

Question 1

2018 MEMO Trials Paper 2. (i)

[7 marks]

(a) 8; 6; b; -66; -142.

$$T_n = a T_{n-1} - 4 T_{n-2}$$

$$b = 6a - 4 \cdot 8$$

$$\Rightarrow b = 6a - 32 \quad (1)$$

$$-142 = -66a - 4b$$

$$\Rightarrow 4b = -66a + 142 \quad (2)$$

$$11b = 66a - 352 \quad (1) \times 11 \quad (3)$$

$$b =$$

$$15b = -210$$

$$b = -14$$

Sub into (1)

$$-14 = 6a - 32$$

$$18 = 6a$$

$$a = 3$$

Question 2

[8 marks]

A: Sam paid more than was agreed upon over the 6 months period.

(A) B: balance outstanding remained constant. ie Sam paid only the interest to keep the balance constant for 4 months.

C: Sam did not pay anything for the next 7 months.

D: Sam increased his monthly instalment to repay what was in fact a

Question 3

[8 marks]

balance more than the original loan.

A = 1.7 million

$$\left(1 + \frac{8.5\%}{4}\right)^4 = \left(1 + \frac{i}{12}\right)^{12}$$

$$\sqrt[12]{\left(1 + \frac{8.5\%}{4}\right)^4} - 1 = i$$

$$0.007033$$

$$\text{So } A = \frac{i}{12}$$

$$1,500,000 = 14,000 \left(\frac{(1 + A)^{7 \times 12} - 1}{A} \right) \quad (11)$$

Question A (21 marks)

20 year loan
R 1 250 000.

$\frac{15\%}{12} \rightarrow \frac{1}{80}$ Sko A.

15% pa monthly.

(a) $1\,250\,000 = x \left(\frac{1 - \left(1 + \frac{15\%}{12}\right)^{-240}}{\frac{15\%}{12}} \right)$ *annuity* ✓
correct ✓

$\frac{1\,250\,000 \times A}{\left(1 - \left(1 + A\right)^{-240}\right)} = x.$ 15625

$x = 16\,459,87$
 $x = 16\,460$ ✓ (5)

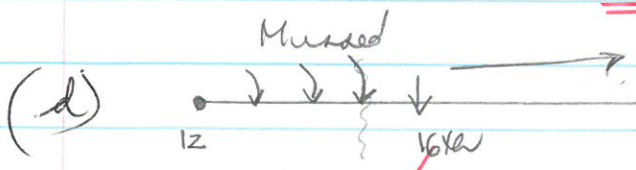
(b) $BO = 1\,250\,000 \left(1 + \frac{15\%}{12}\right)^{12} - \frac{16\,460 \left(\left(1 + \frac{15\%}{12}\right)^{12} - 1 \right)}{\frac{15\%}{12}}$

$1\,450\,943,147 - 211\,681,55$
Sko B Sko C

$BO_{12} = 1\,239\,261,60.$ ✓ (5)
Sko D.

(c) Principal = $1\,250\,000 - 1\,239\,261,60$
 $= 10\,738,40.$ ✓

Interest paid = $16\,460 \times 12 - 10\,738,40$
total amt pd - principal.
 $= 1\,86\,781,60.$ ✓ (4)



(d) $1\,239\,261,60 \left(1 + \frac{14\%}{12}\right)^3 = x \left(\frac{1 - \left(1 + \frac{14\%}{12}\right)^{-72}}{\frac{14\%}{12}} \right)$ *annuity* ✓
Sko F.

