18.03 Recitation 9

Operator Notation and ERF

1. (a) Express $(D^3 - D)(x + y)$ as an operator acting on x plus and operator acting on y. (If $(D^3 - D)(x + y) = Ax + By$, what do A and B equal in terms of D?)

(b) Find the general solution to the homogeneous equation $(D^3 - D)x = 0$?

(c) Find a particular solution to $(D^3 - D)x = e^{2t}$.

(d) Find a particular solution to $(D^3 - D)x = e^{-t}$.

(e) Find a particular solution to $(D^3 - D)x = 1$.

2. (a) Find a particular solution of $(D^2 + 9)x = e^{3t} + 9$.

(b) Find a particular solution of $\dfrac{d^4x}{dt^4} - x = e^{-2t}$.

4. Consider the damped harmonic oscillator corresponding to the differential operator $10D^2 + 2D + 5I$. Find:

(a) the angular frequency ω_n that the undamped oscillator would have, in case the damping term were put to zero.

(b) the rate a at which the exponential decay occurs, when the homegeneous solution has a factor e^{-at}.

(c) the angular frequency ω_d.