Algebra 2

Lesson 6-3: Dividing Polynomials

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Dividing two numbers we use a process known as long division.

$1512 \div 4$	$1649 \div 7$

We can also polynomials:

$x^2 + 3x - 18 \; by \; x - 3$	1. look at the first term in each polynomial. Here, ask, *x goes into x^2 how many times?* 2. As with long division, multiply quotient by the divisor. and simplify; drop the next term from the dividend 3. Repeat the process of bringing down the next term followed by dividing, multiplying, and subtracting
$x^2 + 2x - 30 \div x - 5$	$x^3 + 7x^2 - 4 \div x + 2$

When there is a remainder, the proper form for the factor is:

(dividend) = (divisor)(quotient) + remainder

How does this dividing help us?

1. Given a factor, we can simplify by dividing to find the factor pair.
2. We can verify if a polynomial is a factor of another polynomial. If the remainder is zero then our divisor is a factor!

Remainder Theorem

If we have a polynomial $P(x)$ and it is divided by $x - a$, then:

$$P(a) = number = remainder$$

A second type of division we can use which is quicker than long division is known as **synthetic division**. This technique works only when we have a **linear binomial in the form of** $\boldsymbol{x - a}$, $\boldsymbol{that\ is\ x - \boxed{a}}$

$x^3 - 7x^2 + 15x - 9 \div x - 3$	$x^3 + 4x^2 + x - 6 \div x + 1$

Is $(x + 2)$ a factor of:

$2x^2 + 7x + 6$	$x^3 - 5x - 10$

The volume in cubic feet of a workshop's storage chest can be expressed as the product of its three dimensions by the given function: $V(t) = x^3 + 7x^2 + 10x$. The depth of the chest is given by the function $(x + 2)$. Find the linear expressions for the other two dimensions.

Find $P(4)\ for\ P(x) = x^4 - 5x^2 + 4x + 12$ use synthetic division:

Now solve for $P(-4)$

Find $P(-1)\ for\ P(x) = 2x^4 + 6x^3 - 5x^2 + 60$