HOMOGENEOUS DIFFERENTIAL EQUATIONS WORKSHEET

1. Solve the differential equations

   (a) $y'' - 2y' - 8y = 0$

   (b) $2y'' - 5y' - 3y = 0$

   (c) $3y'' - 10y' + 8y = 0$

   (d) $4\frac{d^2y}{dx^2} - 36y = 0$

2. Solve the differential equations

   (a) $y'' - 4y' + 4y = 0$

   (b) $y'' + 8y' + 16y = 0$

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

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

3. Solve the differential equations

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

   (b) $y'' + 2y' + 5y = 0$

   (c) $2y'' + y' + 3y = 0$

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

4. The movement of the needle of an instrument used for measuring the strength of an electric current can be modeled by the differential equation

$$4\frac{d^2\theta}{dt^2} + 5\frac{d\theta}{dt} + \theta = 0$$

   where θ represents the angle turned from a standard position and t represents time.

   Find the general solution of the differential equation.

ANSWERS

1. (a) $y = Ae^{-2x} + Be^{4x}$ (b) $y = Ae^{-x} + Be^{\frac{3}{2}x}$ (c) $y = Ae^{-\frac{2}{3}x} + Be^{4x}$
   (d) $y = Ae^{-3x} + Be^{3x}$

2. (a) $y = e^{2x}(Ax + B)$ (b) $y = e^{4x}(Ax + B)$ (c) $y = e^{-\frac{1}{2}x}(Ax + B)$
   (d) $y = e^{\frac{2}{3}x}(Ax + B)$

3. (a) $y = A\cos x + B\sin x$ (b) $y = e^{x}(A\cos 2x + B\sin 2x)$
   (c) $y = e^{-\frac{1}{4}x}\left(A\cos\left(\frac{\sqrt{23}}{4}x\right) + B\sin\left(\frac{\sqrt{23}}{4}x\right)\right)$ (d) $y = e^{\frac{3}{4}x}\left(A\cos\left(\frac{\sqrt{7}}{4}x\right) + B\sin\left(\frac{\sqrt{7}}{4}x\right)\right)$

4. $\theta = Ae^{-\frac{1}{4}t} + Be^{-t}$