

MAT 201
Assignment 6
Tuesday, March 10, 2015

For full credit on these problems, each must be submitted with a complete and clear solution, showing all of your work. You may work with other classmates on these problems, but please indicate on your assignment if you received help. Partial answers and incomplete solutions may be eligible for some partial credit, depending on the level of completeness and demonstrated understanding.

1. Use the following table of functional values to answer the following questions about the function $f(x)$

x	2.9	2.99	2.999	3	3.001	3.01	3.1
$f(x)$	6.2	6.9	6.94	?	9.03	9.44	9.61

- (a) Estimate $\lim_{x \rightarrow 3^-} f(x)$
(b) Estimate $\lim_{x \rightarrow 3^+} f(x)$
(c) What do you think $\lim_{x \rightarrow 3} f(x)$ is?
(d) Do you think $f(x)$ is continuous at $x = 3$? Why or why not?
2. Find all values x where the following functions are not continuous, classify the points as removable or non-removable discontinuities, and write appropriate limit statements for each of the discontinuities.
- (a) $f(x) = \frac{x^2 + x - 2}{x^2 + 3x - 4}$
(b) $f(x) = \frac{x^3 + x^2 - 6x}{x^6 - 13x^4 + 36x^2}$
3. Sketch a graph of a function $f(x)$ with the following properties.
- $\lim_{x \rightarrow -4^-} f(x) = \infty$, $\lim_{x \rightarrow -4^+} f(x) = -\infty$, and $f(-4)$ is undefined.
 - $\lim_{x \rightarrow -1^-} f(x) = \infty$, $\lim_{x \rightarrow -1^+} f(x) = \infty$, and $f(-1) = 2$.
 - $\lim_{x \rightarrow 2^-} f(x) = -2$, $\lim_{x \rightarrow 2^+} f(x) = 5$, and $f(2) = 3$.
 - $\lim_{x \rightarrow 5} f(x) = -2$, and $f(5) = 3$.
4. Find the left and right-hand derivatives at $x = -1$ and $x = 2$ for the following function $f(x)$. Is the function differentiable at $x = -1$? At $x = 2$?

$$f(x) = \begin{cases} x^2 + 2x, & x < -1 \\ -1, & -1 \leq x \leq 2 \\ x - 3, & x > 2 \end{cases}$$

5. Find the derivative of the following functions using the limit definitions.
- (a) $f(x) = 5x - 7$
(b) $f(x) = x^4$
(c) $f(x) = \sqrt{x + 2}$