

# Math 3325

## Annihilator Problems

1. Write down the annihilators for each of the following functions:

- (a)  $f(x) = x^3 e^{-4x}$
- (b)  $f(x) = 2x^3 \cos 2x - 3e^{-x} \cos 2x$
- (c)  $f(x) = x \cos 3x$
- (d)  $f(x) = x^3 \sin^3 x$
- (e)  $f(x) = x^2 - 3xe^{-5x}$
- (f)  $f(x) = (x - 4x^2 e^{-3x})^3$ .

2. Write down the "best possible" form of a particular solution to each of the following non-homogeneous differential equations:

- (a)  $(D + 1)^3 y = \sin x$
- (b)  $(D^2 + 1)^3 y = \sin x$
- (c)  $(D - 1)^2 (D + 3)^4 (D^2 - 9)^4 y = xe^x - x^4 e^{-3x}$
- (d)  $(D^4 - 3D^3 + 6D^2 - 5D + 2)y = x^3 e^{2x}$
- (e)  $(D^5 - 2D^4 - 2D^3 + 8D^2 - 7D + 2)y = x^3 e^x$ .

3. Using the annihilator method, find a particular solution to each of the following non-homogeneous problems:

- (a)  $(D + 2D - 3)y = e^x$
- (b)  $(D - 1)^2 y = xe^x$
- (c)  $(D^2 + 1)y = 2 \cos x - 3 \sin x$

4. Find the general solution to each of the problems in Problem 3.