

Thursday 14 June 2012 – Morning

A2 GCE MATHEMATICS (MEI)

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

Candidates answer on the Question Paper.

OCR supplied materials:

- Insert (inserted)
- MEI Examination Formulae and Tables (MF2)

Other materials required:

- Scientific or graphical calculator
- Rough paper

Duration: Up to 1 hour



Candidate forename		Candidate surname	
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Centre number						Candidate number				
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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 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 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**.
- This document consists of **8** pages. Any blank pages are indicated.

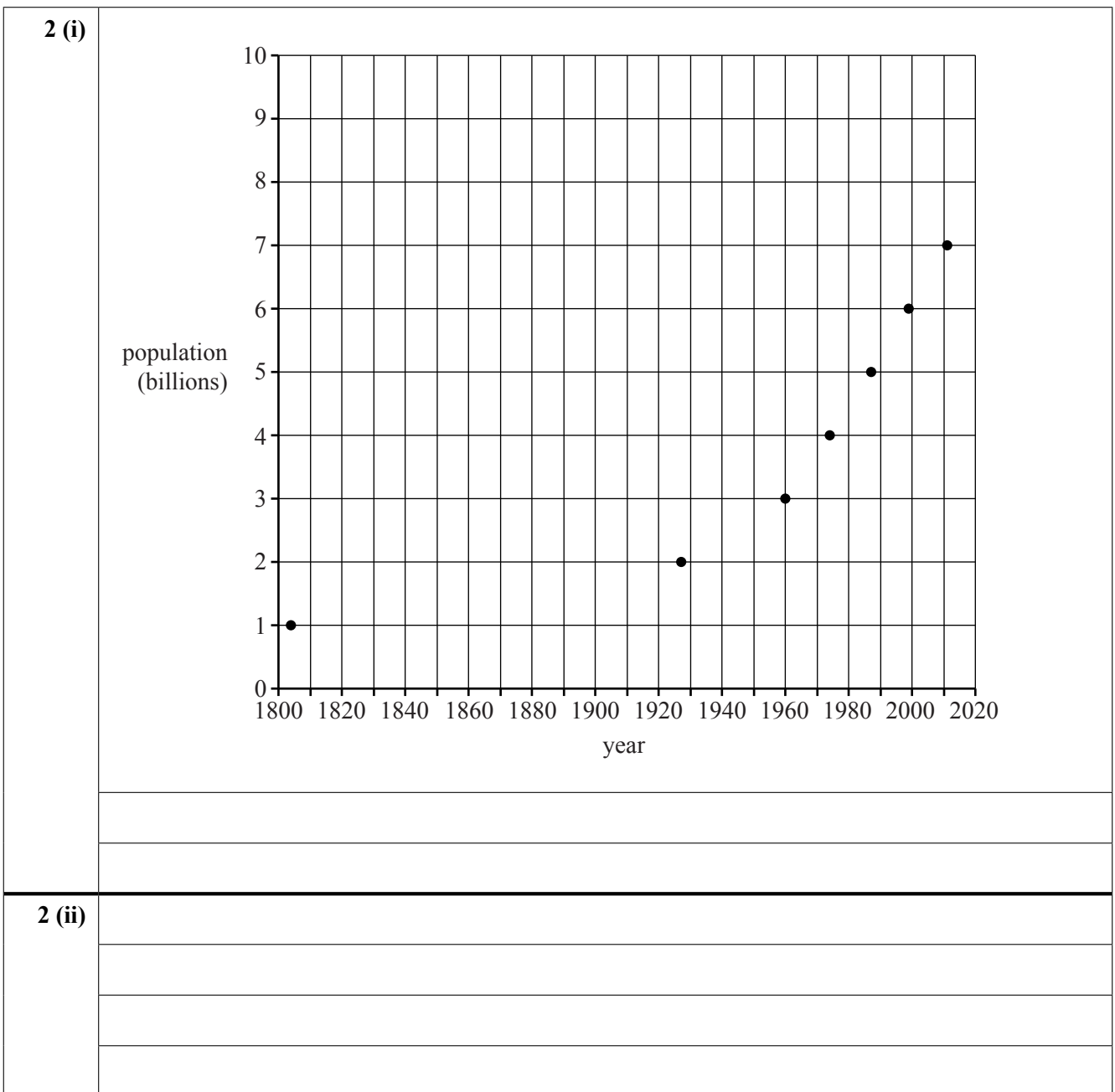
- 1 Use Fig. 4 to estimate the number of 50–54 year olds in the UK in 2001. (These were born in the post World War 2 baby boom.) [1]

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]



- 3 (i) In line 21, the solution of the differential equation $\frac{dp}{dt} = kp$ 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 (ii)	

