Section 5.6: LONG DIVISION OF POLYNOMIALS AND SYNTHETIC DIVISION

When you are done with your homework you should be able to…

- Use long division to divide by a polynomial containing more than one term
- Divide polynomials using synthetic division

WARM-UP:

1. Divide using long division:

$$56\overline{)1234567}$$

2. Simplify:

$$\frac{5x^5 - 8x^3 + x^2}{2x^2}$$

STEPS FOR DIVIDING A POLYNOMIAL BY A BINOMIAL

1. _____ the terms of _____ the _____ and the _____ in _____ powers of the variable.
2. _____ the _____ term in the _____ by the _____ term in the _____. The result is the _____ term of the _____.
3. _____ every term in the _____ by the _____ term in the _____. Write the resulting _____ beneath the _____ with _____ terms lined up.
4. _____ the _____ from the _____.
5. _____ down the next term in the _____ dividend and write it next to the _____ to form a new _____.
6. Use this new expression as the _____ and repeat the process until the _____ can no longer be _____. This will occur when the _____ of the _____ is _____ than the _____ of the _____.

Example 1: Divide.

a. $\dfrac{x^2+7x+10}{x+5}$

b. $\dfrac{2y^2-13y+21}{y-3}$

c. $\dfrac{x^3+2x^2-3}{x-2}$

d. $\left(8y^3+y^4+16+32y+24y^2\right)\div\left(y+2\right)$

DIVIDING POLYNOMIALS USING SYNTHETIC DIVISION

We can use _____ division to divide _____ if the _____ is of the form _____. This method provides a _____ more quickly than _____ division.

STEPS FOR SYNTHETIC DIVISION

1. Arrange the _____ in _____ powers, with a _____ coefficient for any _____ term.
2. Write _____ for the _____, _____. To the _____, write the _____ of the _____.
3. Write the _____ _____ of the _____ on the _____ row.
4. _____ _____ times the _____ just written on the _____ row. Write the _____ in the next _____ in the _____ row.
5. _____ the values in this new column, writing the _____ in the _____ row.
6. Repeat this series of _____ and _____ until all _____ are filled in.

7. Use the numbers in the last row to write the _____ plus the _____ _____ the _____. The _____ of the _____ term of the quotient will be _____ less than the _____ of the first term of the _____. The final value in this row is the _____.

Example 2: Divide using synthetic division.

a. $\left(x^2+x-2\right)\div\left(x-1\right)$

b. $\left(x^2-6x-6x^3+x^4\right)\div\left(6+x\right)$

c. $\dfrac{x^7-128}{x-2}$

d. $\left(y^5-2y^4-y^3+3y^2-y+1\right)\div\left(y-2\right)$

APPLICATION

You just signed a contract for a new job. The salary for the first year is $30,000 and there is to be a percent increase in your salary each year. The algebraic expression

$$\frac{30000x^n - 30000}{x - 1}$$

describes your total salary over n years, where x is the sum of 1 and the yearly percent increase, expressed as a decimal.

a. Use the given expression and write a quotient of polynomials that describes your total salary over four years.

b. Simplify the expression in part (a) by performing the division.

c. Suppose you are to receive an increase of 8% per year. Thus, x is the sum of 1 and 0.08, or 1.08. Substitute 1.08 for x in the expression in part (a) as well as the simplified expression in part (b). Evaluate each expression. What is your total salary over the four-year period?