Homework 3

Calculus I, section 10

Due September 27, 2022 by 4:10 PM

As usual, you may use any resources to solve these problems except where stated otherwise, with the exception of computational software and posting these problems anywhere to be answered by others. Collaboration is encouraged, but everyone should write their own solutions. Write the names of any collaborators or sources used at the top of your homework. If you did not use any sources, write "sources used: none."

If you find any errors in either the homework or the lecture notes, please let me know, even if you are unsure whether it is an error or not.

As on most math problems, the mathematics is the issue, not the answer: whether you have a correct method is more important then whether you get to the correct number at the end, so include your method!

You do not have to simplify your answers completely (so for example $\frac{2}{2}$ is fine), but you do need to do all the computations (so for example if the problem is "find the largest value of $f(x)$," the answer "$f(3)$" is incomplete; you would also need to evaluate f at 3).

Problem 1. For each of the following functions $f(x)$, find all real numbers a such that f is discontinuous at a, and determine what kind of discontinuity it is.

(a) $f(x) = \log_2(|x|)$

(b) $f(x) = \begin{cases} 1 & x \geq 1 \\ \frac{x+1}{x^2+x} & x < 1 \end{cases}$

The above problem is primarily directed towards Objective 3: Continuity.

Problem 2. Let c be a real number, yet to be determined, and consider the function

$$f(x) = \begin{cases} \frac{cx+1}{x^2-1} & x > -1 \\ c & x \leq -1 \end{cases}$$

Is there a value of c such that $f(x)$ is continuous at $x = -1$? If so, what is it?
The above problem is primarily directed towards Objective 3: Continuity.

Problem 3. For each of the following functions, find all of their horizontal, vertical, or diagonal asymptotes, i.e. give an equation for the line they approach as x goes to ∞ or $-\infty$.

(a) $f(x) = \frac{2x^2+x+1}{x+1}$

(b) $f(x) = \cos(\frac{1}{x})$

The above problem is primarily directed towards Objective 4: Asymptotes.

Problem 4. Give an example of a function with two diagonal asymptotes, along the lines $y = x$ and $y = -x$, and a vertical asymptote at $x = 1$ (and no other asymptotes).
The above problem is primarily directed towards Objective 4: Asymptotes.

Survey. Complete the following survey by rating each problem you attempted on a scale of 1 to 10 according to how interesting you found it (1 = "mind-numbing," 10 = "mind-blowing"), and how difficult you found it (1 = "trivial," 10 = "brutal"). Also estimate the amount of time you spent on each problem to the nearest half hour.

	Interest	Difficulty	Time Spent
Problem 1			
Problem 2			
Problem 3			
Problem 4			