

3.2 Long Division and Synthetic Division  
Honors Algebra 2 with Trig

$\begin{array}{r} \text{Quotient} \\ \text{Divisor} \overline{) \text{Dividend}} \end{array} + \frac{\text{remainder}}{\text{divisor}}$	$\text{Dividend} = (\text{Quotient})(\text{Divisor}) + \text{Remainder}$
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**Warm-ups with Long Division (no calculator!)**

<p>1. <math>2445 \div 3</math></p>	<p>2. <math>976 \cdot 5^{-1}</math></p>	<p>3. <math>\frac{2089}{4}</math></p>
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**Use the same procedure with polynomials!**

<p>4. <math>(4x^3 - 9x^2 - 10x - 2) \div (x - 3)</math></p>	
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<p><b>Remainder Theorem:</b> If a polynomial <math>f(x)</math> is divided by <math>(x - k)</math> then the remainder is <math>R = f(k)</math>.</p>	<p><b>Factor Theorem:</b> A polynomial <math>f(x)</math> has a factor <math>(x - k)</math> if and only if <math>f(k) = 0</math>.</p>
<p>Verify the Remainder Theorem for #4:</p>	<p>Is <math>(x-3)</math> a factor of the polynomial in #4?</p>

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5.  $(-x^4 + 5x^3 - 10x - 4) \cdot (x + 1)^{-1}$

Is the divisor a factor?

Evaluate the polynomial for  $x = -1$

6.  $\frac{(4x^3 - 7x^2 - 11x + 5)}{(4x + 5)}$

Is the divisor a factor?

Evaluate the polynomial for  
 $x = -\frac{5}{4}$

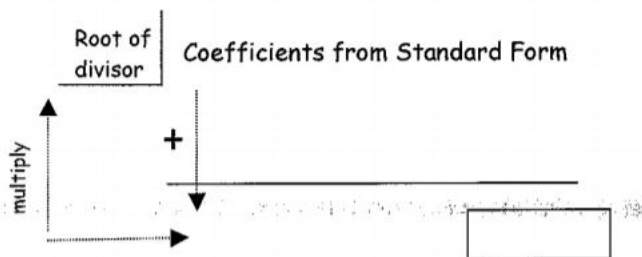
7.  $(5x^4 + 2x^3 - 9x + 12) \div (x^2 - 3x + 4)$

Is the divisor a factor?

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**Synthetic Division:** used to divide a polynomial by a binomial divisor in the form  $(x - c)$  in which  $c$  is a constant and the coefficient of  $x$  is 1.

\* You will need a place-holder of the coefficient "zero" for each missing term!



<p>1. <math>(x^3 - 6x^2 + 2x - 4) \div (x - 2)</math></p> <p>Is the divisor a factor?</p>	<p>2. <math>(2x^3 + x^2 - 8x + 16) \cdot (x + 4)^{-1}</math></p> <p>Is the divisor a factor?</p>
<p>3. <math>\frac{4x^4 - 2x^2 + x + 1}{(x - 1)}</math></p> <p>Is the divisor a factor?</p>	<p>4. <math>(x^3 - 64) \div (x - 4)</math></p> <p>Is the divisor a factor?</p>

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What if the coefficient of  $x$  is not 1?

5.  $(6x^2 - 5x + 9) \div (2x - 1)$

Find the value of  $k$  so that the remainder for each of the following is 3.

6.  $(x^2 - x + k) \div (x - 1)$

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

8.  $(x^2 + 5x + 7) \div (x + k)$