OCR
Oxford Cambridge and RSA

Friday 23 June 2017 – Morning

A2 GCE MATHEMATICS (MEI)

4754/01B Applications of Advanced Mathematics (C4) Paper B: Comprehension

QUESTION PAPER

Candidates answer on the Question Paper.

OCR supplied materials:
- Insert (inserted)
- MEI Examination Formulae and Tables (MF2)

Other materials required:
- Scientific or graphical calculator

Duration: Up to 1 hour

* 4 7 5 4 0 1 B *

* 7 3 5 0 9 8 2 4 8 8 *

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- The Insert will be found inside this document.
- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.
- The Insert contains the text for use with the questions.
- You are permitted to use a scientific or graphical calculator in this paper.
- Final answers should be given to a degree of accuracy appropriate to the context.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- You may find it helpful to make notes and do some calculations as you read the passage.
- You are **not** required to hand in these notes with your question paper.
- You are advised that an answer may receive **no marks** unless you show sufficient detail of the working to indicate that a correct method is being used.
- The total number of marks for this paper is **18**.
- This document consists of **8** pages. Any blank pages are indicated.

1 State the set of values of x_0 for which the iteration

$$x_{n+1} = 2.5x_n(1 - x_n)$$

(i) converges to a single non-zero number, **[1]**

(ii) has all terms from x_1 onwards equal to zero. **[1]**

1(i)	
1(ii)	

2 **(i)** Use the algebraic method indicated in lines 68 to 70 to find the equilibrium point of the iteration

$$x_{n+1} = 1.6x_n(1-x_n).$$ **[2]**

(ii) Show that the iteration

$$x_{n+1} = x_n^2 + 2$$

does not have any points of equilibrium. **[2]**

2(i)

2(ii)

3 One of the assumptions for the model used for the population of squirrels in the text was that there are no predators.

An alternative model is proposed in which predators kill a fixed number of squirrels each year.

An iterative equation for this model is given by

$$x_{n+1} = kx_n(1-x_n) - 0.25.$$

In the table below x_0 is taken to be 0.55 and four different values are considered for k.

(i) Complete as many of the empty cells as you need to in order to establish the outcomes for these values of k.

(ii) Comment on what the table tells you for each of the four values of k. **[6]**

3(i)

	$x_{n+1} = kx_n(1-x_n) - 0.25$			
	$k = 2$	$k = 3$	$k = 4$	$k = 5$
x_0	0.55	0.55	0.55	0.55
x_1	0.245	0.4925	0.74	0.9875
x_2				
x_3				
x_4				
x_5				
x_6				
x_7				
x_8				
x_9				
x_{10}				
...	...	...	...	...

3(ii)	

4 **(i)** Table 3 gives the first four points of bifurcation of the iteration

$$x_{n+1} = kx_n(1 - x_n).$$

Feigenbaum's Constant is 4.6692 correct to 5 significant figures. Using this value for the ratio of the interval lengths, estimate the values of k for the next two points of bifurcation. **[3]**

(ii) **(*A*)** Find, S, the sum to infinity of the geometric series

$$1 + \frac{1}{4.6692} + \left(\frac{1}{4.6692}\right)^2 + \left(\frac{1}{4.6692}\right)^3 + \ldots .$$

[2]

(*B*) Using certain figures from Table 3, a value of k is estimated to be

$$k = 3.5644 + 0.0203 \times S.$$

State what happens at this value of k. **[1]**

4(i)

4(ii)(*A*)	
4(ii)(*B*)	

END OF QUESTION PAPER

PLEASE DO NOT WRITE ON THIS PAGE