

Candidate forename						Candidate surname					
Centre number						Candidate number					

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
A2 GCE

4754B

MATHEMATICS (MEI)

Applications of Advanced Mathematics (C4)
Paper B: Comprehension

THURSDAY 14 JUNE 2012: Morning

DURATION: Up to 1 hour
plus your additional time allowance

MODIFIED ENLARGED

Candidates answer on the Question Paper or any suitable paper provided by the centre. The Question Paper may be enlarged by the centre.

OCR SUPPLIED MATERIALS:

Insert (inserted)

Booklet of Tables and Figures (inserted)

MEI Examination Formulae and Tables (MF2)

OTHER MATERIALS REQUIRED:

Scientific or graphical calculator

Rough paper

READ INSTRUCTIONS OVERLEAF

INSTRUCTIONS TO CANDIDATES

- **The Insert will be found in the centre of 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 to 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 Use Fig. 4 to estimate the number of 50–54 year olds in the UK in 2001. (These were born in the post World War 2 baby boom.) [1]

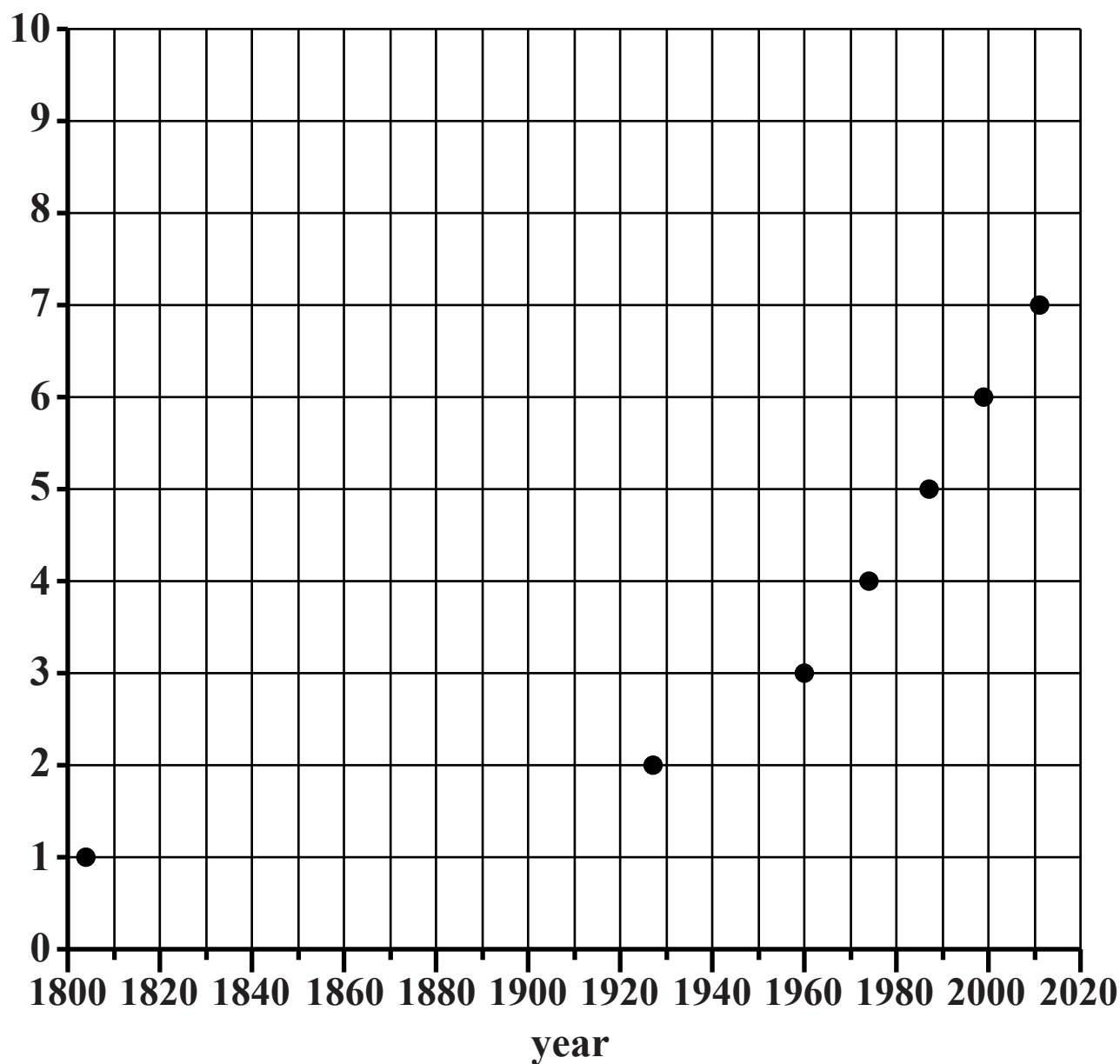
1	

2 A copy of Fig. 2 is given below.

- (i) Join the points with a curve and hence estimate the rate of population growth in the year 1927 in people per year. [3]**
- (ii) Estimate this rate as a percentage of the population at that time. [2]**

2 (i)

**population
(billions)**



2 (i)	continued ...
2 (ii)	

3 (i) In line 31, the solution of the differential equation

$$\frac{dp}{dt} = kp \text{ is stated to be } p = p_0 e^{kt}.$$

Use integration to derive this result. [3]

(ii) The article then goes on to say

“If a model is to be valuable in this context, it must be possible to use it to predict the size of the world population in the future. So, as a test case, the first two data points in Table 1 should allow the later values to be predicted. These data points are

$$1804 \quad t = 0, p = p_0 = 10^9,$$

$$1927 \quad t = 123, p = 2 \times 10^9,$$

and these correspond to $k = 0.00563 \dots$.”

