Math 1050 ~ College Algebra
8 Using Synthetic Division to Factor Polynomials

When solving for the zeros of a function, it helps if we can break the function down into factors. Synthetic division will be useful to us.

Factor Theorem	**Remainder Theorem**
A polynomial $f(x)$ has a factor $(x-k)$ if and only if $f(k)=0$.	If a polynomial $f(x)$ is divided by $(x-k)$, then the remainder $r=f(k)$.

Long division is ALWAYS useful for division of polynomials.

Synthetic division is only useful when dividing by $(x-k)$ where $k \in \Re$.

EX 1

Use long division to divide $(4x^3+10x^2-2x-5)$ by $(2x^2-1)$.

EX 2

Divide (x^3+4x^2-3x+2) by $(\ x-3\ )$ in two ways.

Long division

Synthetic division

EX 3

Use synthetic division to compute this quotient.

$$(5x^3 + 6x + 8) \div (x + 2)$$

Write the result in the form $f(x) = (x - k)(q(x)) + \mathrm{r}(x)$

EX 4

Use the remainder theorem and synthetic division to show that (x + 3) is a factor of this function.

$$\mathrm{f}(x) = 3x^3 + 5x^2 - 3x + 27$$

EX 5

Use division to show that $2/3$ is a solution of $48x^3 - 80x^2 + 41x - 6 = 0$. Use the result to factor the polynomial completely and find all solutions.