

Math 5A Midterm: Grading and Partial Credit Philosophy

Accurately solving problems is heavily dependent on correctly setting up the mathematical models. Incorrectly setting up a problem with the aid of a note-sheet suggests a lack of mastery of the concepts covered in sections 4.1 through 4.4 of the text, and resulted in significant point deductions. A student who correctly set up problems but made minor computational errors afterwards still earned the majority of the available credit, and with the extra credit opportunities, often could still earn over 100 on the exam.

- 1.) (32 points) This is an initial value problem, so the numerical values are particularly important. Incorrectly calculating the roots of the characteristic polynomial can significantly alter the nature of the problem by completely changing the model from the intended overdamped case. Using an incorrect model suited to a different damping case left students unable to show their understanding of the overdamped case of an initial value problem, and those errors were awarded at most roughly one third of the total possible credit. The first 15 points of credit were given to those who correctly identified the characteristic roots and the general solution to the overdamped system based on those roots. Another 5 points were given to those who then correctly identified the derivative of the general solution. The remaining 12 points were awarded to those who correctly calculated the two linear equations produced by the initial position and initial velocity, and then correctly solved for the unknown constants in the general solution to identify the particular solution satisfying the given initial conditions.
- 2.) (32 points) Although this was one problem, a student's performance was evaluated in three parts: (1) Finding the homogenous solution (12 points), (2) Finding the first particular solution (8 points), (3) Finding the second particular solution (12 points).
 - a) As emphasized in discussion-section, and italicized in the book in section 4.4 on page 251, **ALWAYS CHECK THE HOMOGENOUS SOLUTION FIRST**. If a student found the correct homogenous solution, 12 points were awarded. If the student did not check the homogenous solution and did not give the correct particular solution, no points were awarded for this portion of the problem. However, if the student was able to find the correct particular solution without finding the homogenous solution, there were no points deducted from the student's score.
 - b) The third part of this problem was evaluated in the following manner: If a student was able to correctly guess the associated polynomial of the particular solution, eight points were awarded. If all computations were correct and led to the correct answer, an additional four points were awarded. If the student was not able to complete either part of this problem, no points were awarded.
- 3.) (28 points) The challenge in this problem is to correctly identify the roots of the characteristic polynomial, the real and imaginary components of those roots (that is, the α and β values as presented on page 230), and then use those values to express the general solution in one of the acceptable forms involving real functions. If errors caused a student to incorrectly use a model for a different damping case (rather than the correct under-damped case), they could potentially earn up to half credit on this problem. Correctly identifying the characteristic roots earned the first 10 points, identifying the α and β values earned another 6 points, and the remaining 12 points depended on presenting the general solution either in the linear combination form (with c_1 and c_2) or the quasi-periodic form (with A and δ). Common errors included incorrectly identifying the β value, neglecting to include the arbitrary constants in the general solution, and neglecting to include the variable t properly in the solution, resulting in deductions of 4 to 8 points (depending on the severity of each error).
- 4.) (12 points, 14 points)
 - a.) This problem asks for specific k values for which the mass-spring system of Problem 1 will be over-damped, critically damped, or under-damped. While it is true that the discriminant greater than zero, equal to zero, and less than zero, will yield over-damped, critically-damped, and under-damped cases respectively, this was not enough to be awarded any credit for this problem. Partial credit was awarded if the student attempted to find the general k , demonstrating they understood what was being asked, but made minor arithmetic errors in their calculations.
 - b.) This problem was straightforward in that the only answer that could be accepted was a trajectory drawn in the phase plane. A time-series graph, even if accurate, was not accepted given the specific request of the problem. However, partial credit was given if a student drew a spiral approaching the origin, but in the wrong direction.