Start here for Question Number: 8

(a) $\frac{dP}{dt} = kP$.

$t = 0 \quad P = 102.$

$t = 75 \quad P = 2000\,000.$

a) $\boxed{P = P_0 e^{kt}.}$

$P_0 = 102$

$2000\,000 = 102e^{75k}.$

$\frac{2000\,000}{102} = e^{75k}.$

$\ln\left(\frac{2000000}{102}\right) = 75k$

$k = \frac{\ln\left(\frac{2000\,000}{102}\right)}{75}$

$k = 0.131782\ldots$

$t = 100 \quad P = ?$

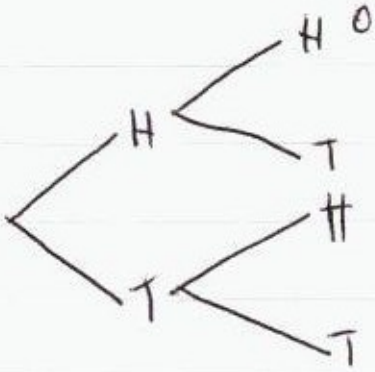
$P = 102e^{100k}$

$P = 53931181.78$

$\doteq 53931182$ (nearest toad).

(b)

b).



P(both showing heads) = [P(1 head)]^2 = 0.36

= [0.36]^2

P (both showing heads) = 0.36

P (showing one head) = $\sqrt{0.36}$.

P (showing tails) = $1 - \sqrt{0.36}$

= 0.4.

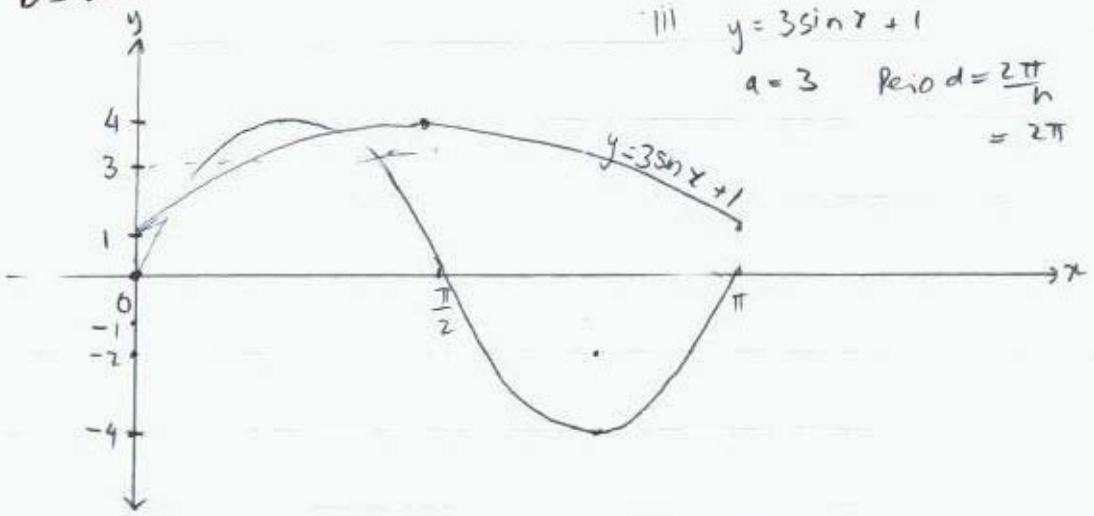
c) i $A = 4$.

ii ~~$b = \frac{2\pi}{n}$~~

Period = $\frac{2\pi}{n}$ $b = n$.

$\pi = \frac{2\pi}{b}$.

$b = 2$.

iii) 

iii $y = 3\sin x + 1$

$a = 3$ Period = $\frac{2\pi}{n}$

$= 2\pi$

Additional writing space on back page.

d) $f(x) = x^3 - 3x^2 + kx + 8$.

$f'(x) = 3x^2 - 6x + k$. >0 for increasing

$3(x^2 - 2x + \frac{k}{3}) > 0$.

or $x^2 - 2x + \frac{k}{3} > 0$.

$\Delta = b^2 - 4ac$

$0 = 4 - 4\left(\frac{k}{3}\right)$ so only one root.

$-4 < -\frac{4k}{3}$

$3 > k$.

You may ask for an extra Writing Booklet if you need more space to answer question 8.