Homework 4

Math 147 (section 501–502-503), Spring 2015

This homework is due on Wednesday, February 11. *Hint:* If you do not have a graphing calculator, you can use this one online: `https://www.desmos.com/calculator`

0. Read Sections 3.2, 3.3, 3.4

1. For each of the following functions $h(x)$, determine the domain and where (at which points) the function is continuous. Additionally, find functions $f(x)$ and $g(x)$ such that $h(x) = f \circ g(x)$. *Recall that* $f \circ g(x) := f(g(x))$.

   (a) $h(x) = \cos\left(\frac{x^2-3}{1-x}\right)$

   (b) $h(x) = \log_2\left(x^2 + 1\right)$

   (c) $h(x) = \log_3\left(1 - x\right)$

2. Section 1.2 # 18

3. Sketch the graph of the following function, and determine where it is discontinuous.

$$f(x) = \begin{cases} 2x + 1 & \text{if } x \leq -1 \\ 3x & \text{if } -1 < x < 1 \\ 2x + 1 & \text{if } x \geq 1 \end{cases}$$

4. Are there real numbers a and b for which the following function $f(x)$ is continuous? If so, then determine a and b, and sketch a graph of $f(x)$. If not, then explain why not.

$$f(x) = \begin{cases} -1 & \text{if } x \leq -1 \\ ax + b & \text{if } -1 < x < 1 \\ 5 & \text{if } x \geq 1 \end{cases}$$

5. Evaluate the following limits.

   (a) $\displaystyle\lim_{x \to \infty} -3x^5 + 6x$

   (b) $\displaystyle\lim_{x \to -\infty} xe^{-x}$

   (c) $\displaystyle\lim_{x \to \infty} \frac{3x^3 + 2x^5 - 1}{-x^2 + 5}$

   (d) $\displaystyle\lim_{x \to \infty} \frac{x^5 + 8}{-2x^2 + 6x^3}$

6. Section 3.2 # 8, 28, 48

7. Section 3.3 # 20, 28

8. Section 3.4 # 4, 10, 12, 16

9. (These problems are *not* to be turned in!)

    (a) Section 1.2 # 16
    (b) Section 3.2 # 5, 7, 11, 15, 20, 23, 41, 45
    (c) Section 3.3 # 1, 3, 5, 8, 13, 21, 25, 29
    (d) Section 3.4 # 2, 5, 11, 13, 15, 17

10. (These problems are *not* to be turned in!) For each function below, determine the value(s) (if any) of a that make $f(x)$ continuous.

    (a)
    $$f(x) = \begin{cases} a & \text{if } x \leq \pi \\ \cos x & \text{if } x > \pi \end{cases}$$

    (b)
    $$f(x) = \begin{cases} e^x & \text{if } x < 0 \\ ax & \text{if } x \geq 0 \end{cases}$$