OCR
Oxford Cambridge and RSA

Level 3 Certificate
Quantitative Reasoning (MEI)
H866/02 Critical Maths

Wednesday 25 May 2016 – Morning
Time allowed: 2 hours

You must have:
- the Insert (inserted)

You may use:
- a scientific or graphical calculator

First name									
Last name									
Centre number						Candidate number				

INSTRUCTIONS
- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Write your answer to each question in the space provided.
- Additional paper may be used if required but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the barcodes.
- 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.

INFORMATION
- The total mark for this paper is **60**.
- The marks for each question are shown in brackets **[ ]**.
- This document consists of **16** pages.
- Final answers should be given to a degree of accuracy appropriate to the context.

Answer **all** the questions.

1 The opinion poll company Ipsos Mori conducted two opinion polls in 2014 about UK membership of the European Union. On both occasions the question asked was; 'How would you vote if there were a referendum now on whether Britain should stay in or get out of the European Union?'. The results are shown in the table below.

	All			**All expressing an opinion**	
Date	**Stay in (%)**	**Get out (%)**	**Don't know (%)**	**Stay in (%)**	**Get out (%)**
10–12 May 2014	54	37	10	59	41
11–14 October 2014	56	36	8		

(i) The figures for **all** those questioned show that in May 2014, 'Stay in' was 17 percentage points ahead of 'Get out'. How many percentage points was 'Stay in' ahead of 'Get out' in October 2014? **[1]**

(ii) For May 2014, 54 + 37 +10 = 101. The **unrounded** percentages would add to 100. Give an example of what the three **unrounded** percentages for May 2014 could have been. **[2]**

1(i)

1(ii)

(iii) By using the figures 54 and 37 for May 2014, show how to calculate the figure 59 for 'All expressing an opinion'. **[3]**

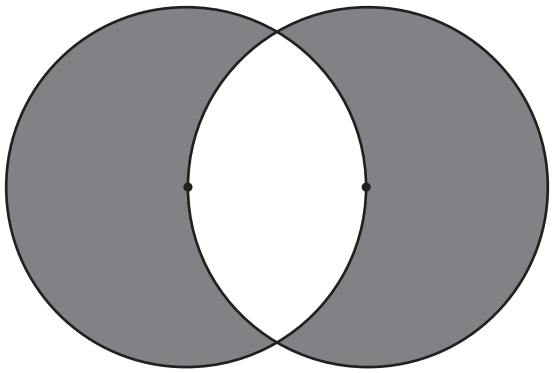
1(iii)

(iv) Calculate the two missing percentages for the October 2014 row. Write your answers in the spaces in the copy of the table below. Show your working. **[3]**

1(iv)

	All			All expressing an opinion	
Date	**Stay in (%)**	**Get out (%)**	**Don't know (%)**	**Stay in (%)**	**Get out (%)**
10–12 May 2014	54	37	10	59	41
11–14 October 2014	56	36	8		

2 The design for part of a garden consists of two overlapping circles, as shown below. The circles are equal in size. The centre of each circle is on the circumference of the other circle. The design consists of three regions. The two outer regions are shaded.



(i) Explain why the two outer (shaded) regions have equal area. **[1]**

(ii) Decide whether the area of the middle (unshaded) region is bigger, smaller or equal to the area of **one** of the shaded regions. Show your reasoning. **[2]**

2(i)	
2(ii)	

3 A National Minimum wage was introduced in the UK in 1999. The table below gives the National Minimum Wage and the median full time hourly wage for 1999 and 2012. A spreadsheet has been used to show this information in two charts, Fig. 3.1 and Fig. 3.2.

	1999	2012
Minimum hourly wage (£)	3.60	6.19
Median hourly wage (full time) (£)	8.60	12.83

