# Candidate Style Answers

# Critical Maths

# Medium banded responses

### Introduction

This resource has been produced by a senior member of the Core Maths examining team to offer teachers an insight into how the assessment objectives are applied. It has taken questions from the sample question paper and used them to illustrate how the questions might be answered and provide some commentary on what factors contribute to overall levels.

As these responses have not been through full moderation, they are banded to give an indication of the level of each response. Please note that this resource is provided for advice and guidance only and does not in any way constitute an indication of grade boundaries or endorsed answers.

The sample assessment material for these answers and commentary can be found on the Core Maths web page and accessed via the following link: <https://www.ocr.org.uk/qualifications/core-maths/a-mei-level-3-certificate-h868/assessment/>

### Question 1

It is possible to drive from London to Leeds on the motorway all the way.

The distance is approximately 200 miles.

How long will it take?

Show your reasoning.

**[3]**

### Sample answer for Question 1

200 miles to drive.

Cars can drive at 80 miles per hour on the motorway.

200 ÷ 80 = 2.5 hours

### Commentary on the answer

This answer has been worked out correctly by dividing distance by time. However, since the speed limit is 70 miles per hour the assumption that cars can drive at 80 miles per hour isn’t valid.

### Question 2

Dan wants to go on a holiday which costs £5000.

He will pay with his credit card which charges an annual interest rate (APR) of 16%.

Dan wants to pay back the money over two years.

He estimates that his monthly repayments will be £208 to the nearest pound.

**(i)** What calculation did Dan do to get £208?

**[1]**

**(ii)** Decide whether Dan’s estimate is too high, too low or about right. Give a reason for your

answer.

**[2]**

### Sample answer for Question 2

(i) 5000 ÷ 12 ÷ 2

(ii) Dan’s estimate is about right as there are 24 months in two years.

### Commentary on the answer

The first answer is correct but the explanation is incorrect because the calculation does not take the interest rate into account.

### Question 3

Usain Bolt won the 100 m and the 200 m gold medals at the London 2012 Olympics.

His time for the 100 m was 9.63 seconds.

His time for the 200 m was 19.32 seconds.

Without using your calculator, decide in which race he had the greater average speed.

Justify your answer.

**[3]**

### Sample answer for Question 3

Speed = distance ÷ time

Speed = 100 ÷ 9.63 = 10.38

Speed = 200 ÷ 19.32 = 10.35

So his speed is faster for the 100 m.

### Commentary on the answer

This answer has correctly used the formula for working out speed by dividing distance by time. However, the question did say “without using your calculator” and there is no working to indicate that the answer was worked out without a calculator. One way to answer this question would have been to double the 100 m time and compare to the 200 m time.

### Question 4

*“The new mathematics GCSE will be more demanding and we anticipate that*

*schools will want to increase the time spent teaching mathematics. On*

*average secondary schools in England spend only 116 hours per year*

*teaching mathematics, which international studies show is far less time than*

*that spent on this vital subject by our competitors. Just one extra lesson each*

*week would put England closer to countries like Australia or Singapore who*

*teach 143 and 138 hours a year of mathematics respectively.”*

Michael Gove 1 Nov 2013

Estimate the number of extra mathematics teachers needed to increase average mathematics teaching time for years 7 to 11 in England from 116 hours per year up to the kind of time taken in Australia or Singapore.

You can use the following assumptions.

**•** There are about 500 000 school students in each year group in England.

**•** A typical secondary school mathematics teacher teaches between 20 and 25 hours a week.

**•** Students are at school for 190 days a year.

Any additional assumptions you make must be clear.

**[7]**

### Sample answer for Question 4

116 hours teaching maths

500 000 × 5 = 2 500 000

30 pupils in a class

2 500 000 ÷ 30 = 83 333.33

25 hours a week = 5 hours a day

= 5 × 190

= 950 hours a year

÷ 5 = 190

190 – 140 = 50

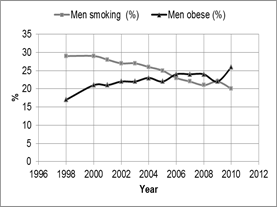
50 × 83 333.33 = 4 166 666 ÷ 116 = 35 919 new teachers

