

Midterm 1 – Math 241

Friday, June 28, 2019

This is a closed-book exam. No calculators allowed.

Justify your answers to obtain full credit (and partial credit, too).

You have 75 minutes.

This exam consists of 6 questions.

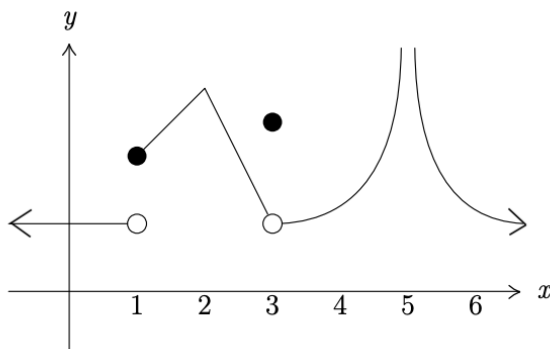
Please verify that you have all pages.

If you need scratch paper, please ask.

Name: _____

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(1) Answer the following questions for the function f graphed below:



(a) On what interval(s) is the function continuous?

(b) For which value(s) of a does $\lim_{x \rightarrow a} f(x)$ **not** exist?

(c) For what value(s) x is $f(x)$ **not** continuous. Explain why.

(d) State the equation(s) of any vertical asymptotes.

(2) Evaluate the following limits. If the limit is ∞ or $-\infty$, please indicate as appropriate.

(a) $\lim_{x \rightarrow -2} \frac{x^2 + 5x + 6}{x^2 - 4}$

(b) $\lim_{x \rightarrow \infty} \frac{4x^3 - 21x^2 + 3x}{x^2 + 13x - 7}$

(c) $\lim_{x \rightarrow 9} \frac{\sqrt{x} - 3}{x - 9}$

(d) $\lim_{x \rightarrow 0} \frac{2x}{\sin 3x}$

(e) $\lim_{x \rightarrow \infty} \frac{\cos(x^2)}{x^4}$

(3) Use the limit definition of a derivative to differentiate $f(x) = x^2 + 4$.

(4) Find the derivatives of the following functions. You do not need to simplify your answer.

(a) $f(x) = 3x^2 + \frac{1}{x^2} - \sqrt{\pi}$

(b) $f(x) = \frac{8 + \sqrt[3]{x}}{3x - 5}$

(c) $f(x) = \sin x + x \tan x$

(d) $f(x) = (x^2 + 2x + 4)^{1/2}$

(e) $f(x) = \sin^2(x^2 + 1)$

- (5) Show that $4x^3 - 6x^2 - 6x + 5 = 0$ has at least one solution. Be sure to state any theorems you are using and why you can use them.

(6) Find an equation of the line tangent to $3x^2 + 2xy + y = 0$ at $(1, -1)$.