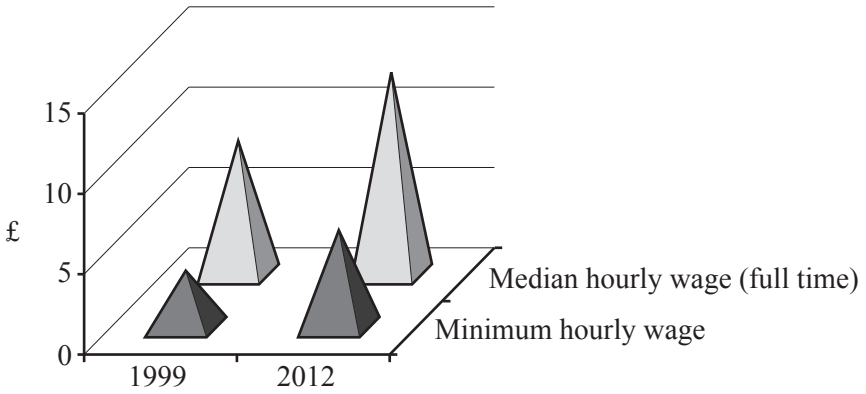


Fig. 3.1

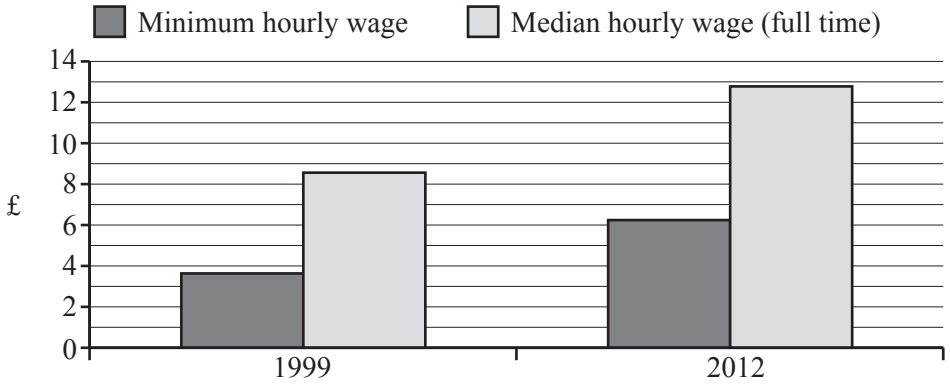


Fig. 3.2

(i) Decide whether Fig. 3.1 or Fig. 3.2 presents the data most clearly and give two reasons to support your decision. **[3]**

3(i)	

(ii) In April 2016, the National Living Wage was introduced for workers aged over 25. This wage is £7.20 an hour. Before April 2016, the minimum wage for those over 25 was £6.50 an hour.

Estimate the yearly wage increase of a full time worker whose hourly pay goes up from £6.50 an hour to £7.20 an hour. Show your reasoning. **[4]**

3(ii)	

Fig. 3.3 is a cumulative frequency graph of hourly wages for adult workers in 2014. The lowest and highest wages are not shown.

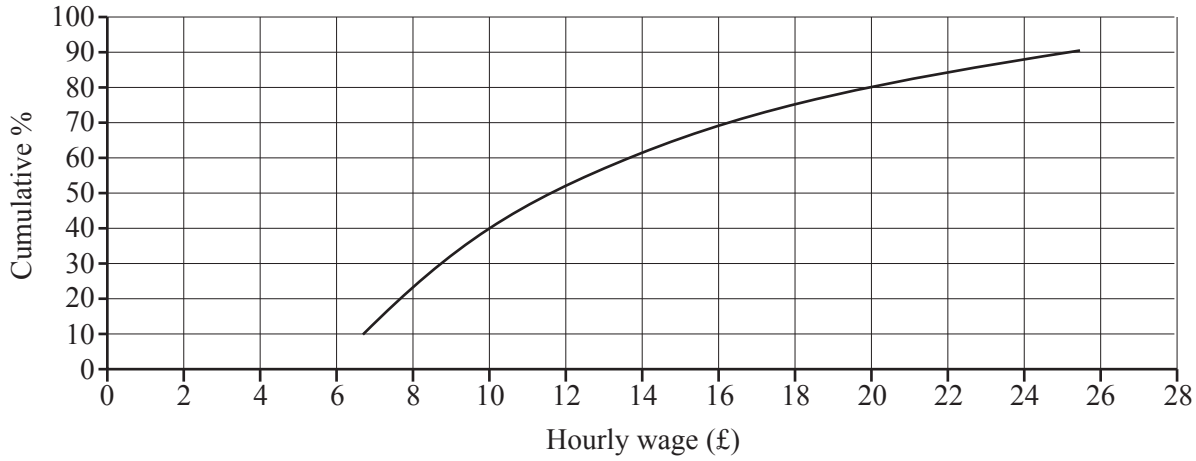


Fig. 3.3

(iii) Estimate the median hourly wage for all adult workers in 2014. **[2]**

3(iii)	

(iv) Estimate the percentage of adult workers earning £6.50, or less, an hour in 2014. **[2]**

3(iv)	

The government's ambition is for the National Living Wage to increase over time until it reaches 60% of median hourly earnings.

(v) What happened to each of the following when people started to earn the National Living Wage one day in April 2016? Assume that no-one else's wages changed on that day. Tick the correct box and explain your reasoning.

