

- (1) Consider the differential equation $y'' - 2xy' + 3x^2y = 0$. Find the first 6 terms of a series solution to the equation (with two constants).
- (2) Consider the differential equation $y'' + e^x y = 0$. Find the first 6 terms of a series solution to the equation (with two constants).
- (3) Consider the system of equations

$$-2x - y + x' = 0$$

$$y' - x - 2y = z$$

$$z' = y + 2z.$$

- (a) Write this system as a matrix equation.
- (b) Find the eigenvalues of the matrix.
- (c) Find the eigenvectors of the matrix.
- (d) Write down the general form of the solution using vector notation.