

1. (20 pts) Starting with  $f(x) = \log_2(x)$ , sketch the graph of  $g(x) = -7 \cdot \log_2(-5x + 20) + 3$  in 5 steps (counting  $f(x) = \log_2(x)$  as the first step). Use  $x = \frac{1}{2}$ ,  $x = 1$ , and  $x = 2$  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  $f(x) = \sqrt{x-11}$  and  $g(x) = x^2 - 4x - 21$ .
  - 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  $\sqrt{\frac{(x-7)^2(x+4)^3}{(x-4)^2(x+2)^3}}$  ?
  - b. (5 pts) What is the domain of  $\log_{11}\left(\frac{(x-7)^2(x+4)^3}{(x-4)^2(x+2)^3}\right)$ ?

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 4550 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:  $|-3x-7|-8 \leq -5$ . Yes, that's 10 points. Counts for 2 Bonus.

**B 2** (5 pts) Re-write  $f(x) = 4x^2 - 3x - 11$  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  $R(x) = \frac{(x-7)^2(x+4)^3}{(x-4)^2(x+2)^3}$ .

**B 5** (5 pts) Sketch the graph of  $Q(x) = \sqrt{\frac{(x-7)^2(x+4)^3}{(x-4)^2(x+2)^3}}$ .

**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  $g(x) = -5 \cdot 3^{3x+9} + 11$ .

**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 18<sup>th</sup> birthday? Assume they make their first payment a month after Jimmy's born.