1) Use the integrating factor method to solve:

(i) $x\frac{dy}{dx} - 2y = \sqrt{x}$

(ii) $\frac{dy}{dx} = y\tan x - 2\sin x$

2) Find the general solutions of the following differential equations:

(i) $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 4y = 0$

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

3) Solve the differential equation,

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

given that when $x = 0$, $y = 1$ and $\frac{dy}{dx} = 0$.

4) The differential equation,

$$L\frac{di}{dt} + Ri = E$$

occurs in electrical theory, L, R and E being positive constants. Given that $i = 0$ when $t = 0$, find i as a function of t.

Hence, show that as t increases indefinitely, i approaches the value $\frac{E}{R}$.

5) Find the solution of the differential equation,

$$\frac{d^2x}{dt^2} + 4x = 6\sin t$$

which satisfies the conditions:

$$\left.\begin{array}{l} x = 0 \\ \frac{dx}{dt} = 0 \end{array}\right\} \text{when } t = 0$$

Show that for all values of t, $-3\sqrt{3} \le 2x \le 3\sqrt{3}$.