

Midterm 1 practice

UCLA: Math 3B, Winter 2017

Instructor: Noah White

Date:

Version: *practice*

- This exam has 4 questions, for a total of 40 points.
- Please print your working and answers neatly.
- Write your solutions in the space provided showing working.
- Indicate your final answer clearly.
- You may write on the reverse of a page or on the blank pages found at the back of the booklet however these will not be graded unless very clearly indicated.
- Non programmable and non graphing calculators are allowed.

Name: _____

ID number: _____

Discussion section: _____

Question	Points	Score
1	15	
2	8	
3	9	
4	8	
Total:	40	

1. Let $f(x) = \frac{x^2-9}{x^2+4}$. Note that $f'(x) = \frac{26x}{(x^2+4)^2}$ and $f''(x) = -\frac{26(3x^2-4)}{(x^2+4)^3}$.

(a) (2 points) Find the x and y intercepts of $f(x)$.

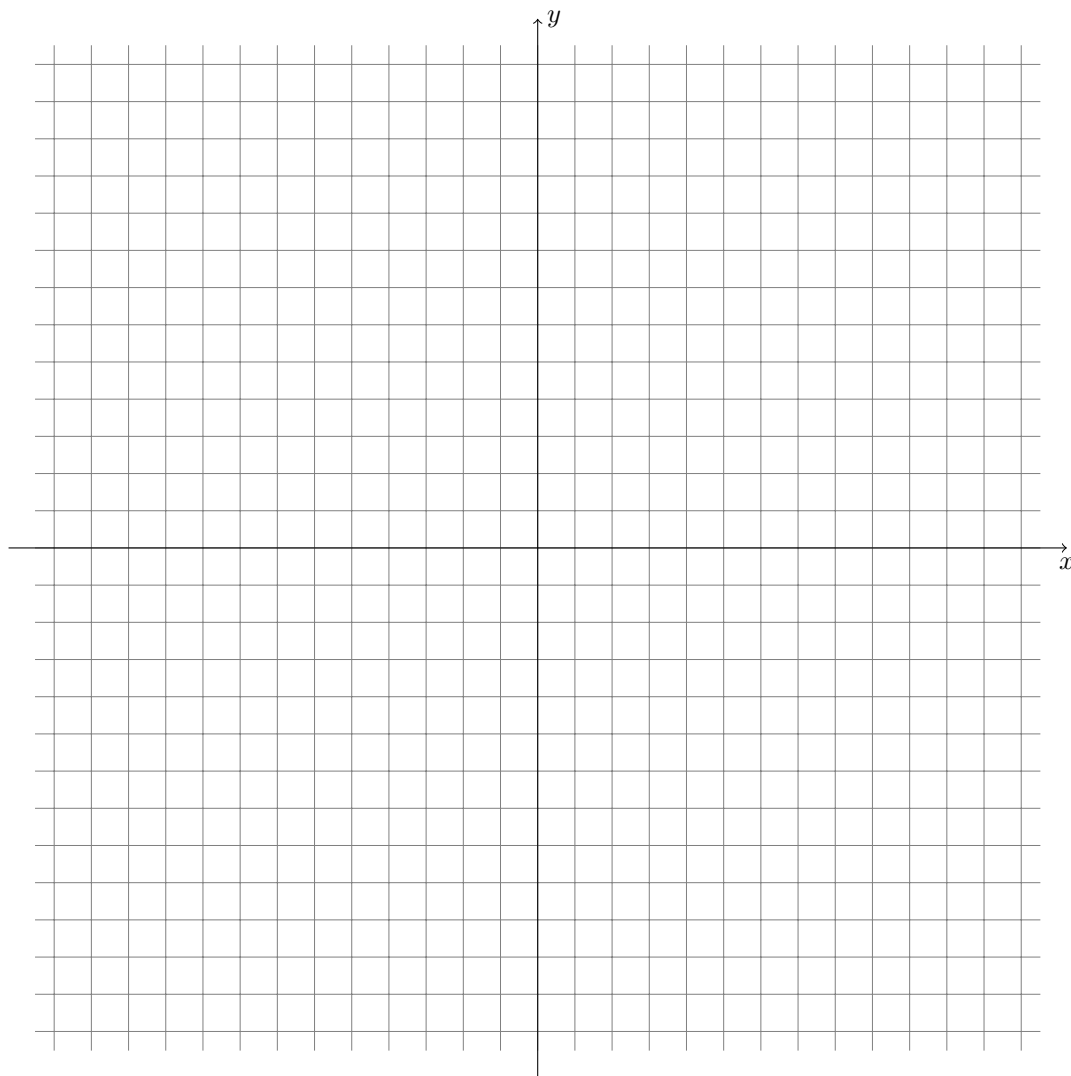
(b) (1 point) Does $f(x)$ have any horizontal asymptotes? If so what are they?

