Notes for Test 3

(3.5 - 3.6, 4.1 – 4.7)

You may NOT use these notes for the test, but they should help you study.

- **Functions (3.5)**
  - Know how to find the domain of a function (type in interval notation)
    - Denominator of a fraction cannot equal 0 (≠0)
    - Square roots must be positive (≥0)
    - If there is a square root in the denominator, the square root must be positive and cannot be 0 (>0)
  - Know how to Add/Subtract/Multiply/Divide two functions and find the domain
  - Know how to find composite functions and their domain - $f\circ g,\ g\circ f,\ f\circ f,\ g\circ g$

- **Inverses (3.6)**
  - Be able to determine if a function is one-to-one
  - Be able to find the inverse of a function (switch x and y and re-solve for y)
  - Be able to graph a function and its inverse (symmetrical to $y = x$)
  - Be able to find the domain and range of a function and its inverse
    - Domain of $f(x)$ $x \neq$
    - Range of $f(x)$ $y \neq$
    - Domain of $f^{-1}(x)$ $x \neq$
    - Range of $f^{-1}(x)$ $y \neq$

- **Quadratic Functions (4.1 and 4.2)**
  - Know the forms of quadratic function
    - General Form: $f(x) = ax^2 + bx + c$
    - Standard Form: $f(x) = a(x-h)^2 + k$ where (h,k) is the vertex
    - Be able to go from standard to general (Don't forget to FOIL!!)
  - Find the vertex $\left(\frac{-b}{2a}, f\left(\frac{-b}{2a}\right)\right)$ and graph
  - Determine if a graph opens up/down, vertex, axis of symmetry, intercepts, graph, domain, and range (similar to 1.4.SbS-21)
  - Know how to find maximum and minimum values given the function

- **Polynomial Functions (4.3)**
  - Find x and y intercepts
  - Find the real zeros of a factored polynomial
  - Determine a zero's multiplicity
  - Determine if the graph will touch or cross at a particular zero
    - Even multiplicity: Touch
    - Odd multiplicity: Cross
  - Determine the end behavior of a graph
    - $f(x) = x^{even}$ both ends of graph opens up
    - $f(x) = -x^{even}$ both ends of graph opens down
    - $f(x) = x^{odd}$ left end of graph is down and right end is up
    - $f(x) = -x^{odd}$ left end of graph is up and right end is down

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- **Synthetic Division (4.4)**
  - Be able to synthetically divide with $(x - c)$
  - Write in form $f(x) = (x - c) * q(x) + r$
  - Use synthetic division with complex numbers
  - Identify remaining zeros (real and complex)
  - Write in factored form
  - Identify graph based upon zeros and multiplicities

- **Zeros of Polynomial Functions (4.5)**
  - Find potential zeros $\pm \frac{factors\ of\ p(constant\ at\ end)}{factors\ of\ q\ (leading\ coefficient)}$
  - Be able to use the Intermediate Value Theorem
  - Form a polynomial given the zeros
  - Find all zeros (real and complex)

- **Rational Functions and Graphs (4.6)**
  - Be able to find the domain and the x- and y- intercepts
  - Find asymptotes (ALWAYS factor and simplify before solving for asymptotes!!)
    - <u>Vertical Asymptote:</u> Set denominator equal to 0 and solve for x.
    - <u>Horizontal Asymptote:</u>
      1. If the degree of the denominator **is greater than** the degree of the numerator, the HA is $y = 0$
      2. If the degree of the denominator **is equal to** the degree of the numerator, the HA is $$y = \frac{coefficient\ of\ the\ numerator}{coefficient\ of\ the\ denominator}$$
    - <u>Slant Asymptote:</u> If the degree of the denominator **is exactly one less than** the degree of numerator, then divide the polynomials and ignore the remainder. The line should be expressed in $y = mx + b$.
    - There will be no Horizontal or Slant Asymptotes if the degree of the denominator is more than one less than the degree of the numerator.
  - Removable Discontinuities
    - Find the domain of $f(x)$
    - Factor and simplify $f(x)$ completely
    - Plug the x-values excluded in the domain into the simplified version of the $f(x)$, this will result in a y-value
    - Write removable discontinuities as an ordered pair (x, y)
    - This point will be represented by a hole on the graph
  - Be able to complete the nine-step graphing strategy (similar to 4.6SbS-43)

- **Variation (4.7)**
  - Direct: $y = kx$ (multiply)
  - Inverse: $y = \frac{k}{x}$ (divide)
  - Joint: $y = kxz$ (multiply)