

Undetermined Coefficients Worksheet

1 We'll start out by solving the ODE $y'' + 3y' + 2y = e^t$.

(a) Find the general solution, $y_c(t)$, of the corresponding homogeneous equation, $y'' + 3y' + 2y = 0$.

(b) Write down the trial solution $Y(t)$ for the nonhomogeneous equation.

(c) Plug $Y(t)$ into the nonhomogeneous equation and solve for the unknown coefficient(s) A, B, C, \dots (*Side note: the solution $Y(t)$ you get after plugging in the coefficients is usually called a particular solution.*)

(d) Write down the general solution of the ODE by adding the particular solution $Y(t)$ and the homogeneous solution $y_c(t)$.

2 Now let's solve a similar looking ODE: $y'' - 3y' + 2y = e^t$.

(a) Find $y_c(t)$, the general solution of the corresponding homogeneous equation.

(b) The trial solution $Y(t)$ for the nonhomogeneous equation should be the same as for the first problem, because the trial solution only depends on the nonhomogeneous part of the equation, which hasn't changed.

Plug $Y(t)$ into the nonhomogeneous equation and solve for the unknown coefficient(s). What happens?

3 Write down the trial solutions for each of these nonhomogeneous equations. (You don't have to solve for the coefficients)

(a) $y'' - 3y = t \cos t$

(b) $y'' + 2y' + 5y = e^{-t} \cos t + 4t$

4 Write down the trial solutions for each of these nonhomogeneous equations — some may need multiplying by t .

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

(b) $y'' - y = 3te^t + t \cos t$

(c) $y'' + y = 3te^t + t \cos t$

(d) $y'' + y = e^t \cos t$