$1\,289\,343,76 = x \left(\frac{79,41}{\frac{14\%}{12}} \right)$
Sko A Sko B

$x = \frac{A}{B} = 16\,158,45$ ✓ (7)

Question 5

[22 marks]

$$\begin{array}{r} 22 \\ 14 \\ \hline 53 \end{array}$$

(a) (i) $b = 2 \times 3 \times 70\% \times 55\%$
 $= 2,31$

$$r = b - d$$

$$= 2,31 - \frac{1}{7}$$

$$= 2,167$$

(5)

(ii) $P_{n+1} = P_n(1 + 2,17)$

$$P_{n+1} = P_n(3,17)$$

(2)

(iii) $P_7 = 15(3,17)^7$
 $= 48251$ $\checkmark$ *servals*

(2)

b)(i) $T_{n+1} = T_n(1 + 0,8) = 1,8 T_n$

$$T_1 = 20(1,8) = 36$$

$$T_2 = 65$$

$$T_3 = 117$$

$$T_4 = 210$$

$$T_5 = 378$$

$$T_6 = 680$$

$$T_7 = 1224$$

$$T_8 = 2203$$

(5)

(ii) $T_n = 20(1,8)^n$ $\therefore T_{22} = 20(1,8)^{22}$

$$= 8260857$$

(2)

(iii) *classical model*

- i environment cannot sustain over 8 million
- herds. $\therefore$ no specified carrying capacity
- " no natural death rate
- " no predators

any (2) ✓✓

(3)

(iv) $1000 = 1000(1,8)^x$

$$x = 800$$

(3)

[22]

Question 6. [14 marks]

$$(a) \quad y = -0,0002x + 0,0213$$

$$(i) \quad r = 0,213 = 2,13\%$$

$$(ii) \quad X \text{ enter apt} \quad 0,0002x = 0,0213$$

$$x = 107 \checkmark$$

$$(iii) \quad \text{Sub } x = 32 \quad y = -0,0002 \times 32 + 0,0213$$

$$= 0,0149$$

$$= 1,49\%$$

$$(iv) \quad P_{n+1} = P_n + 2,13\% \cdot P_n \left(1 - \frac{P_n}{107}\right) \checkmark \checkmark$$

$$P_0 = 21$$

$$P_1 = 21,35 \approx 21$$

$$P_2 = 21,7 \approx 22$$

$$P_3 = 22$$

$$P_4 = 22$$

$$P_5 = 22,8 \approx 23$$

$$P_6 = 23$$

$$P_7 = 24$$

$$P_8 = 24 \checkmark \checkmark$$

Question 6. (cont)

$$(b) \quad P_{n+1} = P_n + r P_n \left(1 - \frac{P_n}{2500}\right)$$

$$(i) \quad K = 2500 \checkmark$$

$$(ii) \quad 375 = 250 + r \cdot 250 \left(1 - \frac{250}{2500}\right) \checkmark$$

$$125 = r \cdot 250 \cdot \frac{9}{10}$$

$$\frac{125}{9 \times 25} = r = 55,56\% \checkmark$$

Question 7.

[17 marks]

5

(a) $1500 = 88,24\% \text{ of } K$
 $K = 1700.$

(2)

(b) $d = 0,05 = \frac{1}{x}$

$x = \frac{1}{0,05} = 20 \text{ years.}$

(2)

(c) $r = 2 \times 45\% \times \text{Survivors.}$

$0,05 = 2 \times 45\% \times \text{sur.}$

$\text{sur} = \frac{0,05}{2 \times 45\%} = \frac{1}{18} = 6\%$

(3)

(d) $35 = 35 + 0,0001 \cdot C_n \cdot 35 - 0,05 W_n.$

$0,0001 C_n \cdot 35 = 0,05 \cdot 35$

$C_n = \frac{0,05}{0,0001}$

$C_n = 500.$

$b \Rightarrow 500 = 500 + 0,05 \cdot 500 \left(1 - \frac{500}{1700}\right) - b \cdot 500 \cdot 35$

$b = 0,1\%$

(6)

(e) max wolves 90 (A)

min rabbits = 200 (B)

(2)

(f) equilibrium no of rabbits at C (500) (1)
 not necessarily the number.

(g) at D after their max of 90 (1)

