Leave a margin at the top left corner (Write MAT 121 in big letters). Write DARK. 10% off for insufficient margin that puts work underneath the staple. Put all scratch work WITH the problem as you work it. Often there are partial credit points that you will NOT earn by writing your scratch on a separate page and stapling it to the back. To me, that's trash. That's why I give as much paper as needed or wanted!

1. (20 pts) Starting with $f(x) = 2^x$, sketch the graph of $g(x) = -5 \cdot 2^{5x+15} + 6$ in 5 steps (counting $f(x) = 2^x$ as the first step). Use $x = -1, x = 0$, and $x = 1$ to find 3 points in the first graph, and show how these 3 points are moved around by each step in the transformation to $g(x)$.

2. (10 pts) Find the *exact* x- and y-intercepts for $g(x)$ from #1. That means no decimal approximations.

   a. x-intercept: $A =$

   b. y-intercept: $B =$

Label your final graph for #1 with the intercepts labeled with A and B.

3. (5 pts) Find the inverse, $g^{-1}(x)$, for $g(x)$ in #1. The moves are very similar to what you did in #2a.

4. Let $f(x) = \sqrt{x+16}$ and $g(x) = x^2 - 5x - 66$.

   a. (5 pts) What is the domain of f ?

   b. (5 pts) What is the domain of g ?

   c. (5 pts) Determine $\left(\dfrac{f}{g}\right)(x)$. (Sometimes this is just called $\dfrac{f}{g}$ in the text.)

   d. (5 pts) What is the domain of $\left(\dfrac{f}{g}\right)(x)$?

   e. (5 pts) Determine $(f \circ g)(x)$ (Again, sometimes just called $f \circ g$).

   f. (5 pts) What is the domain of $f \circ g$?

5. (5 pts) What is the domain of $\sqrt{\dfrac{(x+5)^2(x+3)}{(x-4)^3(x-3)^4}}$?

6. (5 pts) What is the domain of $\log_{11}\left(\dfrac{(x+5)^2(x+3)}{(x-4)^3(x-3)^4}\right)$?

7. (10 pts) Solve $\ln(x-2)+\ln(x+5)=\ln(8)$. Give an exact solution, then round to 3 decimal places.

8. Suppose the half-life of C-14 is 4800 years. (It isn't, quite, but just suppose…).

   a. (10 pts) Derive the exponential decay model, $A(t)=A_0 e^{kt}$. The trick is to use the half-life to find the relative decay rate, k.

   b. (5 pts) How old is a sample of charcoal from a prehistoric fire pit, if 90% of the C-14 has decayed (i.e., 10% is left.) ? Round to the nearest year in your final answer. If it makes it easier for you, use an initial mass of 100 g of radioactive C-14 and a final mass of 10 g of the radioactive material. It's the same thing.

Bonus Answer up to three (3) 5-pointers. That's a total of 15 bonus points possible. Points to be had. Standards are high.

B 1 (10 pts) Solve the absolute value inequality: $|-5x+8|-11>-2$. Yes, that's 10 points. Exception to the 5-point rule, if you can nail it, you can earn up to 20 bonus points.

B 2 (5 pts) Re-write $f(x)=7x^2-5x-57$ in the form $a(x-h)^2+k$.

B 3 (5 pts) Solve the exponential equation $4\cdot 5^x=6\cdot 7^x$. Give an exact answer and a decimal answer, rounded to 4 decimal places. Then rounded to 7 decimal places.

B 4 (5 pts) Sketch the graph of $R(x)=\dfrac{(x+5)^2(x+3)}{(x-4)^3(x-3)^4}$.

B 5 (5 pts) Sketch the graph of $Q(x)=\sqrt{\dfrac{(x+5)^2(x+3)}{(x-4)^3(x-3)^4}}$

B 6 (5 pts) The population of Kokanee salmon at Dworshak reservoir was 1,000 Kokanee, when they first introduced the species on this date 1992. It's quite a coincidence that you'd be taking your test on the anniversary Since then, the population has grown exponentially, with a relative growth rate of 2% every year. What is the Kokanee population in Dworshak Reservoir, today? Round your answer to the nearest fish.

B 7 (5 pts) To the nearest year, when will (did) the population of Kokanee in the previous question reach 10,000?

B 8 (5 pts) Sketch the graph of $g(x)=-5\cdot \log_3(3x+9)+11$