MAT 121 Online, FINAL TEST, Spring, 2014
200 Points 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 $x^2 + 6x - 16 = 0$ 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) $|3x - 2| < 5$

3. Find the domain of each of the following:

part a (10 pts) $f(x)=\sqrt{\dfrac{(x-3)^4(x-5)^7}{(x-1)^3}}$

part b (10 pts) $\ln\left(x^2-5x-24\right)$

4. (20 pts) Let $f(x) = x^2 + 5x$. Simplify the difference quotient $\dfrac{f(x+h) - f(x)}{h}$.

5. (10 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:

$x = 4$, multiplicity = 3
$x = -5$, multiplicity = 2
$x = 4 - 5i$, multiplicity = 1

6. (10 pts) What's the minimum possible degree for the polynomial described?

7. How many ways to…

part a (5 pts) … choose 4 trumpet players for the jazz band, if there are 20 players trying out?

part b (5 pts) … choose 4 trumpet players for the jazz band, if there are 20 players trying out and you will then arrange them into 1st, 2nd, 3rd and 4th chair?

8. Let $f(x) = 4x^4 - 63x^2 + 159x - 130$.

part a (20 pts) Use synthetic division to determine if $x + 5$ is a factor of f.

Interpret the your work by filling in the quotient and remainder in the statement
$4x^4 - 163x^2 + 159x - 130 = (x + 5) \cdot \textit{quotient} + \textit{remainder}$.

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

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 (5 pts) Based on your work, factor $f(x)$ over the real number field. This involves an irreducible quadratic factor.

part d (10 pts) Compute the discriminant of $4x^2 - 12x + 13$. Then find the two nonreal roots of $4x^2 - 12x + 13$, by any method (other than copying from someone else).

part e (5 pts) Based on your work, split $f(x)$ into the product of linear factors.

9. (10 pts) Graph $g(x) = -3(x-2)^2 - 12$ using the techniques of shifting, stretching and reflecting. Label the vertex and all intercepts.

10. (10 pts) Evaluate the sum $\sum_{k=1}^{\infty} 7 \cdot \left(\frac{3}{5}\right)^{k-1}$

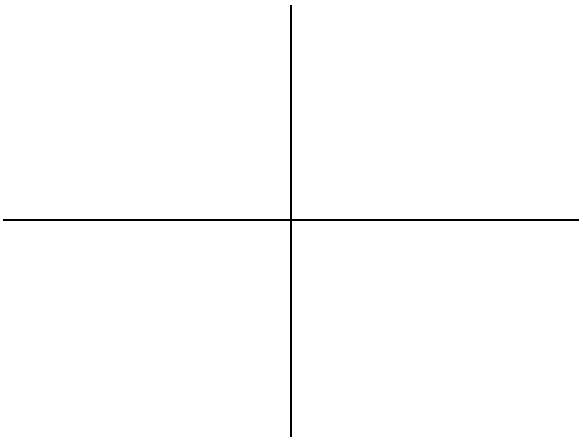
11. The population of a town in 2008 is 15,000 people. The population of that town grows to 16,500 in 2012. The population is a function of time in the exponential model $P(t)=P_oe^{kt}$ where t=0 nrepresents the year 2008.

part a (2 pts) Define the variables given this information and identify the two ordered pairs to use as points.

part b Graphing

i. (2 pts) Label the axes appropriately for the context of the problem.

ii. (2 pts) Graph (plot) the 2 points.



part c i. (2 pts) Find the rate of growth. Show your work. Round to 4 decimal places.

ii. (2 pts) Find the equation of the exponential function which models the situation.

part d (2 pts) Graph the equation of the curve on the same graph as the two points in **part b**.

part e (2 pts) Use the equation to find the estimated population in 2015. Show your work.

part f (2 pts) Use your equation to calculate in what year the population will reach 20000 if the growth continues at this same rate. Show your work.

part g (2 pts) What would be the effect to the population if the rate had the opposite sign? Use complete sentences in your explanation.

part h (2 pts) List two real-life factors which may affect the population such that this model would not prove valid. Use complete sentences.