Qualification Accredited

OCR
Oxford Cambridge and RSA

AS LEVEL

Examiners' report

MATHEMATICS B (MEI)

H630

For first teaching in 2017

H630/02 Summer 2022 series

Version 1

ocr.org.uk/maths

Contents

Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates.

The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. A selection of candidate answers are also provided. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

Where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report.

A full copy of the question paper and the mark scheme can be downloaded from OCR.

Advance Information for Summer 2022 assessments

To support student revision, advance information was published about the focus of exams for Summer 2022 assessments. Advance information was available for most GCSE, AS and A Level subjects, Core Maths, FSMQ, and Cambridge Nationals Information Technologies. You can find more information on our website.

Would you prefer a Word version?

Did you know that you can save this PDF as a Word file using Acrobat Professional?

Simply click on **File > Export to** and select **Microsoft Word**

(If you have opened this PDF in your browser you will need to save it first. Simply right click anywhere on the page and select **Save as . . .** to save the PDF. Then open the PDF in Acrobat Professional.)

If you do not have access to Acrobat Professional, there are a number of **free** applications available that will also convert PDF to Word (search for PDF to Word converter).

Paper 2 series overview

This is the third full session of the linear H630 AS Level Maths B (MEI) specification. Candidates coped well with the mixture of questions from the Pure and Statistics parts of the specification.

Most part questions were answered correctly by a good number of candidates, and all part questions provided some differentiation since all were sometimes answered incorrectly. No candidates obtained full marks with a few candidates getting almost full marks. Very few candidates were unable to make some progress on some of the questions. In particular, the first two questions appeared to be accessible for all candidates. Although the design of the paper was aimed to have a steady increase in demand through the whole paper, many candidates made a good attempt on Question 10, demonstrating good examination technique. The last parts of Question 11 were frequently omitted as were the last parts of Question 8.

Questions 6 and 11 were based on the large data set that has been available for some time as pre-release material. This year there were many candidates who appeared not to be very familiar with the large data set. Using the large data set during the AS course helps candidates practise statistical techniques using realistic data. In addition to this it prepares candidates to answer questions which are designed to provide material advantage to those that have a good feel for the data in the large data set.

Candidates who did well on this paper generally did the following:	Candidates who did less well on this paper generally did the following:
• had sound algebraic techniques • could use calculus appropriately • were able to make relevant comments and explanations in context.	• struggled with hypothesis testing • found logarithms challenging • had difficulty making comments or explanations in context in the statistics questions.

Question 1

1 The probability distribution for the discrete random variable X is shown below.

x	1	2	3	4	5
$P(X=x)$	0.2	0.15	a	0.27	0.14

Find the value of a. **[1]**

Most candidates answered this question correctly with just a few candidates omitting it altogether.

Question 2 (a)

2 **(a)** Factorise $3x^2 - 19x - 14$. **[2]**

This was done well by the majority, but a few candidates had put the expression equal to zero, used their calculators to solve the equation, obtained the solutions x=7 or -⅔ and written as factors(x-7)(x + ⅔) and obtained no marks. A number of candidates went on to give solutions to the expression = 0, but most had already factorised successfully.

Question 2 (b)

(b) Solve the inequality $3x^2 - 19x - 14 < 0$. **[2]**

This part of Question 2 was well attempted, a few following through incorrect answers from part (a). Some candidates were unable to write the inequality correctly or were unable to connect the two inequalities together while others used set theory for their solution which was credited.

Question 3

3 You are given that $y = Ae^{0.02t}$.

- Make t the subject of the formula.
- Find the value of t when $y = 10^8$ and $A = 6.62 \times 10^7$. **[3]**

Most candidates struggled with this question, unable to rearrange it correctly and showing little understanding of the laws of logarithms. Many candidates played with using base A rather than manipulate the whole equation in base. A sizeable number also missed out on the final B1 by ignoring the substitution part of the question even when they had succeeded with the first section. In the exemplar below, it can be clearly seen their rearrangement of the expression and the use of logarithms to obtain an expression for *t*. They have then substituted into it and obtained the correct value of *t*.

Exemplar 1

3 Log $e^{0.02t} = \frac{y}{A}$

$0.02t = \ln \frac{y}{A}$

$t = \frac{1}{0.02} \ln \frac{y}{A}$

$= 50 \ln \frac{y}{A}$

$\therefore t = 50 \ln \frac{10^8}{6.62 \times 10^7}$

$= 50 \times 0.412$

$= 20.62$

Question 4 (a)

4 The position vector of P is $\mathbf{p} = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$ and the position vector of Q is $\mathbf{q} = \begin{pmatrix} 28 \\ 10 \end{pmatrix}$.

