Math 240 - Test 1B

February 10, 2022

Name _____

Score _____

Show all work to receive full credit. Supply explanations where necessary. This test is due February 15. The other portion of the test is in Canvas. **You must work individually on this test.**

1. (12 points) Use the test for exactness to show that the equation is exact. Then solve the initial value problem.

$$3y(x^2 - 1)\,dx + (x^3 + 8y - 3x)\,dy = 0, \qquad y(1) = 2$$

2. (10 points) Solve: $x^2yy' = e^y$

3. (10 points) Solve: $\dfrac{dy}{dx} = \dfrac{-3xy}{x^2 + y^2}$. (Hint: Take the reciprocal of both sides and think about x as a function of y.)

4. (12 points) A tank contains 80 gallons of pure water. A brine solution with 2 lb/gal of salt enters at 2 gal/min, and the well-stirred mixture is drained at the same rate. Find the amount of salt in the tank at time t. When will the tank have a salt concentration of 1 lb/gal?

5. (10 points) Assume $x, y > 0$ and solve: $\quad -2x\dfrac{dy}{dx} + (1+x)y = 6y^3$