

## Section 2: Non-homogeneous differential equations

### Exercise level 1

1. Find the general solutions of the following differential equations.

(i)  $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = 4x^2$

(ii)  $\frac{d^2y}{dx^2} + 4y = e^{2x}$

(iii)  $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = \sin 2x$

(iv)  $\frac{d^2y}{dx^2} + \frac{dy}{dx} - 2y = 6e^x$

(v)  $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 10y = x + \cos x$

(vi)  $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 4y = e^{-2x}$

2. Find the particular solutions of the following differential equations with the given initial conditions.

(i)  $\frac{d^2y}{dx^2} + y = 10e^{-2x}$        $y = 0$  and  $\frac{dy}{dx} = 0$  when  $x = 0$

(ii)  $\frac{d^2y}{dx^2} - \frac{dy}{dx} - 6y = 50\sin x$        $y = 1$  and  $\frac{dy}{dx} = 3$  when  $x = 0$

(iii)  $2\frac{d^2y}{dx^2} - \frac{dy}{dx} - y = 2x^2 - 3$        $y = 0$  and  $\frac{dy}{dx} = 4$  when  $x = 0$