(a) Determine the magnitude of $\overrightarrow{PQ}$. **[2]**

This question was generally answered well by a number of candidates in a variety of ways. Full marks were awarded for the correct answer. The most common mistakes were to add the components of the vectors instead of subtracting, with the occasional slip in the use of Pythagoras' Theorem.

Question 4 (b)

(b) Determine the angle between $\overrightarrow{PQ}$ and the positive x-direction. **[2]**

Many candidates had difficulty identifying the required angle, frequently finding the angle with the y axis and occasionally giving it as a bearing. A few candidates used the cosine rule to find the angle.

Question 5 (a)

5 Ali collected data from a random sample of 200 workers and recorded the number of days they each worked from home in the second week of September 2019. These data are shown in **Fig. 5.1**.

Number of days worked from home	0	1	2	3	4	5
Frequency	41	65	33	26	20	15

Fig. 5.1

(a) Represent the data by a suitable diagram. **[2]**

Most candidates found this difficult to answer with a lack of squared or graph paper to show their visualisation of the data. Most candidates appeared not to have a ruler. There appeared to be a lack of understanding of how discrete data should be displayed. Many candidates used diagrams appropriate to continuous data with line graphs or frequency polygons frequently seen. A few candidates just plotted points. Bar charts almost always gained full marks if there was a reasonable scale on the vertical axis.

Question 5 (b)

(b) Calculate

- The mean number of days worked from home.
- The standard deviation of the number of days worked from home. **[2]**

Most candidates used their calculators efficiently and were able to answer correctly.

Question 5 (c)

Ali then collected data from a different random sample of 200 workers for the same week in September 2019. The mean number of days worked from home for this sample was 1.94 and the standard deviation was 1.75.

(c) Explain whether there is any evidence to suggest that one or both of the samples must be flawed. **[1]**

Many candidates struggled to answer this, comparing means and standard deviations or stating that one or the other or even both were flawed. There appeared to be a lack of understanding of the limitations of data obtained from sampling and how they can lead to different results.

Question 5 (d)

Fig. 5.2 shows a cumulative frequency diagram for the ages of the workers in the first sample who worked from home on at least one day.

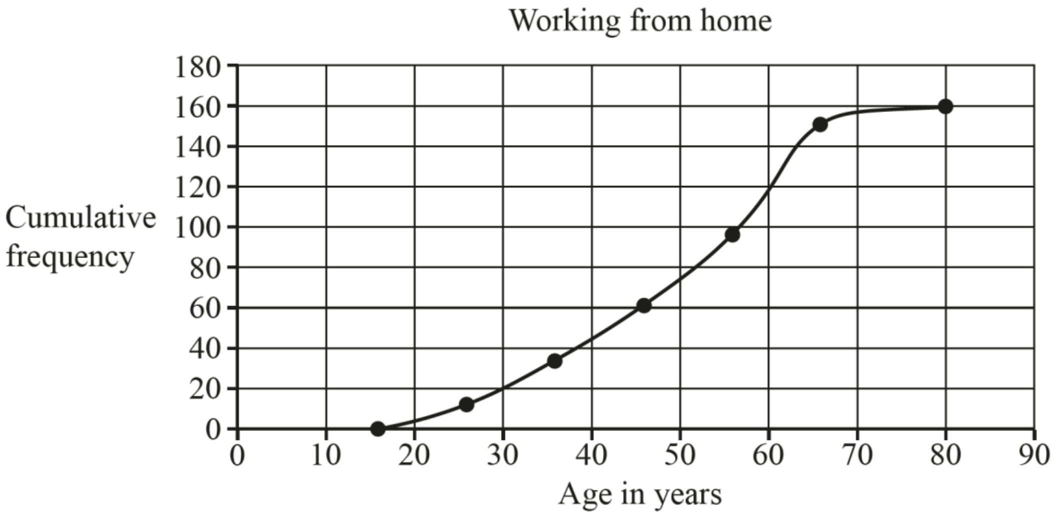


Fig. 5.2

Ali concludes that 90% of the workers in this sample who worked from home on at least one day were under 60 years of age.