(*A*) The **median** hourly wage.
(*B*) The **mean** hourly wage. **[4]**

3(v) (*A*)	The median hourly wage ☐ Increased ☐ Decreased ☐ No change
3(v) (*B*)	The mean hourly wage ☐ Increased ☐ Decreased ☐ No change

4 A shop has a 'buy one, get one half price' offer on **all** the items in the shop. Two ways in which this offer can work for shoppers who buy an even number of items are shown below.

Method A	**Method B**
The prices of all the items the customer wants are listed in order from highest to lowest. The highest priced item is paid for in full, the second is half price. The item with the third highest price is paid for in full, the fourth item is half price and so on.	The prices of all the items the customer wants are listed in order from highest to lowest. The highest priced item is paid for in full, the cheapest is half price. The item with the second highest price is paid for in full, the second cheapest item is half price and so on.

(i) A customer wants to buy four items that are priced at £45, £25, £38 and £19. Work out how much she will pay using each method. **[5]**

4(i)	
	Method A
	Method B

(ii) A customer buys two items. Explain why both methods give the same final price. **[1]**

(iii) Give **one** example of four prices of items where both methods give the same final price. **[1]**

4(ii)	
4(iii)	

(iv) A customer wants to buy five items priced at £45, £25, £38, £19 and £52. Describe a method for working out the final price of the five items for a 'buy one, get one half price' offer. Work out the final price. **[3]**

4(iv)	

5 Read the following news story.

> **Vitamins helped our children do better at school**
>
> "My friends and I have 10 children at the same school. Last year, they did worse than we expected in their exams so we decided to give them extra vitamins."
>
> Most of the 10 children did better after taking the vitamins and are now getting good test marks again.

(i) The story claims that the vitamins have helped the children do better. State one other possible cause for the children's better results. **[1]**

5(i)	

Read the following description of how a headteacher can conduct an experiment to investigate whether or not vitamins help improve test results.

Step number	Description
1	Select 10 different children.
2	The 10 children each pick a different number from 1 to 10 (without looking) from a box at the start of the experiment.
3	Each child is given a tablet every day for a term.
4	The 5 children who picked even numbers get one sort of tablet and the 5 children who picked odd numbers get a different tablet. One sort of tablet has vitamins. The other tablets look and taste the same but do not have any vitamins.
5	The children do not know which sort of tablet they are getting.
6	The teacher does not know which sort of tablet each child is getting.
7	The teacher gives regular tests to all the children and keeps a record of the results.
8	The headteacher compares the results of both groups.

(ii) State one way to improve this experiment. **[1]**

5(ii)	

The headteacher's experiment has the following three features: it is randomised, controlled and double blind.

(iii) For each of (*A*), (*B*) and (*C*), identify one or two steps from the list on page 10 that ensure the experiment has the following feature.

(*A*) Randomised

(*B*) Controlled

(*C*) Double blind **[4]**

5(iii) (*A*)	Randomised (**circle one step**)	1	2	3	4	5	6	7	8
(*B*)	Controlled (**circle one step**)	1	2	3	4	5	6	7	8
(*C*)	Double blind (**circle two steps**)	1	2	3	4	5	6	7	8

(iv) Explain why each of these three features is important. **[3]**

5(iv) (*A*)	Randomised
(*B*)	Controlled
(*C*)	Double blind

6 A new test has been developed for an illness that affects 10% of a population. The test is not completely accurate. 95% of those who have the illness will test positive. 90% of those who do not have the illness will test negative. The whole population is tested using this test.

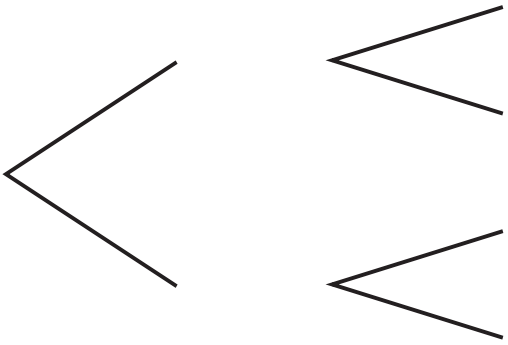
(i) Label the diagram below with words and numbers to represent this information. **[3]**

(ii) What percentage of people test positive? **[2]**

(iii) Show that 51.4% of those who test positive actually have the illness. **[2]**

(iv) Explain why those who have tested positive should have further tests before being treated for the illness. **[1]**

6(i)



6(ii)

6(iii)	
6(iv)	

7 A website claims that, on average, every second 50000 Google searches are started worldwide on the internet.

(i) What is the approximate population of the world? **[1]**

(ii) Give a clearly reasoned argument that
- **either** shows that 50000 Google searches every second is a reasonable estimate
- **or** shows that it is unlikely to be true. **[5]**

7(i)	
7(ii)	

END OF QUESTION PAPER

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