January 19, 2016

Lesson 54. Warm Up (Clickers)

1. Factor: $x^3 + 125$

2. Solve for x: $-3x^2 + 4x - 9 = 2$

Lesson 5.4 Dividing Polynomials

Essential Understanding: You can divide polynomials using steps that are similar to the long-division steps that you use to divide whole numbers.

Numerical long division and polynomial long division are similar.

Numerical Long Division		Polynomial Long Division	
$\begin{array}{r} 32 \\ 21\overline{)672} \\ \underline{63} \\ 42 \\ \underline{42} \\ 0 \end{array}$	21 divides into 67 3 times 21 divides into 42 2 times	$\begin{array}{r} 3x + 2 \\ 2x + 1\overline{)6x^2 + 7x + 2} \\ \underline{6x^2 + 3x} \\ 4x + 2 \\ \underline{4x + 2} \\ 0 \end{array}$	$(2x + 1)$ divides into $(6x^2 + 7x)$ $3x$ times $(2x + 1)$ divides into $(4x + 2)$ 2 times

The remainder from each division above is 0, so 21 is a factor of 672 and $2x + 1$ is a factor of $6x^2 + 7x + 2$.

Ex. Use polynomial long division to divide $4x^2 + 23x - 16$ by $x + 5$. What is the quotient and remainder?

Ex. Use polynomial long division to divide $3x^2 - 29x + 56$ by $x - 7$. What is the quotient and remainder?

Ex. Use polynomial long division to divide $5x^2 + 2x + 3$ by $x + 1$. What are the quotient and remainder?

1 Use polynomial long division to divide the following polynomial by $x + 5$.

$$x^2 - 3x - 40$$

2 Divide the following polynomial by $x - 4$:

$$x^3 - 13x - 12$$

Key Concept The Division Algorithm for Polynomials

You can divide polynomial $P(x)$ by polynomial $D(x)$ to get polynomial quotient $Q(x)$ and polynomial remainder $R(x)$. The result is $P(x) = D(x)Q(x) + R(x)$.

$$\begin{array}{r} Q(x) \\ D(x)\overline{)P(x)} \\ \vdots \\ \overline{R(x)} \end{array}$$

If $R(x) = 0$, then $P(x) = D(x)Q(x)$ and $D(x)$ and $Q(x)$ are factors of $P(x)$.

To use long division, $P(x)$ and $D(x)$ should be in standard form with zero coefficients where appropriate. The process stops when the degree of the remainder, $R(x)$, is less than the degree of the divisor, $D(x)$.

Ex. Is $x^2 + 1$ a factor of $3x^4 - 4x^3 + 12x^2 + 5$? If it is, write P(x) as a product of two factors.

Ex. Is $x - 2$ a factor of $P(x) = x^5 - 32$? If it is, write P(x) as a product of two factors.

Ex. Is $x^4 - 1$ a factor of $P(x) = x^5 + 5x^4 - x - 5$? If it is, write P(x) as a product of two factors.

Ex. The polynomial $x^3 + 7x^2 - 38x - 240$ expresses the volume in cubic inches, of the shadow box shown. What are the dimensions of the box?