Full name(s): ________________________ .

Questions

1. Find the (largest possible) domain and range of the following functions. Use set notation.
   a. $f(x) = \sqrt{x+5}$
   b. $f(x) = \frac{1}{x-\sqrt{x}}$
   c. $f(x) = \frac{1}{x^2+2x+1}$
   d. $f(x) = \sqrt{x^2 - x + 2}$
   e. $f(x) = (x + \frac{1}{x-2})^{1/3}$
   f. $f(x) = \frac{x-2}{2x-4}$
   g. $f(x) = \ln(1-x)$
   h. $f(x) = e^{\ln(|x|)}$
2. If $f(x) = 2x^2 - 1$ and $g(x) = x^2 + 2$ find both $g(f(x))$ and $f(g(x))$.
3. **Challenge.** Find the domain and range of the function $f(x) = g(g(g(g(x))))$ where $g(x) = \sqrt{x} - 2$
4. Find the line perpendicular to the line $y = 2x$ and passing through the point $(1, 5)$ and graph both.
5. At what point do the lines $l_1(x) = 2x + 5$ and $l_2(x) = -2x - 1$ intersect?
6. Find the line through $(1, 1)$ and $(3, \pi)$.
7. Find the line with y-intercept -1 and x-intercept 1 and graph it.
8. Find the line with y-intercept 4 and slope -1 and graph it.
9. Graph the line $y - 2 = 2(x - 3)$
10. Find the secant line of $f(x) = x - x^2$ from 1/2 to 3/4.
11. **Challenge.** Find the three lines containing the sides of the equilateral triangle with its bottom left corner at the origin and its bottom right corner at $(2, 0)$.
12. Simplify the following expressions as much as possible.
    a. $(2^2 3^{-3})^{-1}$
    b. $((a^{(b^c)})^{(b^{2c})})^c$
    c. $\frac{a^{-17}b^0c^5}{a^5b^{-2}c^{18}}$
13. Graph the function $p(t) = 100(.5)^t$. Label at least 4 points.
14. Graph the function $p(t) = 10(2)^t$. Label at least 4 points.
15. Suppose the supply of whiteboard chalk is at 5000 boxes for the math department and is decreasing 12% per month. What will the supply be after 9 months? Sketch a graph of the decline.
16. Suppose the population of an invasive fish is doubling every 18 years. What is the ratio of the current population (in 2022) to the population in 1955?
17. Suppose an investment has a yearly rate of return of 3% per year, and compounds every two weeks. If the initial investment is \$100, how much will the asset be worth in ten years?
18. **Challenge.** Suppose that the sequence of numbers $(1 + \frac{1}{m})^m$ converges (gets closer and closer to) to some number, call it e. Show that as we compound more and more frequently, our investment grows like

$$I(t) = I_0 e^{rt} \quad (1)$$