

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS  
A2 GCE**

**4754/01B**

**MATHEMATICS (MEI)**

**Applications of Advanced Mathematics  
(C4) Paper B: Comprehension**

**QUESTION PAPER**

**FRIDAY 23 JUNE 2017: Morning**

**DURATION: Up to 1 hour  
plus your additional time allowance**

**MODIFIED ENLARGED**

<b>Candidate forename</b>		<b>Candidate surname</b>	
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<b>Centre number</b>						<b>Candidate number</b>				
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**Candidates answer on the Question Paper.**

**OCR SUPPLIED MATERIALS:**

**Insert**

**OTHER MATERIALS REQUIRED:**

**Scientific or graphical calculator**

**READ INSTRUCTIONS OVERLEAF**



## **INSTRUCTIONS TO CANDIDATES**

**The Insert will be found with this document.**

**Write your name, centre number and candidate number in the boxes on the first page. 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).**

**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.**

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**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]**

<b>1(i)</b>	
<b>1(ii)</b>	

- 2 (i) Use the algebraic method indicated in lines 98 to 101 to find the equilibrium point of the iteration**

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

- (ii) Show that the iteration**

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

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

<b>2(i)</b>	

<b>2(ii)</b>	

- 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

$$1 + \frac{1}{4.6692} + \left(\frac{1}{4.6692}\right)^2 + \left(\frac{1}{4.6692}\right)^3 + \dots \quad [2]$$

- (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]

<b>4(i)</b>	

<b>4(ii)(A)</b>	

<b>4(ii)(B)</b>	

**END OF QUESTION PAPER**

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