MAT 121-G81 Final Fall, 2011
200 Points

Name_____

Use the blank paper provided to show your answers and all your work. Do *not* write on these cover pages, other than to sign your name in the space provided. Please make sure your work is in the correct order before stapling it all together. Problems submitted in the wrong order will not receive credit. I would start a fresh page for each numbered problem, and not be afraid to use more than one page, if I needed it.

It is much better to draw a line through your mistakes than it is to do a lot of erasing. I will often award some points for good work that's been neatly crossed-out, even if you changed your mind. This does *not* apply to graphs, where crossouts and scribble-outs are not accepted. Use a pencil and make your graphs as clear and as clean as possible. I'd rather see you cross out your first attempt and re-do a graph than submit something that's not easy to read. If I have to squint, it's hard to give you points.

1. Find the solution set for each of the absolute value equations and inequalities.

   a. (10 pts) $|2x - 5| = 3$

   b. (10 pts) $|2x - 5| > 3$

   c. (10 pts) $|2x - 5| < 3$

2. (10 pts) Find the interval solution of the inequality $2x - 5 \leq 3x + 2$.

3. Find the solution set for the quadratic equation $x^2 + 4x - 12 = 0$ in 3 ways:

   a. (10 pts) Factoring

   b. (10 pts) Completing the square

   c. (10 pts) Quadratic formula

4. Lines, linear equations and their graphs...

   a. (5 pts) Find an equation of the line through (-4, -3) and (-1, 5). Sketch its graph, using its slope and *y*-intercept.

   b. (5 pts) Find an equation of the line through (- 4, 10) that is parallel to the line in part a.

   c. (5 pts) Find an equation of the line through (- 4, 10) that is perpendicular to the line in part a.

   d. (5 pts) Sketch the graph of the line in part a. For full credit, you must include the *x*- and *y*-intercept of the line in your graph, and you must use ordered pairs to label them.

5. Sketch the graph of $g(x) = -2 \cdot 3^{x-1} + 7$ by transforming the **basic function** $f(x) = 3^x$. Use 4 sketches, counting the graph of $f(x)$. Here's the points breakdown:

   a. **(10 pts)** ***The first graph***: $f(x) = 3^x$, showing the 3 points $\left(-1, \frac{1}{3}\right)$, $(0,1)$, and $(1,3)$, and all the characteristic exponential function features.

   b. **(2 pts)** ***Show horizontal asymptote*** in every sketch.

   c. **(8 pts)** ***Track the locations to which your original 3 points are moved*** (Stretched or shifted). For instance, your 2nd sketch should be of $f(x-1) = 3^{x-1}$, and original point $(0,1)$ from the 1st sketch should show up one unit to the right, at $(1,1)$.

   d. **(4 pts)** ***Use (at least) 4 sketches***, counting the **basic function** as the 1st. It will take at least 4 sketches to show each transformation clearly, but even then, you'll be combining a reflection *and* a stretch in one move. If you want to do the reflection and the stretch in separate moves, you will need a total of 5 sketches. Full credit if you do it correctly in 5 steps.

   e. **(16 pts)** ***Show the x-intercept.*** This will constitute the exponential equation-solving portion of this test.

6. (10 pts) Solve $\frac{(x-2)(x+3)^2}{(x+1)^3} \geq 0$.

7. (10 pts) What is the domain of $\log_5\left(\frac{(x-2)(x+3)^2}{(x+1)^3}\right)$? Hint: You just did most of the work.

8. Compute the sums. Hint: $S = \frac{a\left(1-r^n\right)}{1-r}$

   a. (5 pts) $\sum_{k=1}^{7} 2\left(\frac{3}{2}\right)^{k-1}$

   b. (5 pts) $\sum_{k=1}^{\infty} 5\left(\frac{2}{3}\right)^{k-1}$

9. (10 pts) Use the Binomial Theorem (Pascal's Triangle) to expand $(x-2y)^4$. Best you can earn by brute force is half-credit.

10. (10 pts) Use synthetic division to find $f(2)$ for $f(x) = x^4 - 3x^3 - 10x^2 + 4x - 10$.

11. (10 pts) Expand the product: $(x-1+2i)(x-1-2i)$

12. (10 pts) Write a polynomial (in factored form) with *real* coefficients, of degree 6, that has the given zeros with the given multiplicities:

zero	multiplicity
2	1
-3	3
$2 + 3i$	1

13. (10 pts) **Bonus** Let P = present value (principal), R = Periodic payment, i = interest rate per period, n = total number of periods.

The accumulated amount A of P dollars, kept in a savings account for n periods is

$$A = P(1 + i)^n .$$

The future value FV of n payments of R dollars is given by the annuity formula

$$FV = R\left[\frac{(1 + i)^n - 1}{i}\right]$$

If you want to borrow P = \$10,000 from a banker, on a 3-year loan at 11% interest, what will the monthly payment R need to be in order to pay off the loan? Hint: This question involves the banker getting the same future value out of your stream of payments as she would get by just putting \$10,000 in a savings account.