### Commentary on the answer

This answer starts off with a correct assumption of class size being 30 and worked from there to how many classes in total are needed for years 7 to 11. There is also a correct assumption of the teacher working 25 hours and how many hours per year this would be. It is not clear what the purpose of dividing the 950 by 5 is; it appears to be working out how many hours a year the average teacher will spend with each year group. The answer has a correct assumption of the target number of hours being about 140 a year for each class. However the answer does not correctly address the increase in total teaching hours needed – it subtracts the number of hours targeted per class from the total number of hours per year for each teacher at the moment, rather than finding the difference between the hours for each class in England at present (116) and the target number of hours (140). There seems to be a realisation towards the end that 116 has not been used so it is brought into the calculation but not correctly. Although some of the working is labelled with what is being worked out, more of this would make the working easier to follow – this is also important for the candidate when working out the solution to an extended problem. Stringing working together with equals signs when the quantities on each side are not equal further confuses the presentation of the solution.

### Question 5

The graphs below show data for smoking and obesity for men in England.



Data: Copyright © 2013, Re-used with the permission of the Health and Social Care Information Centre. All rights reserved.

Do these graphs show that giving up smoking causes obesity? Justify your answer by making three comments about the data.

**[3]**

### Sample answer for Question 5

Yes, there is negative correlation. When obesity is the highest then smoking is at the lowest.

When obesity is the lowest, smoking is at the highest.

### Commentary on the answer

This answer correctly identifies that there is negative correlation between obesity and smoking. The three comments made however are not distinct. There is no comment on causation – which is what the question was asking.

### Question 6

Two statements from different news websites about the same story are given below.

*70% of parents were fined for taking their children out of school for a holiday in*

*term time.*

*The number of parents fined for taking their children out of school for a holiday*

*in term time rose by 70% from the previous year.*

Explain what each of these statements means and decide whether they mean the same thing.

**[5]**

### Sample answer for Question 6

1 = Of all the parents, 70% of them took their children for a holiday in term time and were fined.

2 = Say last year 100 parents got fined, this year 170 parents got fined.

They are not the same thing.

Total = £33.65

### Commentary on the answer

In this answer, the two statements are explained correctly but there isn’t really a comparison between them – merely a statement that they are different without a clear explanation of why they cannot be the same.

### Question 7

The male to female sex ratio at birth is the number of males that are born for every female born. The table below shows the countries with the two highest male to female sex ratios at birth in 2013.

|  |  |  |  |
| --- | --- | --- | --- |
| **Country** | **Male to female sex ratio at birth** | **Population (thousands)** | **Births per 1000**  **of population** |
| Liechtenstein | 1.26 | 37 | 10.67 |
| Azerbaijan | 1.13 | 9590 | 17.17 |

Data: CIA World Factbook

**(i)** Use the information in the table to show that the total number of births in 2013 in Liechtenstein can be estimated as 395. Show that approximately 175 are girls and approximately 220 are boys.

**[4]**

A researcher is investigating whether the number of boys born in some countries is distinctly different from the number of girls.

Her initial model is that the long-term probability of a new baby being a boy is 0.5.

**(ii)**

1. For Liechtenstein investigate whether the figures of 175 girls and 220 boys provide strong evidence that the initial model is incorrect.

Explain your reasoning and show your working clearly.

**[7]**

1. In 2013 in Azerbaijan 77 305 girls and 87 355 boys were born. Do these figures provide strong evidence that the initial model is incorrect?

**[4]**

### Sample answer for Question 7

(i) 37 000 = 37 × 10.67

= 394.79 which is about 395

220 ÷ 175 = 1.26 which is the ratio

(ii) *A*. 395 ÷ 2 = 197.5 girls and 197.5 boys

Standard deviation = 

197.5 + 2 × 14.05 = 225.6

so okay

197.5 – 2 × 14.05 = 225.6

*B*. 77 305 87 355

mean = 77 305 + 87 355 ÷ 2 = 82 330

standard deviation =  = 286.93

82 330 + 2 × 286.93 = 82 904 and the number of boys is higher

### Commentary on the answer

1. This first calculation is correct but the working contains a string of equals signs between values which are not equal obscuring the structure of the solution. The second calculation correctly shows that the ratio of male to female is 1.26 given the number of boys and girls, but the question asked for these numbers to be worked out from the ratio. This answer has been worked backwards rather than forwards and has not shown that the numbers given are consistent with 395 births.
2. (*A*) This calculation correctly works out that if the probability is 0.5 then the expected number of boys and girls is 197.5. The answer has also used the standard deviation to identify whether the numbers given are outliers. However, there is a mistake in working out the standard deviation – the answer has divided *n* by 2 then square rooted rather than square root *n* and then divide by 2. Also the same number has been found by both adding and by subtracting twice the standard deviation from the mean – there is clearly a mistake somewhere.

