## APPM 1345

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Final Exam	Name		
Final Exam	Instructor	Lecture Section	
Spring 2024	Instructor		

This exam is worth 150 points and hasproblems.

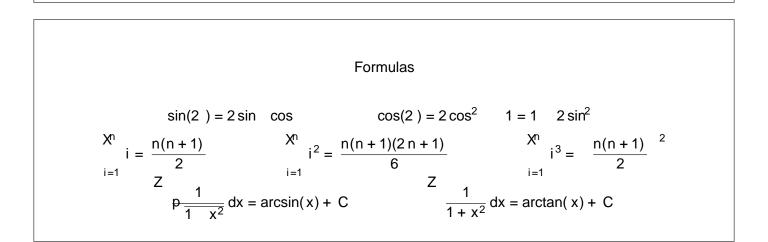
Make sure all of your work is written in the blank spaces provided. If your solutions do not t, you may ask one of your proctors for a piece of scratch paper. Do NOT use any paper that you have brought with you.

Show all work and simplify your answers. Name any theorem that you use. Answers with no justi cation will receive no points unless the problem explicitly states otherwise.

Notes, papers, calculators, cell phones, and other electronic devices are not permitted

## End of Exam Check List

- 1. If you nish the exam before 12:45 PM:
  - Go to the designated area to scan and upload your exam to Gradescope.
  - Verify that your exam has been correctly uploaded and all problems have been labeled.
  - Leave the physical copy of the exam with your proctors in the correct pile for your Lecture Section.
- 2. If you nish the exam after 12:45 PM:
  - Please wait in your seat until 1:00 PM.
  - When instructed to do so, scan and upload your exam to Gradescope at your seat.
  - Verify that your exam has been correctly uploaded and all problems have been labeled.
  - Leave the physical copy of the exam with your proctors in the correct pile for your Lecture Section.





- 2. (26 points) The following problems are not related:
  - (a) Find the derivative of  $f(x) = \lim_{Z \to I_{n(3)}} \tan^{-1}(x)$ .
  - (b) Evaluate the de nite integral  $\int_{0}^{100} \sinh(x) \cosh(x) dx$ , and fully simplify your answer.
  - (c) Determine the value of the  $\liminf_{x! 0^+} x^2 \ln(x^2)$ .



3. (16 points) Find the area of the largest rectangle which is symmetric arounyd-abries, bounded below by the x-axis, and which has two corners touching the graph( $\alpha f$ ) =  $\frac{1}{1 + x^2}$ 

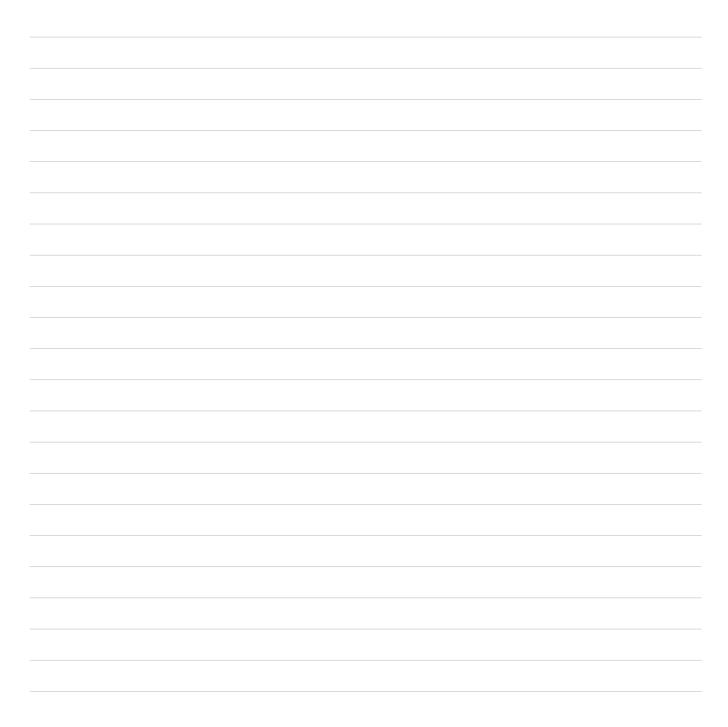
4. (18 points) A bug ying in a straight line starts decelerating at time 0 at a constant rate  $dfft=s^2$  for 5 seconds. Answer the following questions about the bug over the time intervalt 5.

(a)

5. (12 points) For what value of is the following function continuous?

$$f(x) = \begin{cases} 8 \\ \gtrless 2x^2 & x + a; \\ x & 0 \end{cases}$$
$$f(x) = \frac{1}{2} \frac{x}{2\sin(x)}; \qquad x > 0$$

Justify your answer with appropriate computations.



## 6. (18 points) Consider the function

$$g(x) = \arctan(x) + \frac{1}{x^2 - 4}$$

- (a) Find the domain of the function, and give your answer in interval notation.
- (b) Find all horizontal asymptotes g(x), and justify your answer with limits.



- 7. (16 points) The half-life of the chemical element cobalt-56 is approximatelydays. Suppose we have 1a milligram sample of cobalt-56.
  - (a) Find a formula for the mass of cobalt-56 remaining affeetays.
  - (b) How long will it take for only1 milligram of cobalt-56 to remain in the samplet?s OK for your answer to have a logarithm in it.



- 8. (16 points) For each of the following questions, give a short justi cation for your answer.
  - (a) If f (x) is an odd function and  $\int_{3}^{Z_{0}} f(x) dx = +1$ , nd  $\int_{3}^{Z_{3}} f(x) dx$ .
  - (b) Find the absolute minimum of the function  $(x) = x 2^x$ , if it exists.
  - (c) Evaluate the limiting  $\frac{\arctan(3x+3h)}{h}$   $\frac{\arctan(3x)}{h}$ :
  - (d) Suppose that (x) is differentiable everywhere, with (1) = 1 and f(1) = 3. Is there some value such that  $f^{0}(c) = 1$ ?