Continuing Opportunity to Demonstrate Mastery

If there were topics on the mid-term for which you did not yet demonstrate mastery, you can have another chance to do so. Below is a list of topics associated to each of the questions. If you would like to have another chance to demonstrate mastery on any of these topics, here is what you need to do:

1. Correct that question on the exam and show your correct work to Professor Donnay. You may come see him for help and also get help from Kathryn.

2. Do some additional problems related to that topic and hand those in to be checked. For each question, I give you some problems to do. You will need to do at least those problems but you can do more.

3. When you have done (1) and (2), you can take a new assessment on the topics you have prepared. If you demonstrate mastery on this new assessment, your midterm score will be adjusted to indicate this new level of proficiency. You have until the last day of the semester to finish the re-assessment.

Topics:

Question 1: Types of differential equations. Practice problems:

a. \( \frac{dy}{dt} = t^2 + e^t y \)  
   Separable/ Non-Separable  
   Linear/ Non-Linear  
   Homogeneous / Non- homogeneous  
   Constant Coefficient/ Non-Constant Coefficient

b. \( \frac{dy}{dt} + 5ty = 0 \)  
   Separable/ Non-Separable  
   Linear/ Non-Linear  
   Homogeneous / Non- homogeneous  
   Constant Coefficient/ Non-Constant Coefficient

Question 2: Check and guess method to determine if a function solves a DE. Sect. 1.2 # 2 (3rd Edition). Also check whether \( y(t) = 4t^2 + 3t + 2 \) solves the differential equation

\[
\frac{dy}{dt} + 2y = 8t^2 + 10t + 7
\]

Explain. If it does not solve the differential equation, give a differential equation that it does solve.

Question 3: Create a model by translating a sentence. Sect. 1.1 #10, Also, ”A new species of insect is spreading across the country. We wish to determine the amount of land that the insect is populating. The amount of land populated by the insects is growing at a rate that is proportional to the amount of land that the insects have already populated. Write a differential equation that models this situation. Decide for yourself what would be appropriate units.”
Question 4: Slope fields and equilibrium. Sect 1.6 #2, 32, 35.

Question 5: Euler's method. Sect 1.5 #10 with \( y(0) = -5 \) and \( 0 \leq t \leq 2 \). Do it first (by hand) with \( \Delta t = .5 \). Then do it with Excel with \( \Delta t = .2 \).


Question 7 (a). Mixing Problem. Sect 1.2 #33 (set up the model. Solve for \( t=10 \) minutes and give limit as \( t \to \infty \)). Sect 1.9 #25 (set up the model for this but do not solve).

(b) Separation of variables (see above) and Non-homogeneous linear equations. Sect 1.8 #9, 21.

Question 8: Slope field, equilibrium, qualitative analysis of solutions, phase line. Sect 1.6 #7 (also sketch the slope field and draw a variety of solutions with different initial conditions), #30 (also sketch the slope field and draw a variety of solutions with different initial conditions). (also sketch the slope field and draw a variety of solutions with different initial conditions) Question 9: Bifurcations. Sect 1.7 #2.