

Advanced Higher Mathematics - Methods in Algebra and Calculus
Unit Assessment Preparation - Further Practice Questions

Methods in Algebra and Calculus Assessment Standard 1.4

1. Find the particular solution of the 2nd order differential equations:

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

(b) $\frac{d^2y}{dx^2} + \frac{dy}{dx} - 6y = 0$ when $x = 0, y = 0$ and $\frac{dy}{dx} = 10$

(c) $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 3y = 0$ when $x = 0, y = 3$ and $\frac{dy}{dx} = 5$

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

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

(f) $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 4y = 0$ when $x = 0, y = 1$ and $\frac{dy}{dx} = 2$

(g) $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 2y = 0$ when $x = 0, y = 1$ and $\frac{dy}{dx} = 3$

(h) $\frac{d^2y}{dx^2} - 10\frac{dy}{dx} + 25y = 0$ when $x = 0, y = 3$ and $\frac{dy}{dx} = 20$

(i) $\frac{d^2y}{dx^2} - y = 0$ when $x = 0, y = 1$ and $\frac{dy}{dx} = 2$

Answers:

- 1 **(a)** $y = 2e^{2x} - 2e^x$ **(b)** $y = 2e^{2x} - 2e^{-3x}$ **(c)** $y = 2e^x + e^{3x}$ **(d)** $y = 4e^x + 2e^{-2x}$
 (e) $y = (3x + 2)e^{3x}$ **(f)** $y = (4x + 1)e^{-2x}$ **(g)** $y = e^x(2\sin x + \cos x)$
 (h) $y = (5x + 3)e^{5x}$ **(i)** $y = 2e^x - 1$