

# SHEET 6 SECOND ORDER DIFFERENTIAL EQUATIONS

1. Find the general solution for the following second order differential equations.

(a)  $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = 0,$

(b)  $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 0,$

(c)  $\frac{d^2y}{dx^2} - 7\frac{dy}{dx} + 12y = 0,$

(d)  $\frac{d^2y}{dx^2} - 8\frac{dy}{dx} + 7y = 0,$

(e)  $\frac{d^2y}{dx^2} + \frac{dy}{dx} - 2y = 0,$

(f)  $\frac{d^2y}{dx^2} + \frac{dy}{dx} - 6y = 0,$

(g)  $\frac{d^2y}{dx^2} - \frac{dy}{dx} - 12y = 0,$

(h)  $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} - 7y = 0,$

(i)  $4\frac{d^2y}{dx^2} - 6\frac{dy}{dx} - y = 0,$

(j)  $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} - 2y = 0,$

(k)  $-2\frac{d^2y}{dx^2} + \frac{dy}{dx} - 3y = 0,$

(l)  $3\frac{d^2y}{dx^2} - 6\frac{dy}{dx} - 7y = 0,$

2. Find the specific solution to the indicated parts of question 1 using the following.

(a)  $y(0) = 1, y'(0) = 0,$

(b)  $y(0) = -1, y'(0) = 1,$

(c)  $y(0) = 2, y'(0) = 1,$

(d)  $y(0) = 3, y'(0) = 1,$

(e)  $y(0) = 1, y'(0) = -1,$

(f)  $y(0) = 0, y'(0) = 1,$

(g)  $y(0) = 1, y(5) = 4,$

(h)  $y(0) = 1, y'(5) = 5.$

3. Find the general solution of the following second order differential equations.

(a)  $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = 0,$

(b)  $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 9y = 0,$

(c)  $4\frac{d^2y}{dx^2} - 12\frac{dy}{dx} + 9y = 0,$

(d)  $9\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + y = 0,$

(e)  $4\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + y = 0,$

(f)  $9\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + y = 0,$

4. Find the specific solutions of question 3 which satisfy the following.

(a)  $y(0) = 1, y'(0) = 2,$

(b)  $y(0) = -1, y'(0) = 0,$

(c)  $y(0) = -2, y'(0) = 0,$

(d)  $y(0) = 2, y'(0) = 3,$

(e)  $y(0) = -1, y(1) = 1,$

(f)  $y(0) = -2, y(1) = 0.$

