Engineering Mathematics – Midterm 1

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1. Solve the ODE by any method.   10

$$y' = \frac{y^2 - 2y + 2}{\sqrt{x}(x + 1)}$$

2. Solve the ODE by method of integration factor.   10

$$x^2 y' + 13xy = \frac{x^2 + 3}{x^{11}(x + 2)}$$

3. Solve the ODE by method of variation of parameters.   10

$$y' + \frac{1}{x}y = \cos(5x)$$

4. Solve the ODE by any method that you prefer.   10

$$y' + 2\cot(x)\, y = \cot(x)\, y^6$$

5. Solve the ODE by method of exact equations.   10

$$\left(\frac{y}{1 + x^2 y^2} + ye^{xy}\right) dx + \left(\frac{x}{1 + x^2 y^2} + xe^{xy}\right) dy = 0$$

6. Suppose that a 9-th order homogeneous linear differential   10
    equation with constant coefficients has characteristic roots:

    2, 2, 3, 4+2i, 4-2i, 4+2i, 4-2i, 7-3i, 7+3i

    What are the general solutions of the differential equation?