

Test Number: 1255

MA 16010

Exam 1

Fall 2024

Student's Name: _____

Section Number: _____

(Without your name and section number, we will NOT be able to locate your exam booklet.)

1. Fill out your name and section number in the space provided above. On the scantron, fill in **your name, section number, test number and student ID**. Sign your name.
2. You can write on this exam booklet. Turn in both your scantron and your exam booklet when you are done. Note: **you will be graded ONLY based on your scantron answer sheet**.
3. Only a one-line display scientific calculator is allowed. NO other electronic devices are allowed. No books or notes are allowed.
4. There are 12 questions with 8 points each for a total of 96 points. You will have 60 minutes to complete the exam. Good luck!

Instructor	Time	Section	Instructor	Time	Section
Anderson, Sarah	3:30pm	019	Anderson, Sarah	4:30pm	020
Bairnsfather, Chris	3:30pm	002	Bairnsfather, Chris	4:30pm	001
Baring, Geoffrey	9:30am	030	Baring, Geoffrey	10:30am	029
Barnes, Russell	2:30pm	023	Barnes, Russell	4:30pm	024
Batavia, Manav	3:30pm	035	Batavia, Manav	4:30pm	036
Carper, Patrick	11:30am	033	Carper, Patrick	12:30pm	034
Chen, Ying	7:30am	300	Chen, Ying	8:30am	400
Chlopecki, Anna	3:30pm	011	Chlopecki, Anna	4:30pm	012
Dasiuk, Jaden	12:30pm	017	Dasiuk, Jaden	1:30pm	018
Delgado, Huimei	online	999			
Fong, Justin	3:30pm	008	Fong, Justin	4:30pm	007
Gismondi, Nick	1:30pm	021	Gismondi, Nick	2:30pm	022
Gutwein, Linda	10:30am	027	Gutwein, Linda	11:30am	028
Hong, Kyungtak	1:30pm	015	Hong, Kyungtak	2:30pm	016
Hsu, Alexander	3:30pm	009	Hsu, Alexander	4:30pm	010
Kessinger, Ethan	8:30am	004	Kessinger, Ethan	9:30am	003
LaClair, Adam	12:30pm	013	LaClair, Adam	1:30pm	014
O'Connor, Sam	9:30am	032	O'Connor, Sam	10:30am	031
Ouseph, Chrisil	10:30am	005	Ouseph, Chrisil	11:30am	006
Polak, Raechel	12:30pm	500	Polak, Raechel	2:30pm	200
Styles, Nikos	3:30pm	025	Styles, Nikos	4:30pm	026

Problem 1

What can you conclude if you build up the following table when you are trying to find the limit of $f(x)$ numerically?

x	4.9	4.99	4.999	4.9999	5	5.0001	5.001	5.01	5.1
$f(x)$	-0.1	-0.01	-0.001	-0.0001		0.0001	0.001	0.01	0.1

1. (A) $\lim_{x \rightarrow 5} f(x) = 5$
- (B) $\lim_{x \rightarrow 0} f(x) = 5$
- (C) $\lim_{x \rightarrow 0} f(x)$ does not exist
- (D) $\lim_{x \rightarrow 5} f(x) = 0$
- (E) $\lim_{x \rightarrow 5} f(x)$ does not exist
- (F) $\lim_{x \rightarrow 0} f(x) = 0$

Problem 2

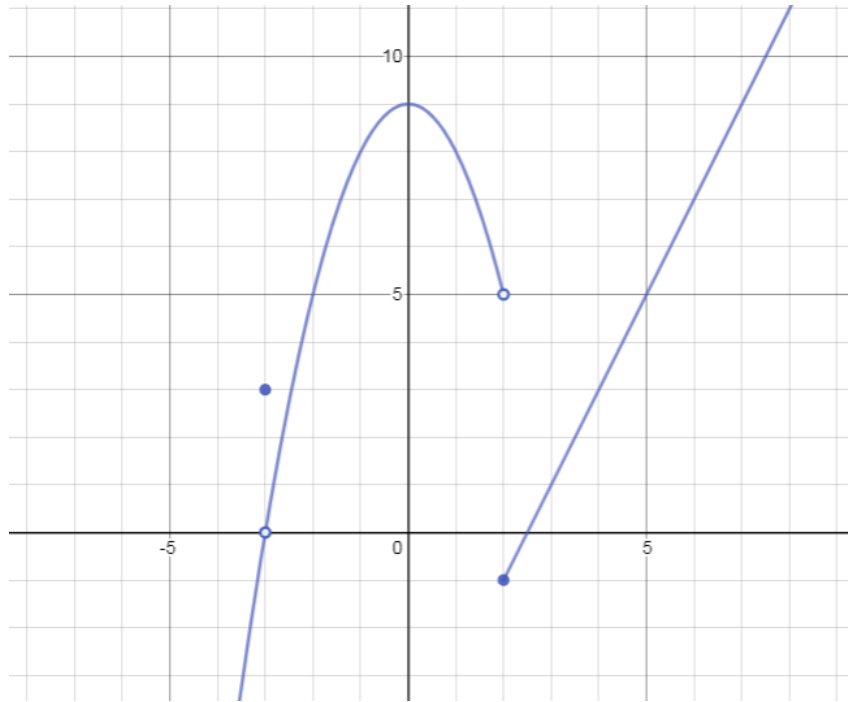
Compute the following limit if it exists.

$$\lim_{x \rightarrow 2} \frac{x^2 + 3x - 10}{x^2 - 2x}$$

2. (A) 1
- (B) $\frac{7}{2}$
- (C) $\frac{9}{2}$
- (D) 0
- (E) The limit does not exist.
- (F) ∞

Problem 3

Consider the graph of $f(x)$ below. How many statements are true?



