

# MA 221 Homework Solutions

## Due Thursday/ Friday, February 5/6, 2009

4.2 p. 167-169 # 19, 47

4.3 p. 177 #26

4.4 p. 186 # 19

(Underlined problems are to be handed in)

### Section 4.2

For problem 19, solve the given initial value problem.

19.)

$$y'' - 4y' - 5y = 0, y(-1) = 3, y'(-1) = 9$$

Solution:

$$r^2 - 4r - 5 = (r - 5)(r + 1) = 0$$

$$r = 5, -1$$

$$y(t) = c_1 e^{5t} + c_2 e^{-t}$$

$$y(-1) = 3 = c_1 e^{-5} + c_2 e$$

$$y'(-1) = 9 = 5c_1 e^{-5} - c_2 e$$

Solving the system

$$c_1 = 2e^5$$

$$c_2 = e^{-1}$$

$$\Rightarrow y(t) = 2e^{5(t+1)} + e^{-(t+1)}$$

For problem 47, solve the initial value problem.

47.)

$$y''' - y' = 0, y(0) = 2, y'(0) = 3, y''(0) = -1$$

$$r^3 - r = 0$$

$$r = 1, -1, 0$$

$$y(t) = c_1 e^{0t} + c_2 e^{-t} + c_3 e^t = c_1 + c_2 e^{-t} + c_3 e^t$$

$$y'(t) = -c_2 e^{-t} + c_3 e^t$$

$$y''(t) = c_2 e^{-t} + c_3 e^t$$

$$y(0) = c_1 + c_2 + c_3 = 2$$

$$y'(0) = -c_2 + c_3 = 3$$

$$y''(0) = c_2 + c_3 = -1$$

$$c_1 = 3$$

$$c_2 = -2$$

$$c_3 = 1$$

$$\Rightarrow y(t) = 3 - 2e^{-t} + e^t$$

### Section 4.3

For problem 26, solve the initial value problem.

26.)

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

$$r^2 - 2r + 1 = (r - 1)^2 = 0$$

$$r = 1$$

$$y(t) = c_1 e^t + c_2 t e^t$$

$$y'(t) = c_1 e^t + c_2 t e^t + c_2 e^t$$

$$y(0) = c_1 = 1$$

$$y'(0) = c_1 + c_2 = -2$$

$$c_1 = 1, c_2 = -3$$

$$\Rightarrow y(t) = e^t - 3te^t$$

#### Section 4.4

For problem 19, find a particular solution to the differential equation.

19.)

$$4y'' + 11y' - 3y = -2te^{-3t}$$

$$y_p(t) = t^s(A_1 t + A_0)e^{-3t}$$

$$4r^2 + 11r - 3 = 0$$

$$r = -3, s = 1$$

$$y_p(t) = t(A_1 t + A_0)e^{-3t} = (A_1 t^2 + A_0 t)e^{-3t}$$

$$y_p' = [-3A_1 t^2 + (2A_1 - 3A_0)t + A_0]e^{-3t}$$

$$y_p'' = [9A_1 t^2 + (9A_0 - 12A_1)t + 2A_1 - 6A_0]e^{-3t}$$

$$[-26A_1 t e^{-3t} + (8A_1 - 13A_0)e^{-3t}] = -2te^{-3t}$$

$$-26A_1 = -2, 8A_1 - 13A_0 = 0$$

$$A_1 = 1/13, A_0 = 8/169$$

$$\Rightarrow y_p(t) = (t/13 + 8/169)te^{-3t}$$