Show how this value of k is obtained. [2]

3 (i)	

3 (i)	continued ...
3 (ii)	

4 In Table 6, the population profile of an imaginary country was predicted. Complete the table below subject to the same general assumptions except that, after 2010:

- **the average number of children per female is 2.2;**
- **60% of those in the 40–59 age group survive into the 60–79 age group;**
- **20% of those in the 60–79 age group survive into the 80+ age group. [3]**

4 As in Table 6, the figures in the following table are in millions.

Age group	2010	2030	2050	2070
80+	1			
60–79	10			
40–59	20			
20–39	20			
0–19	20			
TOTAL	71			

5 In constructing Table 6, some assumptions were made about the proportion of people surviving from one age group to the next. Use Table 6 to find

(i) the proportion of people in the 40–59 age group surviving into the 60–79 age group, [1]

(ii) the proportion of those in the 60–79 age group surviving into the 80+ age group. [1]

5 (i)	
5 (ii)	

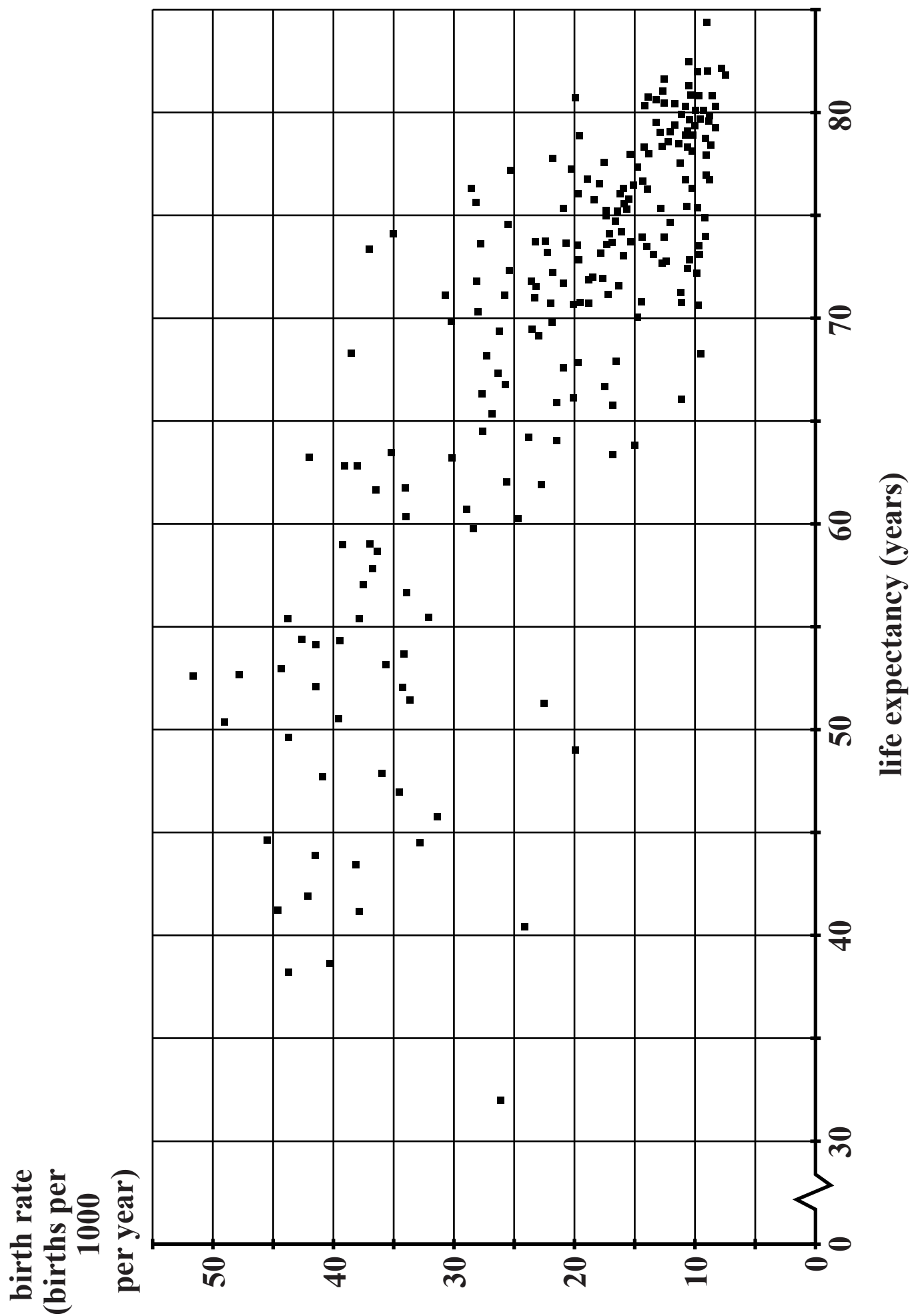
6 The following table refers to the UK. It gives life expectancy and birth rate every 20 years from 1901 to 2001.

YEAR	LIFE EXPECTANCY	BIRTH RATE (BIRTHS/1000)
1901	47	28.5
1921	58	22.7
1941	64	14.5
1961	71	17.8
1981	74	12.9
2001	78	12.0

Explain how these data relate to the conclusions of the article. [2]

[A copy of Fig. 7 is given opposite. You do not need to use it but may find it helpful.]

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