MATH 307: Problem Set #5

Due on: May 18, 2015

Problem 1 *Annihilating Operators*

For each of the following, find a nonzero linear ordinary differential operator with constant coefficients which annihilates the specified function

(a) 13

(b) e^{4t}

(c) $\sin(2t)$

(d) te^t

. . . . . .

Problem 2 *Annihilating Operators*

For each of the following, use the method of annihilating operators to determine a form for the particular solution y_p

(a) $y'' - 2y' - 3y = 5e^{2t}$

(b) $y'' - 2y' - 3y = 17e^{-t}$

(c) $y'' + 2y' + 5y = \cos(2t)$

(d) $y'' + 2y' + y = 2e^{-t}$

. . . . . .

Problem 3 *Method of Undetermined Coefficients: General Solutions*

In each of the following, find the general solution of the given differential equation

(a) $y'' - 2y' - 3y = 3e^{2t}$

(b) $y'' - 2y' - 3y = -3te^{-t}$

(c) $y'' - 2y' - 3y = te^{-t} + 7e^{2t}$

(d) $y'' - 2y' - 3y = 2te^{-t} - 3e^{2t}$

(e) $y'' - 2y' - 3y = 4te^{-t} + e^{2t}$

(f) $y'' + 2y' + 5y = \sin(2t)$

(g) $y'' + 2y' + 5y = \cos(2t)$

(h) $y'' + 2y' + 5y = 4\sin(2t) + 7\cos(2t)$

(i) $y'' + 2y' = 3 + 4\sin(2t)$

(j) $y'' + 2y' + y = 2e^{-t}$

(k) $y'' + y = 3\sin(2t)$

(l) $y'' + y = t\cos(2t)$

(m) $y'' + y = 3\sin(2t) + t\cos(2t)$

(n) $y'' - y' - 2y = e^{t}$

(o) $y'' - y' - 2y = e^{-t}$

(p) $y'' - y' - 2y = \cosh(t)$ [Hint: $\cosh(t) = (e^{t} + e^{-t})/2$]

. . . . . .

Problem 4 *Method of Undetermined Coefficients: Initial Value Problems*

In each of the following, find the solution of the given initial value problem

(a) $y'' + 4y = t^2 + 3e^{t}$, $y(0) = 0$, $y'(0) = 2$

(b) $y'' - 2y' - 3y = 3te^{2t}$, $y(0) = 1$, $y'(0) = 0$

(c) $y'' + 2y' + 5y = 4e^{-t}\cos(2t)$, $y(0) = 1$, $y'(0) = 0$

. . . . . .

Problem 5 *More differential operator techniques*

Using differential operators to convert each of the following to a system of two first-order equations. Then solve it.

(a) $y'' - 3y' - 4y = 3e^{2t}$

(b) $y'' + 2y' + y = 2e^{-t}$

. . . . . .