

Math 242, Exam 2, Spring, 2024

You should KEEP this piece of paper. Write everything on the **blank paper provided**. Return the problems **in order** (use as much paper as necessary), use **only one side** of each piece of paper. Number your pages and write your name on each page. Take a picture of your exam (for your records) just before you turn the exam in. I will e-mail your grade and my comments to you. **Fold your exam in half** before you turn it in.

The exam is worth 50 points. Each problem is worth 10 points. **Make your work coherent, complete, and correct.** Please CIRCLE your answer. Please **CHECK** your answer whenever possible.

The solutions will be posted later today.

No Calculators, Cell phones, computers, notes, etc.

- (1) Is $y = e^x \cos x$ a solution of $y'' - 2y' + 2y = 0$? Explain.
- (2) Solve the Differential Equation

$$xy \frac{dy}{dx} = y^2 + x\sqrt{4x^2 + y^2}.$$

Please check your answer.

- (3) Solve the Differential Equation

$$x \frac{dy}{dx} + 4y - x^4 y^2 = 0.$$

Please check your answer.

- (4) Suppose an object is dropped near the surface of a planet. Gravity provides a constant acceleration of g ft/sec², while air resistance provides r ft/sec² of deceleration for each foot per second of the objects's velocity.
- (a) Find the velocity of the object at time t . (Of course your answer will involve the positive constants g and r .)
- (b) Find the limit as time goes to infinity of the velocity of the object.
- (5) A 1500 gallon tank initially contains 600 gallons of brine, which is water with 5 lbs of salt dissolved in it. Brine, with a salt concentration of $15(1 + \cos(t))$ lbs/gal, enters the tank at a rate of 9 gal/hr. The well mixed solution leaves the tank at a rate of 6 gal/hr. Let $x(t)$ represent the number of pounds of salt in the tank at time t , where t is measured in hours. Write the Initial Value Problem whose solution is equal to $x(t)$. **Please, do not solve the Initial Value Problem. Just write it down.**