7.2) Second-order homogenous differential equations

Worked example

Find general solutions to:

$$\frac{d^2y}{dx^2} = 6x$$

$$\frac{d^2y}{dx^2} = 24x^2$$

Your turn

Find the general solution to:

$$\frac{d^2y}{dx^2} = 12x$$

$$y = 2x^3 + Ax + B$$

Worked example

Find general solutions to:

$$2\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 3y = 0$$

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

Your turn

Find the general solution to:

$$2\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 3y = 0$$

$$y = Ae^{-\frac{3}{2}x} + Be^{-x}$$

Worked example

Find general solutions to:

$$\frac{d^2y}{dx^2} - 8\frac{dy}{dx} + 16y = 0$$

$$\frac{d^2y}{dx^2} + 10\frac{dy}{dx} + 25y = 0$$

Your turn

Find the general solution to:

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

$$y = (A + Bx)e^{3x}$$

Worked example

Find general solutions to:

$$\frac{d^2y}{dx^2} + 9y = 0$$

$$\frac{d^2y}{dx^2} + 25y = 0$$

Your turn

Find the general solution to:

$$\frac{d^2y}{dx^2} + 16y = 0$$

$$y = A\cos 4x + B\sin 4x$$

Worked example

Find general solutions to:

$$\frac{d^2y}{dx^2} + 2\frac{dy}{dx} - 15y = 0$$

$$\frac{d^2y}{dx^2} - 10\frac{dy}{dx} + 25y = 0$$

$$\frac{d^2y}{dx^2} + 25y = 0$$

$$\frac{d^2y}{dx^2} - 10\frac{dy}{dx} + 34y = 0$$

Your turn

Find general solutions to:

$$\frac{d^2y}{dx^2} + 6\frac{dy}{dx} + 8y = 0$$

$$y = Ae^{-4x} + Be^{-2x}$$

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

$$y = (A + Bx)e^{-3x}$$

$$\frac{d^2y}{dx^2} + 9y = 0$$

$$y = A\cos 3x + B\sin 3x$$

$$\frac{d^2y}{dx^2} + 6\frac{dy}{dx} + 10y = 0$$

$$y = e^{-3x}(A\cos x + B\sin x)$$