Midterm 1 – Math 241

Friday, September 14, 2018

This is a closed-book exam. No calculators allowed.
Justify your answers to obtain full credit (and partial credit, too).
You have 50 minutes.
This exam consists of 5 questions.
Please verify that you have all pages.

Name:_____ **ID#:**_____

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1. (*20 points*) Consider the function $f(x)$ given below. Find

(i) $\lim_{x \to k^-} f(x)$

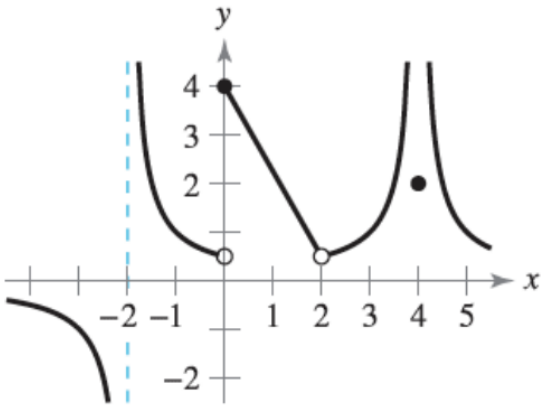
(ii) $\lim_{x \to k^+} f(x)$

(iii) $\lim_{x \to k} f(x)$

(iv) $f(k)$

(v) Is $f(x)$ continuous at k? (yes or no)

for each of the given values of k. If the given value does not exist, write "DNE", ∞, $-\infty$, or "undefined" as necessary:



(a) $k = -1$

(b) $k = 0$

(c) $k = 2$

(d) $k = 4$

2. (*25 points*) Evaluate the following limits Be as specific as possible (i.e write ∞ or $-\infty$ instead of DNE when applicable):

(a) $\lim_{x \to -1} \dfrac{x^2 - 5x - 6}{x + 1}$

(b) $\lim_{x \to 3^-} \dfrac{4}{(x-3)^2}$

(c) $\lim_{x \to \infty} \dfrac{x^3 + x^2 + 2}{7x^3 + x + 1}$

(d) $\lim_{x \to 25} \dfrac{x - 25}{\sqrt{x} - 5}$

(e) $\lim_{x \to 0} \dfrac{\sin 4x}{5x}$

3. (*20 points*)

(a) Using the limit definition of a derivative, differentiate the following:

$$f(x) = x^2 - 3x - 1$$

(b) Find the equation of the line tangent to $f(x)$ at $x = 1$

4. (*20 points*) On which interval(s) is the following function continuous. Justify your answers using limits:

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

5. (*15 points*)

(a) Evaluate $\lim_{x \to 0}(x^2 \sin(4x) + 1)$

(b) Show that the equation $x^3 - x^2 + 2x - 7 = 0$ has a solution in the interval $[1, 2]$. State any theorems you use to support your answer.

Final Score

	Score	Out of
Question 1		20
Question 2		25
Question 3		20
Question 4		20
Question 5		15
Total		100