Name ______________________ Class ____________ Date ____________

5-4 Reteaching Answer Key

Dividing Polynomials

* write remainders as fractions

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.

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

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

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

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

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

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

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

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

$2x^2 + 6x + 7$ 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
2. $(x^3 + 5x^2 - 3x - 4) \div (x + 6)$
   $x^2 - x + 3$, R -22
3. $(x^2 + 3x - 8) \div (x - 5)$
   $x + 8$, R 32
4. $(x^2 + 6x + 14) \div (x + 3)$
   $x + 3$, R 5
5. $(x^3 - 7x^2 + 11x + 3) \div (x - 3)$
   $x^2 - 4x - 1$
6. $(2x^3 - 3x^2 - x - 2) \div (x - 2)$
   $2x^2 + x + 1$
7. $(2x^2 - 4x + 7) \div (x - 3)$
   $2x + 2$, R 13
8. $(x^3 + 2x^2 - 20x + 4) \div (x + 7)$
   $x^2 - 5x + 15$, R -101
9. $(x^2 - 5x + 2) \div (x - 1)$
   $x - 4$, R -2
10. $(2x^3 + 3x^2 + x + 6) \div (x + 3)$
    $2x^2 - 3x + 10$, R -24

Name ______________________ Class ____________ Date ____________

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