get  $4x$ . Bring down the next term,  $7$ .

$$\begin{array}{r} 2x \\ x + 1 \overline{) 2x^2 + 6x + 7} \\ \underline{2x^2 + 2x} \phantom{+ 7} \\ 4x + 7 \end{array}$$

**Step 4** Divide the highest-degree term of  $4x + 7$  by the highest-degree term of  $x + 1$ . Circle these terms before dividing.

$$\begin{array}{r} 2x + 4 \\ \textcircled{x} + 1 \overline{) 2x^2 + 6x + 7} \\ \underline{2x^2 + 2x} \phantom{+ 7} \\ \textcircled{4x} + 7 \end{array}$$

**Step 5** Repeat Steps 2 and 3. The *remainder* is 3 because its degree is less than the degree of  $x + 1$ .

$$\begin{array}{r} 2x + 4 \\ \textcircled{x} + 1 \overline{) 2x^2 + 6x + 7} \\ \underline{2x^2 + 2x} \phantom{+ 7} \\ \textcircled{4x} + 7 \\ \underline{4x + 4} \\ 3 \end{array}$$

$2x^2 + 6x + 7$  divided by  $x + 1$  is  $2x + 4$ , with a remainder of 3. The quotient is  $2x + 4$  with remainder 3.

Check the answer by multiplying  $(x + 1)$  by  $(2x + 4)$  and adding 3.  
 $(x + 1)(2x + 4) + 3 = 2x^2 + 6x + 7$

### Exercises

Divide using polynomial long division.

1.  $(3x^2 - 8x + 7) \div (x - 1)$

$3x - 5, R 2$

3.  $(x^2 + 3x - 8) \div (x - 5)$

$x + 8, R 32$

5.  $(x^3 - 7x^2 + 11x + 3) \div (x - 3)$

$x^2 - 4x - 1$

7.  $(2x^2 - 4x + 7) \div (x - 3)$

$2x + 2, R 13$

9.  $(x^2 - 5x + 2) \div (x - 1)$

$x - 4, R -2$

2.  $(x^3 + 5x^2 - 3x - 4) \div (x + 6)$

$x^2 - x + 3, R -22$

4.  $(x^2 + 6x + 14) \div (x + 3)$

$x + 3, R 5$

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

$2x^2 + x + 1$

8.  $(x^3 + 2x^2 - 20x + 4) \div (x + 7)$

$x^2 - 5x + 15, R -101$

10.  $(2x^3 + 3x^2 + x + 6) \div (x + 3)$

$2x^2 - 3x + 10, R -24$

# 5-4 Reteaching (continued)

## Dividing Polynomials

### Problem

Use synthetic division to divide  $x^3 + 13x^2 + 46x + 48$  by  $x + 3$ . What is the quotient and remainder?

**Step 1** Set up your polynomial division.

$$(x^3 + 13x^2 + 46x + 48) \div (x + 3)$$

**Step 2** Reverse the sign of the constant, 3, in the divisor.  
Write the coefficients of the dividend: 1 13 46 48.

$$\begin{array}{r|rrrr} -3 & 1 & 13 & 46 & 48 \\ \hline & & & & \end{array}$$

**Step 3** Bring the first coefficient, 1, down to the bottom line.

$$\begin{array}{r|rrrr} -3 & 1 & 13 & 46 & 48 \\ \hline & 1 & & & \end{array}$$

**Step 4** Multiply the coefficient, 1, by the divisor,  $-3$ . Put this product,  $-3$ , underneath the second coefficient, 13, and add those two numbers:  $13 + (-3) = 10$ .

$$\begin{array}{r|rrrr} -3 & 1 & 13 & 46 & 48 \\ & & -3 & & \\ \hline & 1 & 10 & & \end{array}$$

**Step 5** Continue multiplying and adding through the last coefficient. The final sum is the remainder.

$$\begin{array}{r|rrrr} -3 & 1 & 13 & 46 & 48 \\ & & -3 & -30 & -48 \\ \hline & 1 & 10 & 16 & 0 \end{array}$$

The quotient is  $x^2 + 10x + 16$ . Since the remainder is 0,  $x + 3$  is a factor of  $x^3 + 13x^2 + 46x + 48$ .

### Exercises

What is the quotient and remainder of the following polynomials?

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

12.  $(12x^3 - 71x^2 + 57x - 10) \div (x - 5)$   
 $12x^2 - 11x + 2, R 0$

13.  $(3x^4 + x^3 - 6x^2 - 9x + 12) \div (x + 1)$   
 $3x^3 - 2x^2 - 4x - 5, R 17$

14.  $(2x^3 - 15x + 23) \div (x - 2)$   
 $2x^2 + 4x - 7, R 9$

15.  $(x^3 + x + 10) \div (x + 2)$   
 $x^2 - 2x + 5, R 0$

16.  $(x^4 - 12x^3 - 18x^2 + 10) \div (x + 4)$   
 $x^3 - 16x^2 + 46x - 184, R 746$