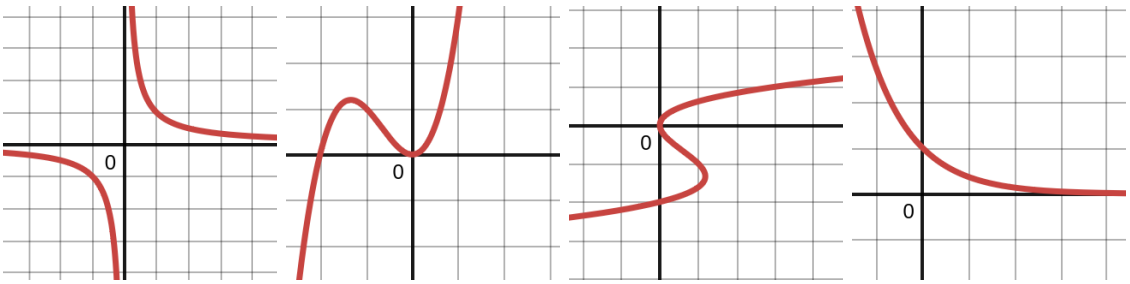
Math 140: Week-in-Review 11 (Chapters 5.7, 5.8, Review over 5.1-5.6)

1. Which of the following graphs represent functions? Which functions are one-to-one?



2. Write the following expression as a single logarithm: $\frac{2}{3}(4\log_b(x) + \log_b(3x+1) - 5\log_b(2))$

3. Use properties of logarithms to fully expand the following:

$$\ln\left(\left(\sqrt[5]{\frac{4e\cdot x^2}{y^3\cdot z^{-4}}}\right)^8\right)$$

4. If $\log_b(3) = 0.428$ and $\log_b(5) = 0.627$ are approximations to 3 decimal places, find an approximation of $\log_b\left(\frac{27b}{125}\right)$.

5. Write each logarithmic expression in its equivalent exponential form.

   (a) $\log_{121}(11) = \dfrac{1}{2}$

   (b) $\log_{1/6}(36) = -2$

   (c) $x = \log_y(x + y)$

6. Write each exponential expression in its equivalent logarithmic form.

   (a) $0.00001 = 10^{-5}$

   (b) $\dfrac{8}{27} = \left(\dfrac{2}{3}\right)^3$

   (c) $y = 7^{3x+5}$

7. Simplify each of the following **without** using a calculator.

   (a) $\log_3\left(\dfrac{27}{9^{-2}}\right)$

   (b) $3^{2\log_3 4}$

   (c) $-17e^{-2\ln x^2}$

8. Algebraically solve the following for x. Give **exact** answers not calculator approximations.

   (a) $\ln(x^2) - \ln(4) = 0$

(b) $16^{x-1} = 2^{x^2}$

(c) $\log_5(x-4) + \log_5(x) = 1$

(d) $e^{5x-1} = e^{x^2+3}$

(e) $\log_3(10-x)-\log_3(x+2)=1$

(f) $64^x = 4^{2x-3}$

(g) $e^{2x}-4e^x-5=0$

9. How long will it take for your money to double in an account paying 3.5% annual interest compounded continuously, assuming no additional deposits, charges, or withdrawals?

10. **Algebraically** determine the domain of each of the following functions. Write your answers using interval notation.

    (a) $f(x) = \log_3(4 - x)$

    (b) $g(x) = \dfrac{\sqrt{2x - 5}}{\log_2(x^2 + 3)}$

(c) $h(x) = \dfrac{\log_5(3x-5)}{\sqrt[7]{x-10}}$

(d) $j(x) = \dfrac{(3x+5)e^{2x-1}}{4x^3-4x^2-24x}$

(e) $k(x) = \dfrac{(5x+11)^{1/4} + 3^{1/x}}{3e^x - 6}$

(f) $\ell(x) = \begin{cases} \dfrac{e^x + 3}{\sqrt[4]{x+10}} & \text{if } -3 \leq x < 3, \\ \dfrac{x-4}{x^2 - 4x} & \text{if } 3 \leq x < 5, \\ 3x^9 + 5x^6 - 12x^4 + 103 & \text{if } x \geq 7. \end{cases}$

11. Determine the zeros of $f(x) = \dfrac{2x(x+4)(3x-8)}{(x-3)(2x+5)}$

12. A company selling gadgets has a price-demand function of $p(x) = -\frac{2}{225}x + 48$, where x is the number of gadgets sold for a price of p dollars. The company has a profit function of $P(x) = -\frac{2}{225}x^2 + 24x - 1800$.

    (a) What is the maximum profit the company will earn?

    (b) What price will be charged in order to maximize profit?

    (c) Write the cost function for the company.

13. Compute and fully simplify the difference quotient of $f(x) = \dfrac{x}{5-x}$

14. Completely simplify the following expression, and write your answer using no negative exponents and no radicals

$$\frac{(5x^{-2}y^4)^{-2}z^8}{x^3\left(\sqrt[3]{x^2yz^{-3}}\right)}$$

15. Write $f(x) = \left|15 - \frac{5}{2}x\right|$ as an equivalent piecewise-defined function.

16. Multiply the following by the conjugate and fully simplify

$$\sqrt{6x + 6h - 4} - \sqrt{6x - 4}$$

17. If $f(x) = \dfrac{x+8}{x-3}$ and $g(x) = x^2 - 4$, compute

(a) $(f \circ g)(0)$

(b) $(f \circ f)(2)$

(c) $(f \cdot g)(1)$

18. **Determine whether each of the following is TRUE or FALSE**

(a) If $f(x) = 3x^6 + 6x^4 + 12x^7 + 13x^9$, then the ends of the function have behavior $\swarrow \cdots \nearrow$

(b) If $g(x) = \frac{1}{5}f(x+6) - 7$, then the graph of $g(x)$ can be found by taking the graph of $f(x)$ and shifting it by 6 units to the left, vertically shrinking it by a factor of 5, reflecting across the x-axis, and then moving down by 7 units.

(c) If x, y and n are all positive numbers, then $\log(xy^n) = n\log(xy)$