

# Math 124 G Fall 2023 Midterm II

November 14, 2023

Name \_\_\_\_\_

Student Number \_\_\_\_\_

## Instructions

- These exams will be scanned. **Please write your name and student number clearly.**
- 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. **Hand in your notes with your exam.**
- 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 we cannot read or follow your work, we cannot grade it. If you have read all the instructions carefully, put a smiley next to your student number for a bonus point. **You may not get full credit for a right answer if your answer is not justified by your work.**

1. (12 points) Compute  $\frac{dy}{dx}$  for the following.

(a)  $y = \sqrt{2 + 5x^3} - (4e^x + 9x)^{17}$

(b)  $y = \sin(\cos(\ln x))$

(c)  $y = (1 + x^2)^{(1 + \sin x)}$

2. (13 points) A curve is given by the implicit equation

$$xy^2 + \ln(1 + x^2 + y) = 2^x - 1.$$

(a) Use linear approximation near  $(0, 0)$  to approximate the value of  $b$  if  $(b, 0.3)$  is on the curve.

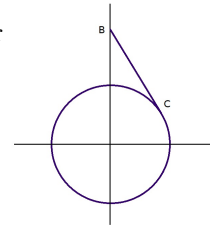
(b) Compute the value of  $y''$  at the point  $(0, 0)$  to decide whether your answer in part(a) is less than or more than the actual value of  $b$ .

3. (15 points) My dog Copper is running counterclockwise around a circular lake. His position at time  $t$  is given by the pair of parametric equations

$$x = 200 \cos(0.2t) \quad y = 200 \sin(0.2t)$$

where  $t$  is in seconds and  $x$  and  $y$  are in meters.

*In this question, round your numbers to two places after the decimal.*

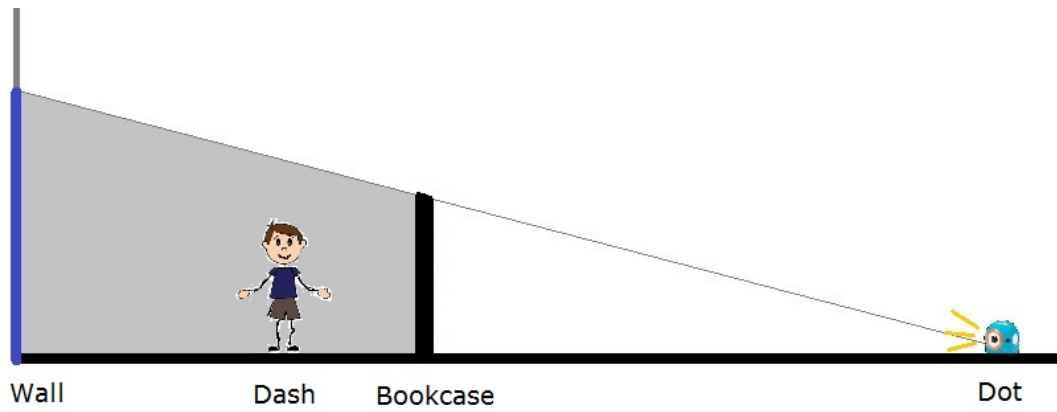


- (a) At  $t = 3$ , Copper spots a bunny at point  $B$  on the  $y$ -axis and he leaves the track at point  $C$ , continuing on a path tangent to the lake. Find the equation of the tangent line. Give your answer in the form  $y = mx + b$ .

- (b) What were the coordinates of the bunny?

- (c) Assuming Copper keeps his linear speed constant, at what time will he be at the point  $B$  where the bunny was- who will, of course, have run off by then.

4. (10 points) Dash is standing between a wall and a 1.5 meter high book case which is 5 meters away from the wall. On the other side of the bookcase is his robot Dot with a lamp attached. Dot is moving towards the bookcase and Dash is trying to compute the speed of Dot from the height of the shadow the bookcase casts on the wall. How fast is Dot moving when the shadow of the book case on the wall is 3 meters and increasing at rate of 1.3 meters per second?



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