MAT 121 Online, FINAL TEST, Spring, 2013
200 Points (10 pts) Name___________________________

This is our final learning opportunity together, and I'm hoping to take full advantage. Read the questions carefully. It's possible to earn points on a problem by *knowing* that you did something wrong and clearly *explaining how* you know and what you're *trying* to accomplish, and how you're going about it. More points for solid terminology and English.

1. Solve the equation $x^2 - 3x + 2 = 0$ in two different ways:

part a (10 pts) Factoring

part b (10 pts) Completing the square

2. Solve the absolute value inequality. Give your answer in set-builder *and* interval notation.

part a (10 pts) $|3x - 2| \geq 5$

part b (10 pts) $|3x - 2| < 5$

#2 cnt'd (These last two are *supposed* to be *easy* ! Conceptual.

part c (5 pts) $|7x + 2| \geq -4$

part d (5 pts) $|2x - 7| < -4$

3. Find the domain of each of the following:

part a (10 pts) $f(x) = \dfrac{x^2 - 9}{x^2 + 5x - 14}$

part b (10 pts) $f(x) = \sqrt{x^2 + 5x - 14}$

part c (10 pts) $\log_3(x^2 + 5x - 14)$

4. (10 pts) Let $f(x) = x^2 - 2x$. Simplify the difference quotient $\frac{f(x+h) - f(x)}{h}$.

5. (15 pts) Form a polynomial (in factored form) that will have *real* coefficients after expanding (which you shouldn't bother to do!) that has the following zeros with the respective multiplicities:

$x = 3$, multiplicity = 2
$x = -5$, multiplicity = 1
$x = 3 - 7i$, multiplicity = 1

(5 pts) What's the minimum possible degree for the polynomial described?

6. Let $f(x) = x^4 - 5x^3 + 3x^2 + 19x - 30$.

Hopefully, your remainder is zero. It's how you get it and how you interpret it that matter to me.

part a (10 pts) Use synthetic division to determine if $x - 3$ is a factor of f.

Interpret the your work by filling in the quotient and remainder in the statement $x^4 - 5x^3 + 3x^2 + 19x - 30 = (x-3) \cdot \textit{quotient} + \textit{remainder}$.

part b (10 pts) Show that $x = -2$ is a root of f by dividing your *quotient* in **part a** by $x - 2$. This question, in itself ought to give you a very clear idea of what your conclusion ought to have been in part a.

part c (15 pts) Compute the discriminant of $x^2 - 4x + 5$. Then find the two nonreal roots of $x^2 - 4x + 5$, by any method (short of copying from someone else).

Bonus (10 pts) Write f as the product of linear factors. Hint: If your work from #6 is up-to-snuff, then the hard part is already done, and I've given you *just* enough touchstones to help you know when you're right, or have a good reason why you aren't. You can still earn the **Bonus** without #6 by *making up* plausible answers and incorporating them into the answer to this question. It should have 2 real and 2 nonreal zeros represented by the factors.

7. (10 pts) Determine a, r and n for the finite geometric series $5+\frac{5}{2}+\frac{5}{4}+\ \dots\ +\frac{5}{128}$

Use a, r, and n to determine the sum by the formula $\sum_{k=1}^{n} a\cdot r^{k-1}=a\left(\frac{1-r^{n}}{1-r}\right)$. A fractional answer is better, but I'll give you most of the points if you provide a decimal answer that is accurate to 4 decimal places.

8. (10 pts) Use Pascal's Triangle (Binomial Theorem) to expand the binomial power $(x-3)^5$. Expanding without using a recognizable version of this technique will earn at most 2 points.

9. (10 pts) Graph $g(x) = -(x-2)^2 + 16$ using the techniques of shifting and reflecting. Start with the graph of the basic function $f(x) = x^2$ and show all stages. In the final graph, indicate (label as ordered pairs) the *x*- and *y*- intercepts.

10. (15 pts) Solve the system of linear equations $\begin{matrix} 2x+3y=7 \\ 3x-4y=-10 \end{matrix}$