(*B*) In this part the working for mean is unclear – as written, 87 355 is divided by 2 and then added to 77 305 – this is not a correct method and is not consistent with the answer given so it appears that some brackets have been omitted from the working. As with part *(A)*, the working for standard deviation is incorrect and the last statement does not address the idea of strong evidence.

### Question 8

A sign in a pay and display car park has the following information about charges for parking.

**Car park charges**

**Monday to Friday 9am to 5pm**

£3 for up to 8 hours

**Other times**

Free

**£40 daily fine for parking without**

**displaying a valid parking ticket**

Drivers who pay get a ticket to display in their cars. A warden checks the cars from time to time. If the warden finds any cars which are not displaying a ticket, their drivers are fined £40 for that day.

The warden is paid to check the cars so the more often they are checked, the more it will cost the car park owner.

Many drivers use the car park every day from 9 am till 5 pm. Assume that some drivers always pay to park and some drivers never pay to park. Assume that all drivers who get a fine will pay it.

How often, on average, should the warden visit the car park to ensure that drivers who always pay end up better off than drivers who never pay?

**[3]**

### Sample answer for Question 8

3 × 5 = 15 so it costs £15 to park for a week.

It costs £30 to park for 2 weeks.

It costs £45 to park for 3 weeks.

So just under 3 weeks.

### Commentary on the answer

This answer correctly identifies the need to see how many times 15 goes into 40. However, it does not answer the question that was asked – how often should the warden visit the car park?

### Question 9

Athletes are tested to see if they have used performance enhancing drugs. Drug tests are not completely accurate. One drug test will show a positive result for 95% of people who have taken performance enhancing drugs and a negative result for 90% of those who have not.

Assume that 5% of athletes use performance enhancing drugs.

**(i)** What proportion of those who test positive in this test have actually used performance enhancing drugs?

**[6]**

**(ii)** What percentage of those who are tested will test positive for use of performance enhancing drugs?

**[2]**

### Sample answer for Question 9

475

positive

95%

Use drugs

5%

500

25

negative

5%

950

positive

10 000

10%

Don’t use drugs

95%

negative

8550

9500

90%

1. Tested positive 
2. Percentage 

### Commentary on the answer

The tree diagram is set up correctly. The representative frequency at the start and on both sets of branches is also correctly done. The first answer incorrectly finds 475 as a proportion of the original 10 000 people, instead of out of all those who had positive results. Finally 475 out of 10 000 is not the same as 19 out of 20; the former fraction is clearly less than a half and the latter is clearly more than a half.

The answer in part (ii) correctly works out a percentage, but it is only taking the positive results from those athletes who use drugs and not adding on those who don’t.

### Question 10

There are five competitors in a dancing competition.

Each dancer is judged by six judges who each give a score out of 20.

Design a method to decide which dancers should take first, second and third places.

Give your method as a set of rules that can be used for other similar competitions.

Explain why your design is fair.

The scores for the dancers in one such competition are shown below.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Dancer** | **Judge 1** | **Judge 2** | **Judge 3** | **Judge 4** | **Judge 5** | **Judge 6** |
| Aretha | 19 | 19 | 15 | 20 | 20 | 14 |
| Esther | 12 | 7 | 4 | 4 | 7 | 8 |
| Mo | 10 | 8 | 11 | 5 | 5 | 2 |
| Vince | 16 | 19 | 20 | 19 | 17 | 16 |
| Yuri | 15 | 6 | 12 | 15 | 6 | 9 |

Use your method to work out which dancers come first, second and third.

**[10]**

### Sample answer for Question 10

Total points

Aretha 107

Esther 42

Mo 41

3rd

Vince 107

Yuri 63

Aretha and Vince tied for first.

### Commentary on the answer

This answer comes to a conclusion based on some evidence, but it is not detailed enough. The combined totals are correct but it is a very simple solution which does not take into consideration all the information given. There is no decision on the tie and nothing mentioned about rank order. The method is not described – only the result of using it is shown. It would have been expected that a description of the method and a reason for choosing it were provided. A complete answer would have used all the information and said how to decide in the event of a tie.

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