Midterm 1 – Math 203

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 6 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:

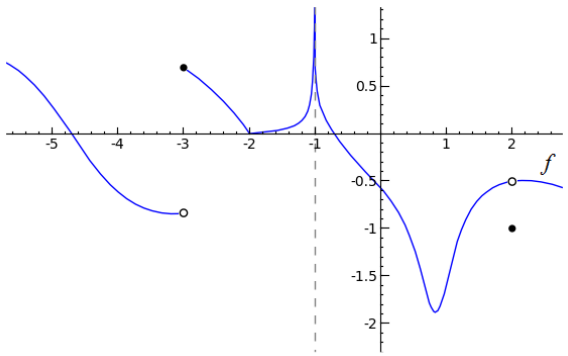

Figure 1: There is an asymptote at $x = -1$

(a) $k = -3$

(b) $k = -2$

(c) $k = -1$

(d) $k = 2$

2. (*15 points*) Evaluate the following limits Be as specific as possible (i.e write ∞ or $-\infty$ instead of DNE when applicable):

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

(b) $\lim_{x\to \infty} \dfrac{2x^4+x^2+2}{3x^4+x+1}$

(c) $\lim_{x\to 9} \dfrac{x-9}{\sqrt{x}-3}$

3. (*20 points*)

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

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

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

4. (*15 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 tiny particle is moving along the x-axis. The position of the particle at time t is given by the function

$$s(t) = -\frac{1}{3}t^3 + t$$

(a) The derivative of position is velocity. Find a function $v(t)$ for the velocity of the particle at time t. Use your answer to find the velocity of the particle when $t = 0$.

(b) The derivative of velocity is acceleration. Find a function $a(t)$ for the acceleration of the particle at time t. Use your answer to find the rate at which the particle is accelerating when $t = 0$.

6. (*15 points*) Using differentiation rules (rules for derivatives), find the derivatives of the following functions:

(a) $-2x + 3\sqrt{x}$

(b) $x^7 - 4x^4 + 2x^3 - x + 4$

(c) $\dfrac{1}{x^5} + 6x + 1$

Final Score

	Score	Out of
Question 1		20
Question 2		15
Question 3		20
Question 4		15
Question 5		15
Question 6		15
Total		100