4 In Table 6, the population profile of an imaginary country was predicted. Complete the table 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	<table border="1" style="margin: auto; border-collapse: collapse;"> <thead> <tr> <th style="padding: 5px;">Age group</th> <th style="padding: 5px;">2010</th> <th style="padding: 5px;">2030</th> <th style="padding: 5px;">2050</th> <th style="padding: 5px;">2070</th> </tr> </thead> <tbody> <tr> <td style="text-align: center; padding: 5px;">80+</td> <td style="text-align: center; padding: 5px;">1</td> <td style="padding: 5px;"></td> <td style="padding: 5px;"></td> <td style="padding: 5px;"></td> </tr> <tr> <td style="text-align: center; padding: 5px;">60–79</td> <td style="text-align: center; padding: 5px;">10</td> <td style="padding: 5px;"></td> <td style="padding: 5px;"></td> <td style="padding: 5px;"></td> </tr> <tr> <td style="text-align: center; padding: 5px;">40–59</td> <td style="text-align: center; padding: 5px;">20</td> <td style="padding: 5px;"></td> <td style="padding: 5px;"></td> <td style="padding: 5px;"></td> </tr> <tr> <td style="text-align: center; padding: 5px;">20–39</td> <td style="text-align: center; padding: 5px;">20</td> <td style="padding: 5px;"></td> <td style="padding: 5px;"></td> <td style="padding: 5px;"></td> </tr> <tr> <td style="text-align: center; padding: 5px;">0–19</td> <td style="text-align: center; padding: 5px;">20</td> <td style="padding: 5px;"></td> <td style="padding: 5px;"></td> <td style="padding: 5px;"></td> </tr> <tr> <td style="text-align: center; padding: 5px;">Total</td> <td style="text-align: center; padding: 5px;">71</td> <td style="padding: 5px;"></td> <td style="padding: 5px;"></td> <td style="padding: 5px;"></td> </tr> </tbody> </table>	Age group	2010	2030	2050	2070	80+	1				60–79	10				40–59	20				20–39	20				0–19	20				Total	71			
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	As in Table 6, the figures are in millions.																																			

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)	

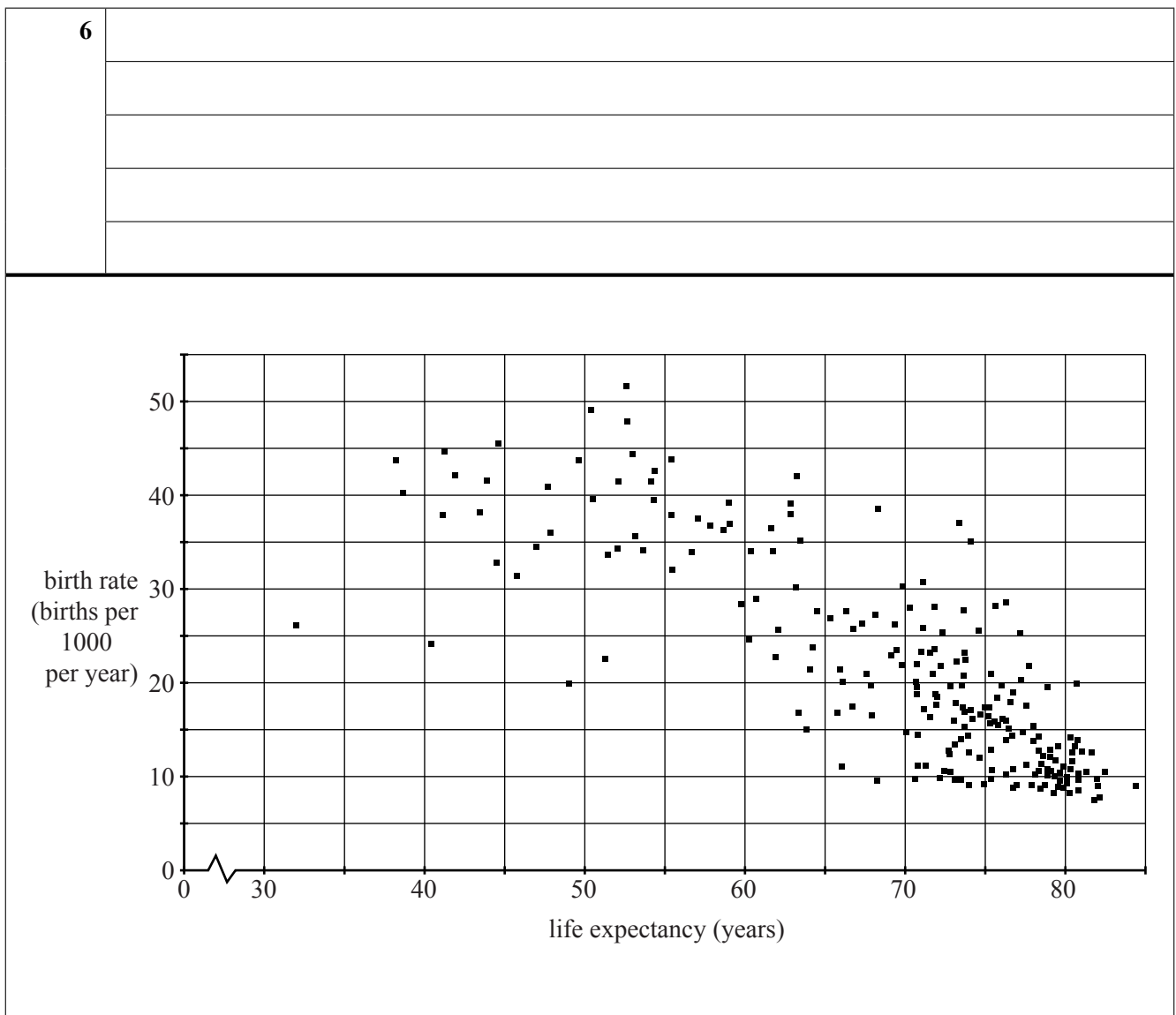
6 This table refers to the UK. It gives life expectancy and birth rate every 20 years from 1901 to 2001.

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 below. You do not need to use it but may find it helpful.]



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