

Midterm # 2 MAT 127

Last Name

First Name

I.D.#

Lecture#

Question	Points	Score
1	20	
2	10	
3	20	
4	30	
5	20	
Total:	100	

Stop!

**Do Not Open This Exam Booklet
Until You Are Told to Do So!**

Exam Rules:

No Calculators. No Books. No Notes.

Show all your work, explain your reasoning, and cross out anything we should ignore when grading this exam. Also where possible, please always give exact answers (for example, " $\sqrt{5}$ " rather than the decimal approximation "2.23").

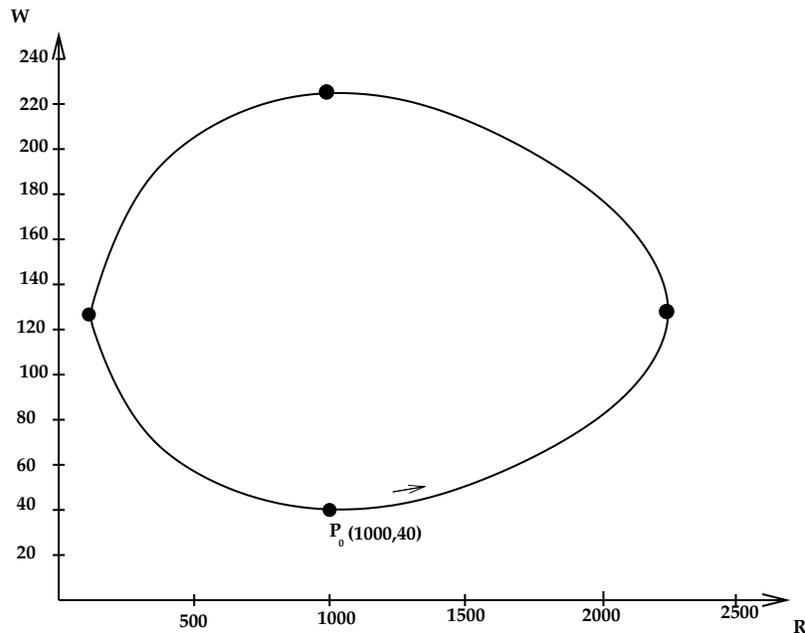
You have 90 minutes to complete this exam.

There are 5 questions, for a total of 100 points. Good luck!

Name: _____

Id: _____

1. The graph below shows a trajectory in the phase plane for a certain predator-prey model. R denotes the number of rabbits and W denotes the number of wolves. Initially (at time $t = 0$), $R = 1000$ and $W = 40$.



- (a) (10 points) Sketch a rough graph of R as a function of $t = \text{time}$.
- (b) (5 points) When the number of rabbits reaches its global maximum, about how many wolves are there?
- (c) (5 points) When the number of rabbits reaches its global maximum, is the wolf population increasing or decreasing?

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2. (10 points) Give an example of a sequence which is bounded and diverges. Explain why!

3. Determine whether the following sequences are convergent or not. If convergent compute their limits. Show your work!

(a) (10 points)

$$a_n = \frac{\sqrt{n}}{1 + \sqrt{n+1}}$$

(b) (10 points)

$$a_n = \frac{2^n}{3^{n+1}}$$

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4. (a) (10 points) Express the number $0.\overline{32} = 0.3232323232\dots$ as a ratio of two integers.

(b) (10 points) Evaluate the sum $5 + \frac{5}{3} + \frac{5}{9} + \frac{5}{27} + \frac{5}{81} + \dots$

(c) (10 points) Determine whether the following series converges or not (explain why!)

$$\sum_{n=1}^{\infty} \frac{5}{3^n - n}$$

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5. (a) (10 points) Does the series $\sum_{n=2}^{\infty} \frac{\ln(n)}{n} = \frac{\ln(2)}{2} + \frac{\ln(3)}{3} + \frac{\ln(4)}{4} + \dots$ converge or diverge? Explain why.

- (b) (10 points) Does $\sum_{n=2}^{\infty} \frac{1}{n(\ln n)^2} = \frac{1}{2(\ln 2)^2} + \frac{1}{3(\ln 3)^2} + \frac{1}{4(\ln 4)^2} + \dots$ converge or diverge? Explain why.