Chapter 3 Semester Final Test Guide

More Quadratics! (3.1 - 3.4)

- Chapter 3 was mainly about "solving" quadratics … i.e. finding the roots/zeros.
- Remember factors give you the roots, and roots give you the factors!
- We use the Zero Product Property with factors to help us find the roots: $if\ a \cdot b = 0\ then\ a = 0\ or\ b = 0$
- We learned a bunch of ways to solve quadratics, each with their own strength and weakness:

Quadratic Form	Description
Graphing (3.1c)	• Only works if you can easily see the roots on the graph • Easier if you can use your calculator • But … you ***CANNOT*** use your graphing calc on the final!
Square root (3.1c)	• Use if in $f(x) = x^2$ form. • Good example of when to use is $(x-2)^2 = 16$ • Take the square root of both sides and simplify • Remember when you take the square root you have $\pm$
Factoring (3.1a, 3.1b, 3.1d)	• Factor fish, Big X, or just see it in your head • Break the quadratic into its two factors • Example: $x^2 + 5x + 4 = (x+4)(x+1)$ • Use the Zero Product Property with the factors to solve (i.e. find the roots)
Completing the Square (3.3a, 3.3b)	• Adjust the equation so you have a perfect square trinomial • Perfect square trinomial: $x^2 + 4x + 4 = (x+2)^2$ • Take half the middle term (b) and add it squared • Example to complete the square on: $x^2 + 6x + 1 = (x^2 + 6x + 9) + 1 - 9$ • In the example we complete the square by adding 9 (6/2 squared) and then also subtract it to keep everything the same • So the final example completed square answer is $(x^2 + 6x + 9) - 8$ $= (x+3)^2 - 8$ • ***VERY*** helpful because it allows you to convert a quadratic in standard form into vertex form.
Quadratic formula (3.4a)	• Can solve ***ANY*** quadratic • $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ • Can have 0, 1 or 2 real number solutions • Can have complex number solutions

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Complex Numbers (mainly 3.2)

- As soon as we introduced the quadratic formula, we encountered quadratics that had the square root of a negative number in its solution. Make sure you review square roots (3.1c):
    - When you take the square root you have the positive and negative ($\pm$) answer.
    - Always reduce to simplest form: $\sqrt{18} = \sqrt{9 \cdot 2} = \sqrt{9}\sqrt{2} = 3\sqrt{2}$
- Make sure you review complex numbers (3.2a, 3.2b, 3.2c):
    - $i = \sqrt{-1}, i^2 = -1, i^3 = -i, i^4 = 1, i^5 = \sqrt{-1}, i^6 = -1, \ldots$
    - Complex number is in the form $a + \sqrt{b}$.
    - Always reduce to simplest form: $\sqrt{-18} = \sqrt{-1 \cdot 9 \cdot 2} = \sqrt{-1}\sqrt{9}\sqrt{2} = 3i\sqrt{2}$.
    - Review how to add, subtract and multiply complex numbers.

Quadratic Inequalities (3.6):

- Be able to look at a quadratic inequality and identify the graph that goes with it.
- First use your normal graphing skills to determine position and orientation:
    - Leading coefficient tells if it opens up or down.
    - Find the x- and y-intercepts as needed.
    - Find the vertex as needed.
- Second, determine if the line will be solid or shaded:
    - Solid if includes equals ($\leq or \ \geq$)
    - Dashed if does not include equals ($< or >$).
- Third, determine where to shade, inside or outside the parabola:
    - Depends on two things:
        - If the parabola opens up or down
        - If the inequality is < or >
    - If all else fails, pick an easy point like (0, 0) and test it. Plug it in and if you end up with a true statement, shade on the side of the parabola that (0, 0) lies. If you end up with a false statement, shade on the other side of the parabola from (0, 0).
    - You can also "logic" it out. If the parabola opens in the same "direction" as the inequality symbol, shade inside. Think of it this way, > points up while < points down.
        - If the parabola opens up and we have >, shade inside (they agree).
        - If the parabola opens up and we have <, shade outside.
        - If the parabola opens down and we have >, shade outside.
        - If the parabola opens down and we have <, shade inside (they agree).