I. $\lim_{x \rightarrow 2^-} f(x) = 5$

II. $\lim_{x \rightarrow 2^+} f(x) = -1$

III. $\lim_{x \rightarrow 2} f(x)$ does not exist.

IV. $\lim_{x \rightarrow -3} f(x) = 0$

V. $f(-3) = 3$

3. (A) Only three statements are true.
- (B) Only four statements are true.
- (C) None of the statements is true.
- (D) Only one statement is true.
- (E) Only two statements are true.
- (F) All of the five statements are true.

Problem 4

The population of a city since the year 1990 can be modeled by $p(t) = 600t^2 - 1800t + 19,000$ where $t = 0$ corresponds to the year 1990. In what year is the population increasing at a rate of 11,400 people per year?

4. ☐ (A) 2005
- ☐ (B) 1997
- ☐ (C) 2011
- ☐ (D) 2013
- ☐ (E) 1999
- ☐ (F) 2001

Problem 5

Given the function $f(x) = \frac{-3x}{x^2 + 6x}$. Find and classify the discontinuities of $f(x)$.

5. ☐ (A) $f(x)$ has a jump at $x = -6$ and a vertical asymptote at $x = 0$.
- ☐ (B) $f(x)$ has a hole at $x = -6$ and a vertical asymptote at $x = 0$.
- ☐ (C) $f(x)$ has a jump at $x = -3$ and a hole at $x = -6$.
- ☐ (D) $f(x)$ has a hole at $x = 0$ and a vertical asymptote at $x = -6$.
- ☐ (E) $f(x)$ has a jump at $x = 0$ and a vertical asymptote at $x = -6$.
- ☐ (F) $f(x)$ has a hole at $x = -3$ and a jump at $x = -6$.

Problem 6

For

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

Choose the correct statement(s) below.

I. $\lim_{x \rightarrow -2} f(x)$ does not exist.

II. $f(x)$ is continuous at $x = -2$.

III. $\lim_{x \rightarrow -2^-} f(x) = 1$

6. ☐ (A) Only II and III are true
- ☐ (B) Only I and II are true
- ☐ (C) Only I and III are true
- ☐ (D) Only II is true
- ☐ (E) Only III is true
- ☐ (F) Only I is true

Problem 7

Consider the function $f(x) = \sqrt{x+2}$. Which of the following is $f'(x)$ by using the limit definition?

7. (A) $\lim_{h \rightarrow 0} \frac{\sqrt{x+h+2} - \sqrt{x+2}}{h}$
- (B) $\lim_{h \rightarrow 0} \sqrt{x+h+2}$
- (C) $\lim_{h \rightarrow 0} (\sqrt{x+h+2} - \sqrt{x+2})$
- (D) $\lim_{h \rightarrow 0} \frac{h}{\sqrt{x+2} + h - \sqrt{x+2}}$
- (E) $\lim_{h \rightarrow 0} \frac{\sqrt{x+2} + h - \sqrt{x+2}}{h}$
- (F) $\lim_{h \rightarrow 0} \frac{h}{\sqrt{x+h+2} - \sqrt{x+2}}$

Problem 8

Find the derivative of

$$f(x) = 4\sqrt[4]{x^3} - \frac{6}{x^3} + 8\sqrt{x}.$$

8. (A) $\frac{3}{\sqrt[4]{x}} + \frac{18}{x^4} + \frac{4}{\sqrt{x}}$
- (B) $4\sqrt[4]{3x^2} + \frac{2}{x^4} + \frac{4}{\sqrt{x}}$
- (C) $\frac{3}{\sqrt[4]{x}} + \frac{18}{x^3} + 4\sqrt{x}$
- (D) $4\sqrt[4]{3x^2} + \frac{2}{x^4} + 4\sqrt{x}$
- (E) $4\sqrt[4]{3x^2} + \frac{18}{x^3} + \frac{4}{\sqrt{x}}$
- (F) $\frac{3}{\sqrt[4]{x}} + \frac{18}{x^4} + 4\sqrt{x}$

Problem 9

Find the x -value at which the function $f(x) = (3x - 1)e^x$ has a horizontal tangent line.

9. (A) $x = 2$

(B) $x = -2$

(C) $x = -\frac{2}{3}$

(D) $x = -\frac{1}{3}$

(E) $x = \frac{1}{3}$

(F) $x = \frac{2}{3}$

Problem 10

Find the derivative of $y = \sec x - \csc x$.

10. (A) $y' = \tan^2 x + \cot^2 x$

(B) $y' = \sec x \cot x + \csc x \tan x$

(C) $y' = \tan x \cot x + \sec x \csc x$

(D) $y' = \sec x \tan x + \csc x \cot x$

(E) $y' = \tan x + \cot x$

(F) $y' = \sec^2 x + \csc^2 x$

Problem 11

Given $f(x) = \frac{\cos x}{3x^2 + 4}$. Compute $f'(\pi)$.

11. (A) $\frac{\pi}{3\pi^2 + 4}$
- (B) $\frac{\pi}{(3\pi^2 + 4)^2}$
- (C) $\frac{6\pi}{3\pi^2 + 4}$
- (D) $\frac{-\pi}{3\pi^2 + 4}$
- (E) $\frac{6\pi}{(3\pi^2 + 4)^2}$
- (F) $\frac{-6\pi}{(3\pi^2 + 4)^2}$

Problem 12

Let $f(x) = \sqrt{3x^2 + 4}$. Find $f'(2)$.

12. (A) $\frac{1}{8}$
- (B) $\frac{5}{12}$
- (C) 4
- (D) 12
- (E) $\frac{3}{2}$
- (F) 16