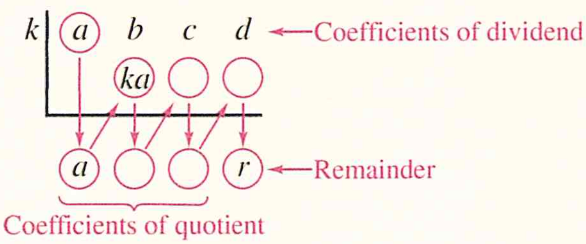
Name: Key Hour: _____ Date: _______________

HONORS – Synthetic Polynomial Division Notes

Last week we used Long Division to find the quotient between two polynomials. Another method that we can use is called *Synthetic Division*.

Synthetic Division (for a Cubic Polynomial)

To divide $ax^3 + bx^2 + cx + d$ by $x - k$, use the following pattern.



Vertical pattern: Add terms in columns.
Diagonal pattern: Multiply results by k.

Examples:

1) $(x^4 - 10x^2 - 2x + 4) \div (x + 3)$

opposite

there was no x^3 term in the polynomial

-3	1	0	-10	-2	4
		-3	9	3	-3
	1	-3	-1	1	1

remainder

$$\boxed{\text{Quotient: } x^3 - 3x^2 - x + 1 + \frac{1}{x+3}}$$

answer is 1 degree lower than the original polynomial!

2) $\frac{-250 - x^2 + 75x}{x + 10}$

put in order

$$\frac{-x^2 + 75x - 250}{x + 10}$$

-10	-1	75	-250
		10	-850
	-1	85	-1100

$$\boxed{-x + 85 - \frac{1100}{x+10}}$$

Use synthetic division to determine if the linear binomial is a factor of the polynomial. Explain how you've made your decision.

1) $(15 - 17x^2 + 3x^3 - 25) \div (x - 5)$

$3x^3 - 17x^2 + 15x - 25$

$$\begin{array}{r|rrrr} 5 & 3 & -17 & 15 & -25 \\ & & 15 & -10 & 25 \\ \hline & 3 & -2 & 5 & 0 \end{array}$$

Quotient: $3x^2 - 2x + 5$

$x-5$ is a factor because there is not a remainder!

2) $4x^3 - 9x + 8x^2 - 18) \div (x + 2)$

$$\begin{array}{r|rrrr} -2 & 4 & 8 & -9 & -18 \\ & & -8 & 0 & 18 \\ \hline & 4 & 0 & -9 & 0 \end{array}$$

Quotient: $4x^2 - 9$

$x + 2$ is a factor because there is not a remainder.

3) $(5x^3 + 6x + 8) \div (x - 6)$

$$\begin{array}{r|rrrr} 6 & 5 & 0 & 6 & 8 \\ & & 30 & 180 & 1116 \\ \hline & 5 & 30 & 186 & 1124 \end{array}$$

Quotient: $5x^2 + 30x + 186 + \frac{1124}{x-6}$

$x-6$ is not a factor because there is a remainder.