Emory University
Exam #1
MA-111 Calculus I
Date: October 6, 2025
Instructor: Mitchell Scott

Student ID _____ Name: _____

Please read the following instructions carefully.

- **This is simply a review session!** This question booklet contains 6 questions, 6 pages (including the cover) for the total of 35 points/marks. Check to see if any pages are missing. DO NOT scribble or do rough work or make any stray marks on it. Use separate sheet for rough work.
- This is meant to represent what an actual exam might look like. **Read the instructions for individual questions carefully** before answering the questions.
- This was not overseen by the coordinator nor other instructors.

Question	Points	Score
1	5	
2	5	
3	5	
4	5	
5	5	
6	10	
Total:	35	

1. (5 points) Summarize
   (a) How can you visualize an average rate of change graphically? Numerically?

   (b) How can you visualize an instantaneous rate of change graphically? Numerically?

   (c) Which of the rates of change (average or instantaneous) are we able to compute at the moment? What is our current way of "computing" the other?

   (d) How do we compute average speed? How do we compute average velocity?

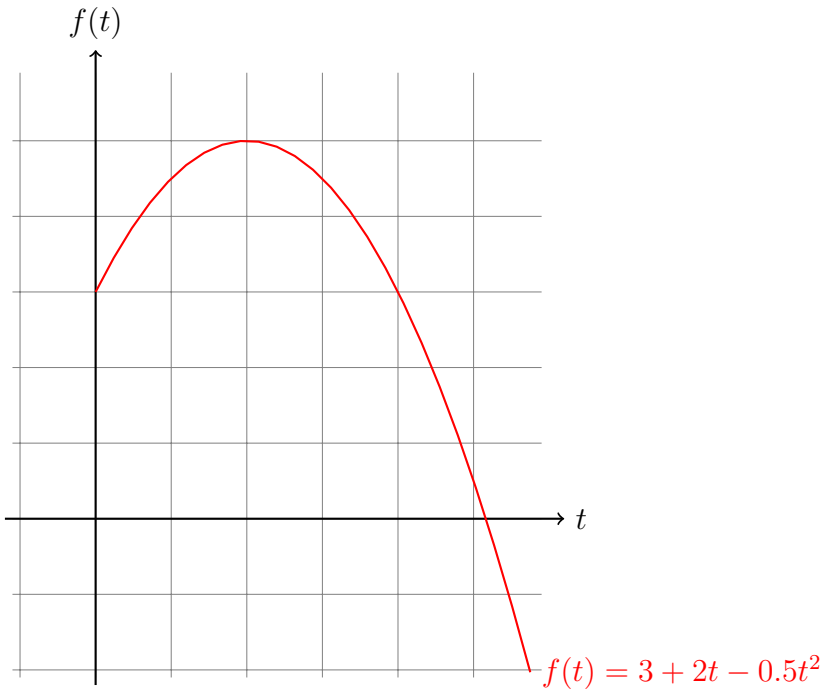
2. (5 points) Below is the race results for someone running a half marathon:

Mile	1	2	3	4	5	6	7	8	9	10	11	12	13
Time	7:58	7:58	8:11	8:25	8:24	9:34	10:00	8:50	9:07	9:13	11:48	9:27	8:54

   (a) What was the runner's average pace between miles 4-6? How is this different than the Nyad problem we had before? Does that matter?

   (b) Assuming the pace is a continuous function, is there a time when the runner is running at 9:45 minutes per miles? 12:00 minutes per mile?

3. (5 points) Given the graph below, which is my position east (in miles) from Emory's Math and Sciecne Center on a given Tuesday morning, where $t = 0$ is 6:00 am, when I wake up, and t is in hours:



(a) Before we knew derivatives, we had to approximate the slope of the tangent line as the slope of a secant line. We are interested in points around $t = 2$hours, or 8:00 am. Write the formula for the secant line, where one point is $t = 2$, and we vary the other point? For example, what is the slope of the secant line between points $P = (t, f(t))$ and $Q = (2, f(2))$.

(b) Approximate the average velocity around $t = 2$ hours by filling out the below table:

t	m_{PQ}	t	m_{PQ}
1		3	
1.5		2.5	
1.9		2.1	
1.99		2.01	
1.999		2.001	
1.9999		2.0001	

(c) Put the following quantities in ascending order (Either compute them graphically or numerically):

1. slope of instantaneous velocity at $t = 0$
2. slope of instantaneous velocity at $t = 2$
3. slope of average velocity between $t = 1.999$ and $t = 2$
4. slope of average velocity between $t = 2.0001$ and $t = 2$
5. slope of average velocity between $t = 0$ and $t = 5$
6. slope of average velocity between $t = 0$ and $t = 4$
7. slope of average velocity between $t = 2$ and $t = 5$
8. slope of average speed between $t = 2$ and $t = 5$.

(d) Draw a graph of my distance from Emory's MSC over time.

Please go on to the next page...

4. (5 points) Summarize
   (a) Write the definition of the limit from both the left and the right? Write the definition of the limit.

5. Compute the following limits:
   (a) (2 points) $\lim_{x\to 4} \frac{x^2+16}{x+4}$

   (b) (3 points) $\lim_{x\to 4} \frac{x^2-16}{x-4}$

   (c) $\lim_{x\to 0} \cos\left(\pi \frac{x^2-16}{x-4}\right)$

6. Our end goal is to compute the derivative of

$$h(x) = \frac{x^2}{e^x\left(\frac{x^3}{3} - \sqrt{3}\right)}$$

   (a) (2 points) Write the quotient rule in terms of $f(x), g(x)$

   (b) (4 points) What is the derivative of $e^x\left(\frac{x^3}{3} - \sqrt{3}\right)$?

   (c) (4 points) Combining your answers above, what is $h'(x)$

End of exam.