Math 131 - Homework 1
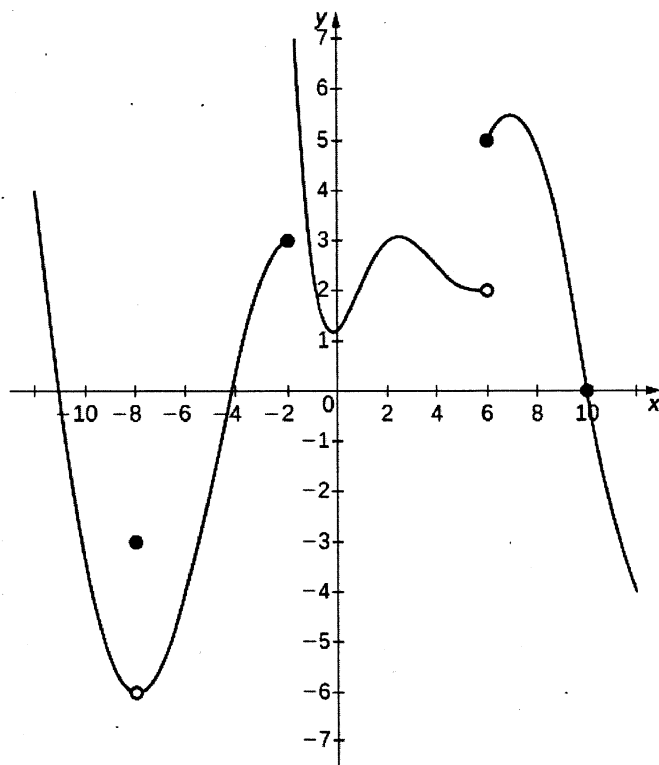
September 8, 2021

Name __key__

Score _____

The following problems are from the suggested homework. Show all work to receive full credit. Supply explanations when necessary. This assignment is due September 13 for section 001 and September 15 for section 950.

1. (2 points) Let $f(x) = \dfrac{\sin 3x}{x}$. On a separate sheet, make a table showing the values of f at $x = \pm 0.1$, $x = \pm 0.01$, $x = \pm 0.001$, and $x = \pm 0.0001$. Use your table to estimate $\lim\limits_{x \to 0} f(x)$.   See Attached Sheet. It looks like the limit is $\boxed{3.}$

2. (2 points) The graph of f is shown below. Say whether each statement is true or false. If false, explain why.

(a) $\lim\limits_{x \to 10} f(x) = 0$ True

(b) $\lim\limits_{x \to -2^+} f(x) = 3$ False, $\lim\limits_{x \to -2^-} f(x) = 3$, $\lim\limits_{x \to -2^+} f(x) = +\infty$

(c) $\lim\limits_{x \to -8} f(x) = f(-8)$ False, limit is -6, but $f(-8) = -3$

(d) $\lim\limits_{x \to 6} f(x) = 5$

   False, $\lim\limits_{x \to 6} f(x)$ DNE, but $\lim\limits_{x \to 6^+} f(x) = 5$

Turn over.

3. (2 points) Evaluate the limit: $\lim\limits_{t \to 9} \dfrac{t-9}{\sqrt{t}-3} \cdot \dfrac{\sqrt{t}+3}{\sqrt{t}+3} = \lim\limits_{t \to 9} \dfrac{(t-9)(\sqrt{t}+3)}{t-9}$

$$= \boxed{6}$$

4. (2 points) Let $f(x) = \begin{cases} x^2, & x \le 3 \\ x+4, & x > 3 \end{cases}$

(a) Evaluate $\lim\limits_{x \to 3^+} f(x)$.

$$= \lim\limits_{x \to 3^+} x+4 = \boxed{7}$$

(b) Evaluate $\lim\limits_{x \to 3^-} f(x)$.

$$= \lim\limits_{x \to 3^-} x^2 = \boxed{9}$$

5. (2 points) Determine if f is continuous at $x = \pi$. Explain your reasoning. If not continuous, say what type of discontinuity there is at the point.

$$f(x) = \begin{cases} x \sin x, & x \le \pi \\ x \tan x, & x > \pi \end{cases}$$

CONT. AT $X = \pi$

BECAUSE

$$\lim\limits_{x \to \pi} f(x) = f(\pi)$$

$f(\pi) = \pi \sin \pi = 0$

$\lim\limits_{x \to \pi^-} f(x) = \lim\limits_{x \to \pi^-} x \sin x = \pi \sin \pi = 0$

$\left.\begin{array}{l} \\ \\ \end{array}\right\}$ $\lim\limits_{x \to \pi} f(x) = 0$

$\lim\limits_{x \to \pi^+} f(x) = \lim\limits_{x \to \pi^+} x \tan x = \pi \tan \pi = 0$

PROBLEM #1 $f(x) = \dfrac{\sin 3x}{x}$

x = 0.100000000000000, f(x) = 2.95520206661340
x = -0.100000000000000, f(x) = 2.95520206661340

x = 0.0100000000000000, f(x) = 2.99955002024957
x = -0.0100000000000000, f(x) = 2.99955002024957

x = 0.00100000000000000, f(x) = 2.99999550000202
x = -0.00100000000000000, f(x) = 2.99999550000202

x = 0.000100000000000000, f(x) = 2.99999995500000
x = -0.000100000000000000, f(x) = 2.99999995500000