

Question 8

$$(a) \quad N = N_0 e^{kt}$$

$$\text{when } t = 0, N = 18$$

$$18 = N_0 e^0$$

$$\therefore N_0 = 18$$

From Year 1923 \rightarrow Year 1993, there are 70 years

$$\text{when } t = 70, N = 5000$$

$$N = 18 e^{kt}$$

$$5000 = 18 e^{70k}$$

$$e^{70k} = \frac{5000}{18}$$

$$70k = \ln \frac{5000}{18}$$

$$\therefore k = \frac{\ln \frac{5000}{18}}{70} = 0.080383\dots$$

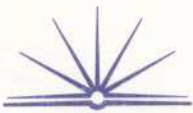
From Year 1923 \rightarrow Year 2001, there are 78 years

$$N = 18 e^{\frac{\ln \frac{5000}{18}}{70} t}$$

$$= 18 e^{\frac{\ln \frac{5000}{18}}{70} (78)}$$

$$= 9511.52$$

\therefore the number of koalas = 9511



(b) (i) $P(A \text{ is drawn first}) = \frac{1}{5}$

(ii) The probability = $\frac{1}{5} \times \frac{1}{4} \times \frac{1}{3} \times \frac{1}{2} \times 1$
= $\frac{1}{120}$

(c) (i) when $\frac{dy}{dt}$ is a maximum, $y_1 = 7.5 \text{ cm}$

when $\frac{dy}{dt}$ is a minimum, $y_2 = 2 \text{ cm}$

