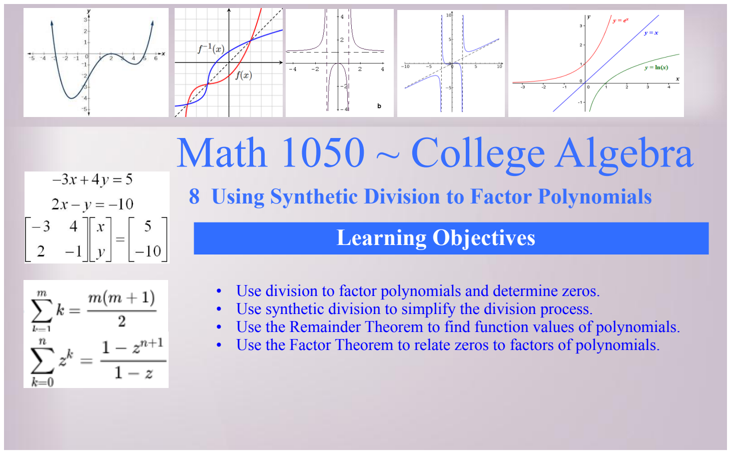

When solving for the zeros of a function, it helps if we can break the function down into factors. Synthetic division will be useful to us.

Factor Theorem

A polynomial $f(x)$ has a factor $(x-k)$ if and only if $f(k) = 0$.

Remainder Theorem

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 $k \in \mathfrak{R}$.

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 $f(x) = (x-k)(q(x)) + r(x)$

Ex 4: Use the remainder theorem and synthetic division to show that (x+3) is a factor of this function.

$f(x) = 3x^3 + 5x^2 - 3x + 27$

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.