MATH 141 Midterm 2

March 23, 2023

NAME (please print legibly): _____

University ID Number: _____

Pledge of Honesty

I affirm that I will not give or receive any unauthorized help on this exam, and that all work will be my own.

Signature: _____

Directions

- Enter your answers where indicated in order to receive credit.
- Show your work. Unjustified answers will **not** receive credit.
- Calculators and notes are not permitted.
- If you are confused about the wording of a question or need clarification, raise your hand and **ask a proctor** about it.

1. (20 points) Compute the following limits.

(a) $\lim_{x \to -5} \dfrac{\sqrt{6-2x}-4}{x+5}$

Answer:

(b) $\lim_{t \to \infty} \dfrac{e^{-3t}+4}{e^{-t}-2}$

Answer:

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

Answer:

(d) $\lim_{h \to 0} \dfrac{\sin\left(\frac{5\pi}{6} + h\right) - \frac{1}{2}}{h}$

Answer:

2. (12 points) Find all of the discontinuities of the following function (there is at least one and no more than four). Classify each discontinuity as **removable**, **jump**, or **infinite**.

$$f(x) = \begin{cases} \frac{2}{x+3} & x \leq -1 \\ 2x - 1 & -1 < x < 2 \\ 4 & x = 2 \\ -x^2 + 2x + 3 & 2 < x \leq 4 \\ 3 - 2x & x > 4 \end{cases}$$

Discontinuity 1:	Discontinuity 2:
Discontinuity 3:	Discontinuity 4:

3. (10 points) Suppose $f(x) = 2x^2 - 1$. Use the **definition of the derivative** to compute $f'(-2)$. (No credit will be awarded for using other methods.)

4. (8 points) Suppose the tangent line of $f(x)$ at $(-4, 3)$ passes through the point $(5, 0)$. Find $f'(-4)$.

Answer:

5. (20 points) Differentiate the following functions.

(a) $f(x) = e^{\sqrt{4x^2+4}}$

(b) $g(x) = \dfrac{2\cos(3x)}{1-\sin(4x)}$

(c) $h(t) = 4^t \sec(e^{4t})$

(d) $r(s) = e^{\pi^2}$

6. (14 points) Suppose $f(x) = 2x^3 + 9x^2 - 24x - 3$.

(a) Find all values of x where f has a horizontal tangent line.

Answer:

(b) Find the interval(s) where f is increasing.

Answer:

7. (16 points) Some values of functions f and g and their derivatives are summarized below.

x	$f(x)$	$g(x)$	$f'(x)$	$g'(x)$
0	-1	-3	2	6
1	1	5	-2	0
2	3	2	6	1
3	2	0	4	-1

Compute the following derivatives.

(a) $\dfrac{d}{dx} f(x)g(x)$ at $x = 0$

Answer:

(b) $\dfrac{d}{dx} \dfrac{f(x)}{x^2}$ at $x = 1$

Answer:

(c) $\dfrac{d}{dx} \ln \sqrt{f(x)}$ at $x = 2$

Answer:

(d) $\dfrac{d}{dx} f(2g(x))$ at $x = 3$

Answer:

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