MAT 127 First Midterm

February 20, 2006

Name: _____ **ID:** _____ **Lect:** _____

Lec 1: Saveleyev, MWF 9:35 Lec 2: Sutherland, TuTh 2:20 Lec 4: Unal, TuTh 5:20

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

There are 5 problems in this exam. The pages are printed on both sides. Make sure that you have them all.

Do all of your work in this exam booklet, and cross out any work that the grader should ignore. You may use the backs of pages, but indicate what is where if you expect someone to look at it. **Books, calculators, extra papers, and discussions with friends are not permitted.** Feel free to consult the Psychic Friends Network if you can do so telepathically.

Problems without full justification (ie, "work") will not receive full credit, even for correct answers.

Leave all answers in exact form (that is, do *not* approximate π, square roots, and so on.)

You have 90 minutes to complete this exam.

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Name: _____ **Id:** _____

1. A culture of bacteria grows at a rate proportional to the number of bacteria present in the culture. At noon on January 24, there were 15 thousand bacteria. At 2 PM, there were 60 thousand present.

   (a) [12 points] Give a formula for $B(t)$, the number of bacteria in the culture t hours after noon on January 24.

   (b) [8 points] When will there be 100 thousand bacteria in the culture?

2. [20 points] Consider the initial value problem given by

$$y' = x - 3y \qquad y(0) = 0$$

Use Euler's method with a stepsize $h = 1$ to find an approximation to $y(3)$.
To receive full credit, show your intermediate steps *clearly*.

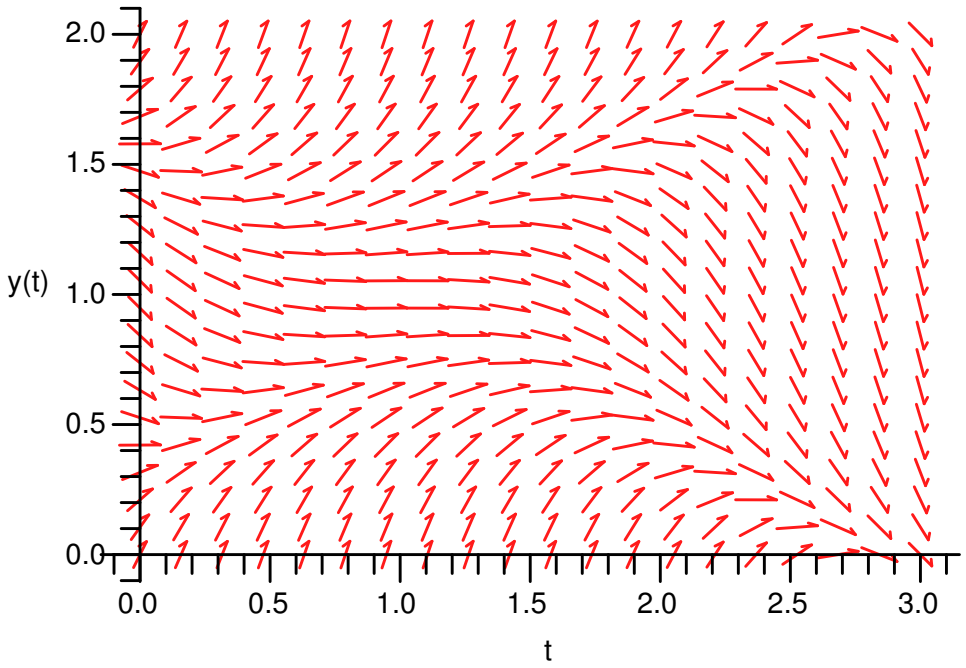
3. Consider the second order linear differential equation

$$y'' - 9y = 0$$

(a) [10 points] Write a formula for the general solution $y(t)$.

(b) [10 points] Let $y(t)$ be the specific solution with $y(0) = 1$ and $y'(0) = 0$. Write a formula for $y(t)$.

4. The direction field for a differential equation is shown below.



(a) [15 points] On the direction field, sketch and **clearly label** the three solutions with initial conditions

$$y_1(0) = 0 \qquad y_2(0) = 1 \qquad y_3(0) = 1.5$$

(b) [5 points] Are there any equilibrium solutions (also called stationary solutions, or constant solutions)? If there are, identify them. If not, give a reason why not.

5. Write solutions to the following initial-value problems.

(a) [10 points] $y' = \dfrac{e^{5x}}{y^4} \qquad y(0) = -1$

(b) [10 points] $y' = 1 + y^2 \qquad y(1) = 0$

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