MAT 155P – PreCalculus Mathematics Plus Common Formulas
(Updated 8/8/17)

Quadratic Functions

The quadratic function, $f(x) = ax^2 + bx + c$ has vertex $\left(\frac{-b}{2a}, f\left(\frac{-b}{2a}\right)\right)$

The quadratic function, $f(x) = a(x-h)^2 + k$ has vertex (h, k)

The Remainder Theorem

If the polynomial $f(x)$ is divided by $x - c$, then the remainder is $f(c)$.

The Factor Theorem

Let $f(x)$ be a polynomial. If $f(c) = 0$ then $x - c$ is a factor of $f(x)$.
If $x - c$ is a factor of $f(x)$ then $f(c) = 0$.

Asymptotes of Rational Functions

Finding the Horizontal Asymptotes

Consider the rational function,

$$f(x) = \frac{a_n x^n + a_{n-1}x^{n-1} + \dots + a_2 x^2 + a_1 x + a_0}{b_m x^m + b_{m-1}x^{m-1} + \dots + b_2 x^2 + b_1 x + b_0}, \quad a_n \neq 0, \quad b_m \neq 0$$

1. If $n < m$, the line $y = 0$ is the horizontal asymptote of the graph of f.
2. If $n = m$, the line $y = \frac{a_n}{b_m}$ is the horizontal asymptote of the graph of f.
3. If $n > m$, the graph of f has no horizontal asymptote.

Finding Oblique (Slant) Asymptotes

Let $N(x)$ and $D(x)$ be polynomials and consider the rational function $f(x) = \frac{N(x)}{Q(x)}$.

If the degree of $N(x)$ is *one more than* the degree of $D(x)$, then graph of $f(x)$ has an oblique (slant) asymptote. To find the equation for the oblique (slant) asymptote first perform long division to obtain

$$f(x) = \frac{N(x)}{D(x)} = mx + b + \frac{remainder}{D(x)}$$

The oblique (slant) asymptote has equation $y = mx + b$.