(c) (1 point) Does $f(x)$ have any vertical asymptotes? If so what are they?

(d) (2 points) For what x is the first derivative $f'(x)$ positive?

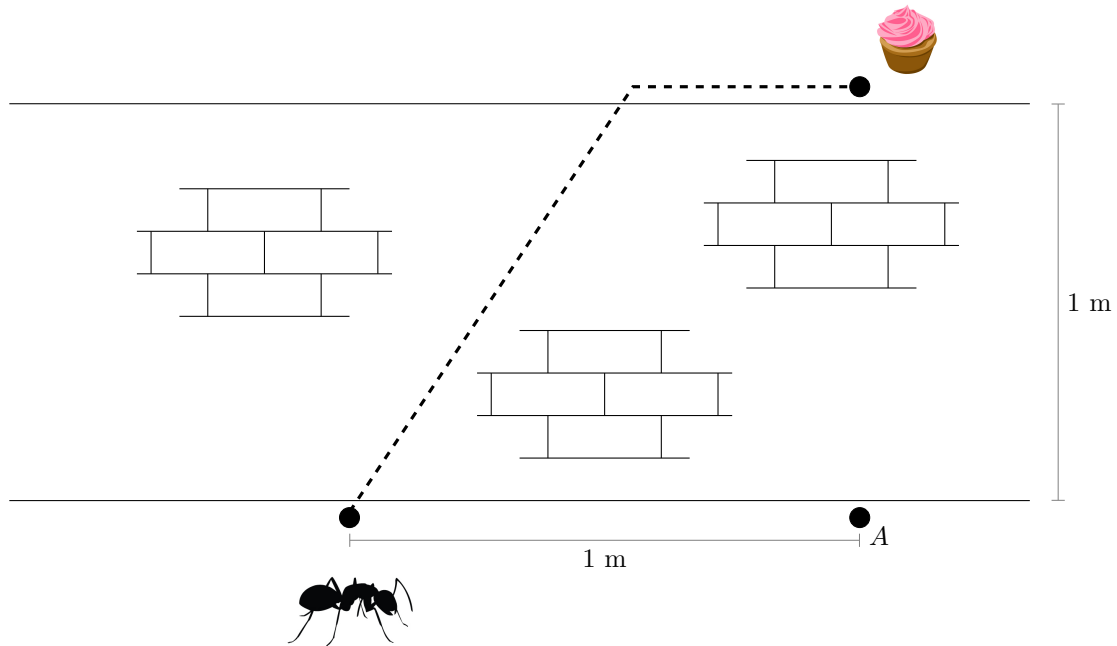
(e) (2 points) For what x is the second derivative $f''(x)$ positive?

(f) (3 points) On the graph provided, sketch $f(x)$



- (g) (4 points) List the local maximums and minimums of $f'(x)$ (note: this question is asking about the extrema of the derivative of f !)

2. An ant wants to climb up a 1 meter high wall to reach a cupcake which is sitting on top of the wall directly above a point A on the ground 1 meter away from the ant. The ant can travel up the wall at a speed of 0.05m/s or along the top of the wall at a speed of 0.1m/s. It starts climbing the wall immediately.



- (a) (3 points) If x is the distance between where the ant reaches the top of the wall and the cupcake, what is the time taken $T(x)$?

- (b) (5 points) How far from the cupcake should the ant reach the top of the wall in order to get to the cupcake in the quickest time possible?

3. Calculate the general antiderivative for the following functions

(a) (3 points) $x^2 + 3x - 4$

(b) (3 points) $x \cos(x^2 - 4)$

(c) (3 points) $\frac{(\ln x)^2}{x}$

4. A chemical manufacturer uses a reaction between two chemicals in solution, chemical A and chemical B to produce chemical X. Theoretically, it is understood that the reaction produces chemical X at a rate of

$$C_X(t) = \frac{1-t}{\sqrt{t+1}} \text{ ppm/s}$$

(parts per million per second), where a negative rate means the chemical X is being absorbed by the reaction and $t = 0$ is the time at the start of the reaction. Since chemicals A and B are very expensive, the manufacturer would like to stop the reaction only when the concentration of chemical X is at its highest.

- (a) (1 point) At what time should the manufacturer stop the reaction?
- (b) (5 points) Write a function that describes the concentration of chemical X at time t given that initially the solution initially contains 0ppm.

- (c) (2 points) What is the maximum yield of chemical X (in parts per million) the manufacturer can achieve?

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