

**Instructions:** Complete each of the following on separate, stapled sheets of paper.

1. Solve each of the following ODEs via variation of parameters (**Hint:** Complementary solutions?).

(a)  $y'' + y = \sin(x)$

(c)  $y'' + y = \sec^2(x)$

(e)  $y'' + y = \sec(\theta) \tan(\theta)$

(b)  $y'' + y = \sec(x)$

(d)  $y'' + y = \tan(x)$

(f)  $y'' + y = \cos^2(x)$

2. Solve the following ODEs via variation of parameters.

(a)  $3y'' - 6y' + 6y = e^x \sec(x)$

(c)  $y'' + y' - 2y = \ln(x)$

(b)  $y'' - 2y' + y = e^x \arctan(x)$

(d)  $2y'' + 2y' + y = 4\sqrt{x}$

3. Solve the following ODEs (**Hint:** Can you easily reduce the order first?).

(a)  $y''' + y' = \tan(x)$

(b)  $y''' + 4y' = \sec(2x)$

(c)  $y''' - 3y'' + 2y' = \frac{e^{3x}}{1 + e^x}$

4. For each of the following Cauchy-Euler equations, determine all solutions of the form  $y = x^m$ .

(a)  $xy'' + xy' = 0$

(c)  $x^3y''' + xy' - y = 0$

(b)  $x^2y'' - 7xy' + 41y = 0$

(d)  $x^4y^{(4)} + 6x^3y^{(3)} + 9x^2y'' + 3xy' + y = 0$

5. Solve the following IVPs.

(a)  $4y'' - y = xe^{\frac{x}{2}}; \quad y(0) = 1, \quad y'(0) = 0$

(b)  $2y'' + y' - y = x + 1; \quad y(0) = 1, \quad y'(0) = 0$

6. Study for Midterm 2.