

Date, Time:

Do your own work on separate paper. Leave plenty of margin and plenty of room around your work. I'm not impressed if you squeeze more work into a smaller space. To the contrary. At the end, please make sure your problems are in order. I'm too old and ornery to want to go on a scavenger hunt to award you points.

1. (20 pts) Starting with $f(x) = 6^x$, sketch the graph of $g(x) = -2 \cdot 6^{-x-4} + 5$ in 5 steps (counting $f(x) = 6^x$ 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 $g(x)$. Finding the x - and y -intercepts is #2, so don't worry about them, until #2. Label each sketch as some variation on $f(x)$, for instance, $7 \cdot 2^{x-11} - 4$ would be $7f(x-11) - 4$.
2. (10 pts) Let $g(x) = -2 \cdot 6^{-x-4} + 5$. Find the x - and y -intercepts for this function, rounded to 4 decimal places. For 5 bonus points, label these intercepts on your final graph for #1.
3. Let $f(x) = \sqrt{x+2}$ and $g(x) = \frac{x-3}{x+12}$.
 - a. (5 pts) What is the domain of f ?
 - b. (5 pts) What is the domain of g ?
 - c. (5 pts) Write the function $\frac{f}{g}$. Do not simplify.
 - d. (5 pts) What is the domain of $\frac{f}{g}$?
 - e. (5 pts) Write the function $f \circ g$. Do not simplify.
 - f. (5 pts) What is the domain of $f \circ g$?
4. Find the domain:
 - a. (5 pts) $\sqrt{(x+3)^2(5-x)(x-8)^3(x-12)}$. To speed up your sign pattern, it should be helpful to know that $(x+3)^2(5-x)(x-8)^3(x-12) = -x^7 + 35x^6 - 423x^5 + 1625x^4 + 5132x^3 - 43680x^2 + 2304x + 276480$.
 - b. (5 pts) $\log_3\left(\left((x+3)^2(5-x)(x-8)^3(x-12)\right)\right)$ (Reinterpret previous sign pattern in the current context!)
5. Consider the equation $\log_3(x-3) + \log_3(x+3) = 3$.
 - a. (5 pts) What is the domain of this equation?
 - b. (5 pts) Solve the equation.
6. (10 pts) Solve $\pi^{x-3} = e^{x+1}$. Give an exact answer *and* a decimal answer, rounded to 4 decimal places.

7. (10 pts) The wolf population in Idaho is doubling every 3 years. If the population is currently 300 wolves, find, to the nearest year, when the population will reach 10,000 individuals.

Solve any two (2) Bonus problems for up to 10 points. I'll grade the first two I come to.

1. BONUS (5 pts) Solve the equation $3\pi^{x-3} = 5e^{x+2}$. Give an exact answer and a decimal answer, rounded to 4 places.



2. BONUS (5 pts) Solve the absolute value inequality $|7 - 3x| \geq 8$. Use a number line and either union or intersection ('and' or 'or') to find the solution.

3. BONUS (5 pts) The absolute value inequality $|7 - 3x| \geq -8$ is always true, since absolute value can never be negative. But show the steps and manage your and's and or's, with a number line graph at the end to interpret what the algebra is telling you.

4. BONUS (5 pts) Give a rough sketch of the function

$$f(x) = (x + 3)^2(5 - x)(x - 8)^3(x - 12) = -x^7 + 35x^6 - 423x^5 + 1625x^4 + 5132x^3 - 43680x^2 + 2304x + 276480$$