

1. (20 pts) Starting with $f(x) = \log_3(x)$, sketch the graph of $g(x) = -2 \cdot \log_3(-5x + 20) + 7$ in 5 steps (counting $f(x) = \log_3(x)$ as the first step). Use $x = \frac{1}{3}, x = 1$, and $x = 3$ 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. Report intercepts as ordered pairs.
 - 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 $f(x) = \sqrt{x-36}$ and $g(x) = x^2 + 3x - 18$.
 - 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 $h(x) = \sqrt{\frac{(x-44)^5(x+1)^{32}}{(x-11)^3(x+17)^{34}}} = \sqrt{\text{Stuff}}$?
 - b. (5 pts) What is the domain of $k(x) = \log_3\left(\frac{(x-44)^5(x+1)^{32}}{(x-11)^3(x+17)^{34}}\right) = \log_3(\text{Stuff})$?

6. (10 pts) Solve $\log_6(x+6) + \log_6(x-3) = 2$. Give the exact solution(s).
7. Suppose the half-life of C-14 is 10,000 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 83% of the C-14 has decayed (i.e., 17% 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 17 g of the radioactive material. But I'd prefer you do it, symbolically.

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

B 1 (10 pts) Solve the absolute value inequality: $|4 - 8x| + 2 \leq 10$. Yes, that's 10 points. Counts for 2 Bonus.

B 2 (5 pts) Re-write $f(x) = 6x^2 - 5x - 12$ in the form $a(x-h)^2 + k$.

B 3 (5 pts) Solve the exponential equation $2 \cdot \pi^{x-3} = 3 \cdot \left(\frac{3}{2}\right)^x$. Give the exact answer in terms of natural logarithms.

B 4 (5 pts) Sketch the graph of $R(x) = \frac{(x-44)^5 (x+1)^{32}}{(x-11)^3 (x+17)^{34}}$.

B 5 (5 pts) Sketch the graph of $Q(x) = \sqrt{\frac{(x-44)^5 (x+1)^{32}}{(x-11)^3 (x+17)^{34}}}$.

B 6 (5 pts) The population of Kokanee salmon at Dworshak reservoir was 200 Kokanee, when they first introduced the species on this this very day you're taking your test, back in 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 5% 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 100,000?

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.