

SMA 2231: DE CAT 2 {30 Marks}. Time: 1 Hour.

Instructions: Attempt all Questions and do not write on this Question paper.

- a. The marketing department of a company manufacturing two types of calculators, fx82 and fx86, established that the marginal profits $\frac{dp_1}{dx}$ and $\frac{dp_2}{dx}$ from the sales of x calculators for the two respectively satisfies the system

$$2 \frac{dp_1}{dx} - 2 \frac{dp_2}{dx} - 3p_1 = x$$

$$2 \frac{dp_1}{dx} + 2 \frac{dp_2}{dx} + 3p_1 + 8p_2 = 2$$

Express the profit p_1 and p_2 in terms of the sales x.

[10 Marks]

- b. Use the transformation $x = e^t$ to transform the equation $x^2 \frac{d^2 y}{dx^2} - 2x \frac{dy}{dx} + 2y = 4x^2$ to a

linear equation with constant coefficients hence solve the equation

[10 Marks]

- c. Using the method of variation of parameters, find the general solution of the equation,

$$\frac{d^2 y}{dx^2} + y = \tan x.$$

[10 Marks]

$$m^2 - m - 2m - 3 = 0$$