Question 8

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

when $t = 0$, $N = 18$

$18 = N_0 e^{0}$

$\therefore N_0 = 18$

From year 1923 $\longrightarrow$ year 1993, there are 70 years

when $t = 70$, $N = 5000$

$N = 18e^{kt}$

$5000 = 18e^{70k}$

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

$70k = \ln \frac{2500}{9}$

$\therefore k = \frac{\ln \frac{2500}{9}}{70} = 0.080383\ldots$

From year 1923 $\longrightarrow$ year 2001, there are 78 years

$N = 18e^{\frac{\ln \frac{2500}{9}}{70} t}$

$= 18e^{\frac{\ln \frac{2500}{9}}{70} (78)}$

$= 9511.52$

$\therefore$ the number of koalas $= 9511$

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

(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, $y_1 = 7.5$ cm

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

(ii)