Sample Exam 1 MA 2051 BD01-BD03,BD05 - Differential Equations Worcester Polytechnic Institute Fall 2021 Prof. B.S. Tilley

You are allowed a 45 minutes to complete all aspects of the exam. There are six problems to be solved. You should have ample room on these sheets to complete your work. The total number of points is 100.

Note:

- All materials except for a pencil or pen should be put in a book bag, and that book bag needs to be completely closed.
- Please put your name and section number in the upper right-hand corner of this page.
- No calculators, phones, tablets, computers, or watches are allowed during the exam.
- The exam is closed book: no textbooks or notes of any kind are allowed on the exam.
- You have 45 minutes to complete the exam.
- You need to show your WPI identification in order to turn in your completed exam.
- This exam is subject to WPI's Academic Honesty Policy, and by taking this exam, you agree not to discuss its contents with any other WPI student without your instructor's approval.

1. (10 points) Classify the following differential equations in terms of order, linear or nonlinear. Further, if the equations are linear, state whether the equation is either homogeneous or nonhomogeneous and if the coefficients are constant or variable.

(a)

$$y^{(iv)} + 3t^2y'' + 8y - \cos t = 0.$$

(b)

$$\frac{d^2y}{dt^2} + y = \alpha y^3 .$$

(c)

$$\frac{d^2y}{dt^2} + y = 0 \ .$$

- 2. (20 points)
 - (a) Find the general solution of the differential equation

$$\frac{dy}{dx} = \frac{x^2 + 2xy}{x^2}$$

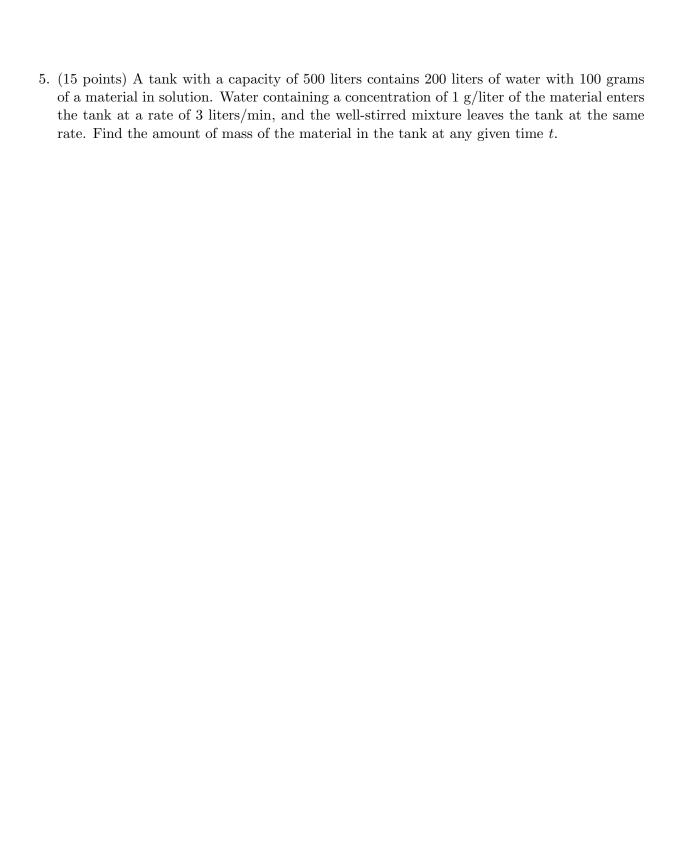
(b) Solve the initial-value problem

$$\frac{dy}{dx} = \frac{x + xy^2}{y}$$
, $y(1) = 0$.

 $3.~(20~{
m points})$ Find the general solution of the differential equation

$$y' + y = e^{-x} \sin x ,$$

4. (20 points) If the number of bacteria in a culture is 5 million at the end of 6 million at the end of 9 hours, how many bacteria were present initially?	hours and 8



Additional Space for Question 5

