Math 124, Spring 2022 Midterm I

April 26, 2022

Name———————————————————————————————————

Student Number————————————————————————————————

Instructions

- **These exams will be scanned. Please write your name and student number clearly for easy recognition.**

- There are 4 questions. The exam is out of 50 points.

- You are allowed to use one page of notes written only on one side of the sheet in your own handwriting.

- You can only use a Ti-30x IIS calculator. Unless otherwise stated, you have to give exact answers to questions. ($\frac{2\ln 3}{\pi}$ and 1/3 are exact, 0.699 and 0.333 are approximations for those numbers.)

- **Show your work**. If I cannot read or follow your work, I cannot grade it. **You may not get full credit for a right answer if your answer is not justified by your work.**

1. (13 points) These limit computations require you to show your work.

(a) Evaluate $\lim\limits_{x \to 3^+} \dfrac{x^2 - 2x + 3}{x^2 - 6x + 9}$.

(b) Evaluate $\lim\limits_{x \to \infty} \left(3x - \sqrt{9x^2 + 4x - 1} \right)$.

(c) Use the limit definition of the derivative to find the derivative of $f(x) = \dfrac{1}{x - 2}$.
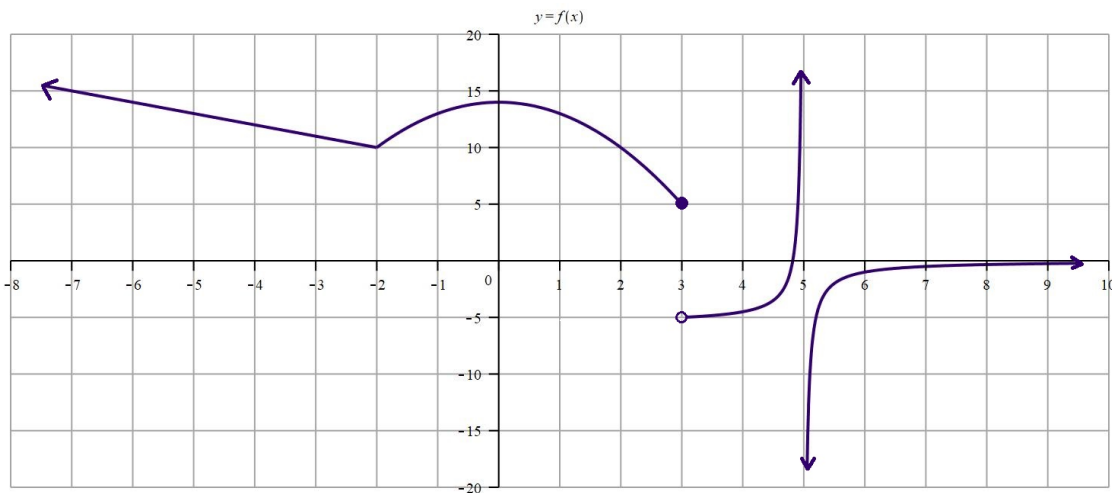
2. (13 points) Differentiate the following. You do not have to simplify your answers, but make sure your parentheses are correct.

(a) $f(x) = \dfrac{5e^x}{7} + \sqrt{9x} - 11x^{13} + x^\pi$

(b) $g(x) = \dfrac{2x^3 + 5\cos x}{7x^{11} + 13\sin x}$

(c) $h(x) = xe^x \tan(x)$

3

3. (11 points) The following is a graph of the function $f(x)$ whose domain is all numbers except for $x = 5$ and $f(3) = 5$. Answer the questions based on the graph. You do not have to show your work.

$y = f(x)$

(i) $\lim\limits_{x \to 5} f(x)$

(ii) $\lim\limits_{h \to 0} \left(\dfrac{f(-5+h) - f(-5)}{h} \right)$

(iii) $\lim\limits_{x \to 5^+} f(x)$

(iv) $\lim\limits_{h \to 0^+} \dfrac{f(h)}{h}$

(v) $\lim\limits_{x \to 3^+} f(x)$

(vi) $f'(-3) =$

(vii) List all values of x where the function $f(x)$ is not continuous.

(viii) List the following in increasing order, from smallest to largest: $f'(0.5), f'(2.5), f'(5.1), f'(8.7), f'(0)$

(ix) List the intervals where the derivative function $f'(x)$ is decreasing.

(x) List the values of x where the derivative is not defined.

4

4. (13 points) The two lines, which intersect at the point $P\left(-\frac{1}{2}, -1\right)$, are tangent to the parabola given by the equation $y = 4x^2 + 7$.
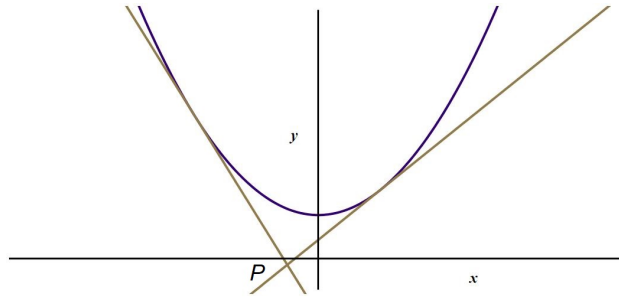
Find the the two points of tangency and the equations of the two lines.

This page is blank. If you continued a question here, make a note on the question page so we can have a look.