

Section 3: Solving systems of differential equations

Exercise level 1

1. Eliminate x from these systems of differential equations to obtain a second order differential equation in y and t .

(i) $\frac{dx}{dt} = 2x - 9y$ $\frac{dy}{dt} = x + 3y$

(ii) $\frac{dx}{dt} = 2x + 3y$ $\frac{dy}{dt} = 5x + 4y$

(iii) $\frac{dx}{dt} = x - y$ $\frac{dy}{dt} = 2x - 4y + 1$

2. Eliminate y from these systems of differential equations to obtain a second order differential equation in x and t .

(i) $\frac{dx}{dt} = -2x + y$ $\frac{dy}{dt} = x + y$

(ii) $\frac{dx}{dt} = 0.1x - 0.9y$ $\frac{dy}{dt} = 0.2x + 0.3y$

(iii) $\frac{dx}{dt} = 2x - y + 5$ $\frac{dy}{dt} = 7x - y + 2$

3. Find the general solution of the systems of differential equations

(i) $\frac{dx}{dt} = 2x + 6y$ $\frac{dy}{dt} = x + y$

(ii) $\frac{dx}{dt} = x + 4y$ $\frac{dy}{dt} = 2x - y$

(iii) $\frac{dx}{dt} = x - 13y - 5$ $\frac{dy}{dt} = 2x - 9y + 7$

4. (i) Find the general solution of the system of differential equations.

$$\frac{dx}{dt} = 3x + 7y \qquad \frac{dy}{dt} = x - 3y$$

- (ii) Find the particular solution given that at $t = 0$, $x = 0$ and $y = 16$.