College Algebra
Test 2 outline

QUADRATIC FUNCTIONS** (3.1, 3.2, 3.3, 3.4)

- Solve a quadratic equation by
  - taking square roots
  - factoring
  - completing the square
  - using the quadratic formula

- The square of every real number is either zero or positive, so a negative number cannot have a real-number square root. Square roots of negative numbers are called imaginary numbers. Complex numbers include both real numbers and imaginary numbers.

- By looking at the discriminant \( B^2 - 4AC \)
  - you can tell how many real-valued solutions the equation \( Ax^2 + Bx + C = 0 \) has.
  - If \( B^2 - 4AC \) is negative, the equation has 0 real-valued solutions ("roots").
  - If \( B^2 - 4AC \) is zero, the equation has only 1 real-valued solutions ("repeated root").
  - If \( B^2 - 4AC \) is positive, the equation has 2 (different) real-valued solutions ("distinct roots").

- Know that the graph of a quadratic function is a parabola.

- The values of \( x \) where the graph of \( y = 3x^2 + 12x + 7 \) crosses the \( x \)-axis are the solutions to \( 3x^2 + 12x + 7 = 0 \)

- Analyze a quadratic function to find its
  - \( y \)-intercept [by substituting 0 for \( x \)]
  - \( x \)-intercept(s) [by solving \( f(x) = 0 \) (because \( y \) is zero)]
  - vertex [by completing the square, or use \(-B/(2A)\) for \( x \) and put into \( f(x) \) to find \( y \)]
  - long-term behavior [by looking at the sign of the \( x^2 \) coefficient]
  - leading coefficient [by looking to see how high/low points 1 unit left/right of vertex are]

- Solve quadratic inequalities graphically (p. 214, Example 1; p. 218, #1-10) and by making a sign chart/table (p. 217, Example 4).

- Use quadratic functions, equations, and/or inequalities to solve applied problems, including projectile motion and revenue problems. (p. 185, #85, 87, 89; p. 202-203, #101, 115)

Here's a math "secret":
A complicated equation can be solved by breaking it into several simpler equations. This works only if one side is ZERO, and the other side can be factored. One side must be zero, because of a special property that is ONLY true for zero: If the product of several numbers is zero, at least one of those numbers must be zero.
GRAPHS AND TRANSFORMATIONS** (mainly in 3.5)

- Given a point in the $x$-$y$ plane, write the $x$- and $y$-coordinates. Given $(x, y)$, plot a point.
- Find each of the following for a given function:
  - $x$-intercept(s) [point(s) of the form $(a, 0)$]
  - $y$-intercept [point of the form $(0, b)$]
- Describe what each of the following does to the graph of $f(x)$:
  - $af(x)$ [vertical scaling by a factor of $a$, shrinking if $|a| < 1$ (if $a$ is "small")]
  - $f(x/c)$ [horizontal scaling by a factor of $c$, shrinking if $|c| < 1$ (if $c$ is "small")]
  - $f(x)+d$ [shift up/down by $d$, down if $d$ is negative]
  - $f(x-b)$ [shift left/right by $b$, right if $b$ is positive]
- Given a basic graph and a formula involving one or more of these transformations, draw the graph of the function. [Example: given $p(x)$, graph $-\frac{1}{4}p(-x+5) + 3$.]

FUNCTION CONCEPT** (3.1, 5.1)

- Given a description (formula, table, graph, or verbal) of a function and a specific input value, use it to evaluate a function.
- Understand that a composition of functions is a function that applies one function after another. The order in which the functions are applied is explained like this:
  - "$fog$" means "do $g$ first, then $f$". Read "$(fog)(x)$" or "$f(g(x))$" as "$f$ of $g$ of $x$".
- Given symbolic, numerical, graphical, or verbal descriptions for functions $f$ and $g$, give a corresponding description for each of these: $fof$, $gof$, $fog$, $gog$...

EXPONENTIAL FUNCTIONS (5.3)

- Given a numerical or graphical description of a function, tell if the function could be linear, exponential, or neither. (p. 401, Example 1; p. 413, #19-24)

Here's another math "secret":
An exponential function multiplies the output by the same ratio whenever the input increases by 1.
"Whenever you wait 1 more year, the value of the car becomes 0.6 times its old value."