

1. (20 pts) Starting with $f(x) = \log_5(x)$, sketch the graph of $g(x) = 6 \cdot \log_5(7x + 21) + 3$ in 5 steps (counting $f(x) = \log_5(x)$ as the first step). Use $x = \frac{1}{5}, x = 1$, and $x = 5$ 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 $f(x) = \sqrt{x+10}$ and $g(x) = x^2 + 3x - 28$.
 - a. (5 pts) What is the domain of f ?
 - b. (5 pts) What is the domain of g ?
 - c. (5 pts) Determine $\left(\frac{f}{g}\right)(x)$. (Sometimes this is just called $\frac{f}{g}$ in the text.)
 - d. (5 pts) What is the domain of $\left(\frac{f}{g}\right)(x)$?
 - 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. The next two domain questions are very closely related.
 - a. (5 pts) What is the domain of $\sqrt{\frac{(x-4)^2(x+3)^3}{(x-9)^2(x+2)^3}}$?
 - b. (5 pts) What is the domain of $\log_{11}\left(\frac{(x-4)^2(x+3)^3}{(x-9)^2(x+2)^3}\right)$?

6. (10 pts) Solve $\ln(x-7) + \ln(x+3) = \ln(11)$. Give the exact solution(s).
7. Suppose the half-life of C-14 is 4000 years. (It isn't, quite, but just suppose...).
- (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 .
 - (5 pts) How old is a sample of charcoal from a prehistoric fire pit, if 47% of the C-14 has decayed (i.e., 53% 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 53 g of the radioactive material. It's the same thing.

Bonus Answer up to four (4) 5-pointers. That's a total of 20 bonus points possible. Points to be had. Standards are high.

B 1 (10 pts) Solve the absolute value inequality: $|-8x+3|-8 \leq -5$. Yes, that's 10 points. Counts for 2 Bonus.

B 2 (5 pts) Re-write $f(x) = 5x^2 - 4x - 11$ in the form $a(x-h)^2 + k$.

B 3 (5 pts) Solve the exponential equation $5 \cdot 4^x = 6 \cdot \pi^x$. Give the exact answer in terms of natural logarithms.

B 4 (5 pts) Sketch the graph of $R(x) = \frac{(x-4)^2(x+3)^3}{(x-9)^2(x+2)^3}$.

B 5 (5 pts) Sketch the graph of $Q(x) = \sqrt{\frac{(x-4)^2(x+3)^3}{(x-9)^2(x+2)^3}}$

B 6 (5 pts) The population of Kokanee salmon at Dworshak reservoir was 300 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 1,000?

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

B 9 (5 pts) Parents of newborn baby Jimmy want to make sure he can go to college, and they estimate it will cost \$100,000. They plan to set aside money every month and have a mutual fund that they believe will earn 5% interest, compounded monthly, over the long haul. How much should they set aside in order for little Jimmy to have \$100,000 in cold hard cash in his education fund on his 18th birthday? Assume they make their first payment a month after Jimmy's born.