

Exam #3
Math 341 - Fall 2002
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Below is the third exam of the semester for Math 341, Fall 2002. Please show all your work clearly. No books, notes, calculators or friends are allowed. Good luck!

(1) A block weighing 32lbs is attached to a spring and stretches the spring 8/9ft. The system moves in a viscous fluid that provides a damping force proportional to the velocity; the damping coefficient is γ .

(a) (5 points) Find the spring constant for the spring.

(b) (5 points) Write the equation of motion for the mass-spring system.

(c) (10 points) Assume that at time zero the block is displaced 1/2ft and released from rest and assume that $\gamma = 13$. Solve for the motion of the block. Plot your solution and indicate the behavior as $t \rightarrow \infty$.

(d) (10 points) Assume the same initial conditions as in part (c), but assume the damping coefficient is $\gamma = 8$. Solve for the motion of the block. Plot your solution and indicate the behavior as $t \rightarrow \infty$.

(e) (15 points) Assume the same initial conditions and damping coefficient as in part (d) but assume the block is forced by a forcing term of $72 \cos(6t)$. Solve for the motion of the block. Determine the steady-state behavior of the system.

(2) (15 points) Define *linear transformation*.

(3) (20 points) Put the following matrix in reduced row-echelon form

$$\begin{pmatrix} 1 & 1 & -1 & 1 \\ 2 & 1 & 3 & 2 \\ 0 & 1 & -5 & 1 \end{pmatrix}$$

(4) (20 points) Find all solutions of the following system

$$\begin{aligned} x_1 + x_2 - x_3 &= 1 \\ 2x_1 + x_2 + 3x_3 &= 2 \\ x_2 - 5x_3 &= 1 \end{aligned}$$