Math 120 - Autumn 2005
Final Exam
December 10, 2005

Name (please print): _____

Section: _____ Student ID Number: _____

Signature: _____

1	10	
2	10	
3	10	
4	10	
5	10	
6	10	
7	10	
8	10	
Total	80	

- Complete all questions.
- You may use a calculator during this examination. Other electronic devices are not allowed, and should be turned off for the duration of the exam.
- If you use a trial-and-error or guess-and-check method, or read a numerical solution from a graph on your calculator when an algebraic method is available, you will not receive full credit.
- You may use one hand-written 8.5 by 11 inch page of notes.
- Show all work for full credit.
- You have 180 minutes to complete the exam.
- Good luck!

1. Suppose the number of rabbits in a certain park is a linear function of time. In 1980, the park had 300 rabbits. In 1994, the park had 1000 rabbits.

   The number of goldfish in the park's pond is also a linear function of time. In 1988, the pond had 100 goldfish, while in 1993, there were 400 goldfish.

   In what year were there 500 more rabbits than goldfish?

2. Ron is in a boat on the far western edge of a circular lake. The lake has a radius of 5 miles. Ron's house is located 12 miles north and 10 miles east of the center of the lake. If Ron paddles his boat at a constant rate of 8 mph directly toward his house, how long (in hours) will it take him to cross the lake?

3. The populations of termites and spiders in a certain house are growing exponentially. The house contains 100 termites the day you move in. After 4 days, the house contains 200 termites. On day 3 after moving in, there are two times as many termites as spiders. On day 8, there were four times as many termites as spiders.

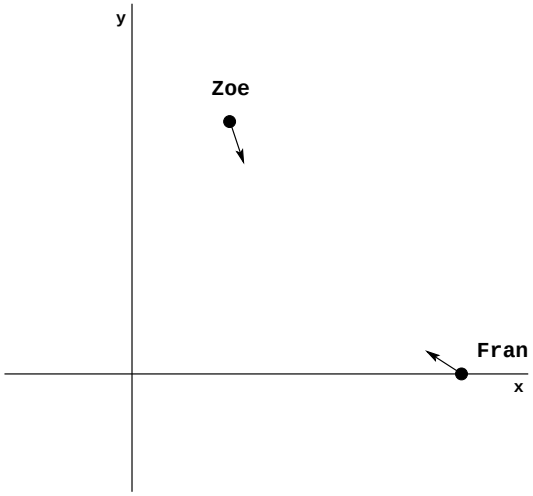
   How long (in days) does it take the population of spiders to triple?

4. As a result of an attack by aliens, in which his brain was exposed to zeta waves, Howard has become Sometimes Smart Guy. His IQ is a sinusoidal function of time. His IQ is at its lowest, 67 points, 4.25 hours after the attack. His IQ then increases to a maximum of 253 points 9.75 hours after the attack.

   During the first 24 hours following the attack, for how many hours is Sometimes Smart Guy's IQ at or above 200?

5. Fran and Zoe live in the coordinate plane. At midnight, Fran starts out from the point (35,0). She moves at a constant speed along a straight line and will pass through the point (0,18) after 5 seconds.

   At midnight, Zoe starts out from the point (5,22) and heads toward the fourth quadrant along the line $y = -(x - 5) + 22$ at the rate of 3 units per second.



   (a) Find parametric equations for Fran's location t seconds after midnight.

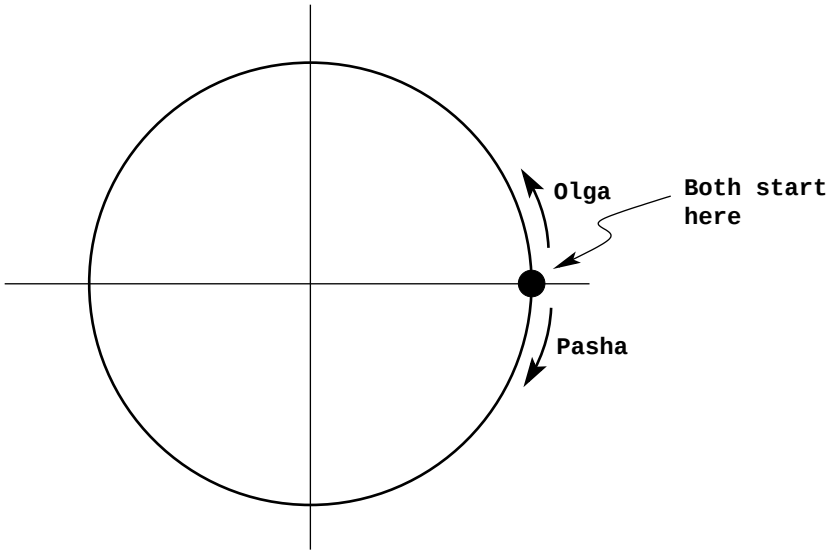
   (b) How long does it take Zoe to reach the x-axis?

   (c) Find parametric equations for Zoe's location t seconds after midnight.

6. Maude is conducting an orchestra of mice. She knows she can achieve a loudness of 80 decibels with 100 mice. With more mice, the loudness will approach, but never exceed, 120 decibels. Of course, with no mice, she achieves a loudness of 0 decibels.

   If the loudness of the orchestra is a linear-to-linear function of the number of mice, how many mice would she need to achieve a loudness of 110 decibels?

7. Pasha and Olga are running around a circular track. They start out together, but run in opposite directions. Pasha runs at 4 meters per second, and it takes him 92 seconds to complete each lap of the track. Olga takes 86 seconds to complete each lap.



(a) What is Pasha's angular speed in radians per second?

(b) What is the radius of the track?

(c) What are Olga's coordinates t seconds after she starts running?

(d) When do Pasha and Olga pass each other for the first time?

8. Let $f(x)$ be defined as follows:

$$f(x) = \begin{cases} 5 - x & \text{if } x < 4 \\ 18 - 2x & \text{if } x \geq 4 \end{cases}$$

(a) Find all solutions to the equation $f(x) = -1$.

(b) Write the multipart rule for the function

$$g(x) = |x - 2| + 3f(x).$$