

YOUR NAME: _____

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Read each problem **very carefully** before starting to solve it. Each problem is worth 10 points. It is necessary to show **all** your work. Correct answers without explanations are worth 0 points. GOOD LUCK!!

1. Determine the values of the parameter r for which the following differential equation has a solution of the form $y(t) = t^r$.

$$t^2 y'' + 4ty' + 2y = 0.$$

2. Solve the initial value problem

$$y' = \frac{2x}{y + x^2 y}, \quad y(0) = -2.$$

3. (a) Compute the integral $\int te^{\frac{1}{2}t} dt$.

(b) Find the general solution of

$$2y' + y = 3t.$$

4. Consider the differential equation

$$y' = e^{2x} + y - 1.$$

(a) Test whether the given equation is exact or not. Show clearly all your steps and state clearly your answer with a brief justification.

(b) If the equation is exact solve it. If it is not exact find an integrating factor $\mu(x)$ that would make it exact. In the latter case, you do not have to solve the resulting equation.

5. Find the particular solution of the initial value problem

$$6y'' - 5y' + y = 0, \quad y(0) = 4, \quad y'(0) = 0.$$