(d) Explain whether Ali's conclusion is correct. **[1]**

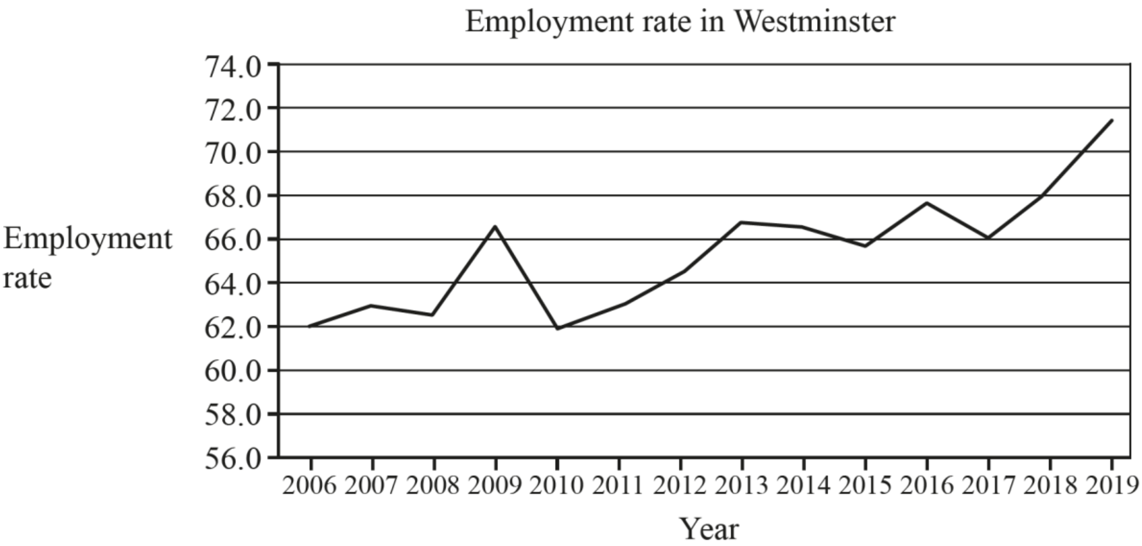
There needed to be two elements to this answer, the first saying that his conclusion is wrong and the then correct numerical reasoning. Many candidates correctly said that it was 120 people aged under 60 but then used a denominator of 200 or 180 to get an incorrect percentage. A good answer is seen below.

Exemplar 2

5(d)	It isn't correct because the C. frequency still increases by 40 which is not ~~a~~ 10% or less. ~~of the age~~ ~~ab~~ this means more than 10% are people above the age of 60.

Question 6 (a)

6 The pre-release material contains information about employment rates in London boroughs. The graph shows employment rates for Westminster between 2006 and 2019.



A local politician stated that the diagram shows that more than 60% of seventy-year-olds were in employment throughout the period from 2006 to 2019.

(a) Use your knowledge of the pre-release material to explain whether there is any evidence to support this statement. **[1]**

Many candidates appeared to have little knowledge of the large data set, judging by common answers like 'there is no data for ages in the large data set'.

Question 6 (b)

In order to estimate the employment rate in 2020, two different models were proposed using the LINEST function in a spreadsheet.

Model 1 (using all the data from 2006 onwards)
$Y = 0.549x - 1040$,

Model 2 (using data from 2017 onwards)
$Y = 2.65x - 5280$,

where Y = employment rate and x = calendar year.

It was subsequently found that the employment rate in Westminster in 2020 was 68.4%.

(b) Determine which of the two models provided the better estimate for the employment rate in Westminster in 2020. **[3]**

The majority of candidates were successful in finding the two values and stating which was the best model and why. A few candidates argued that the most recent data would give the best estimate without doing any calculations, not gaining the mark.

Question 6 (c)

(c) Use your knowledge of the pre-release material to explain whether it would be appropriate to use either model to estimate the employment rate in 2020 in other London boroughs. **[1]**

Many candidates knew that it would not be appropriate but did not mention the employment rate in their answer, often referring to other areas being not as affluent, having poorer housing and other social factors.

Question 6 (d)

(d) What does model 2 predict for employment rates in Westminster in the long term? **[1]**

Most candidates said that it would increase but did not say how or that it would exceed 100% in the long term.

Question 7 (a)

7 **(a)** On the pair of axes in the Printed Answer Booklet, sketch the graphs of

- $y = 2x + 4$
- $y = \dfrac{2}{x}$ **[2]**

Almost all candidates obtained the first B mark for drawing the line correctly but lost the second mark by drawing a reciprocal curve that did not approach the axes or turned back.

Assessment for learning

Candidates should focus on the important features of curve sketching in particular, reciprocal curves in that it approaches the axes or asymptote without either touching or turning away from it.

Question 7 (b)

(b) Determine the x-coordinates of the points of intersection of the line $y = 2x + 4$ and the curve $y = \dfrac{2}{x}$, giving your answers in an exact form. **[5]**

This question was well attempted by many candidates who knew that they needed to equate the expressions for *y* (or rearrange and equate *x*). A few had difficulties in rearranging their equation correctly. Errors were also made in solving the equation and some candidates lost marks through not giving exact answers.

Question 8 (a)

8 In 2018 research showed that 81% of young adults in England had never donated blood.

Following an advertising campaign in 2021, it is believed that the percentage of young adults in England who had never donated blood in 2021 is less than 81%.

Ling decides to carry out a hypothesis test at the 5% level.

Ling collects data from a random sample of 400 young adults in England.

(a) State the null and alternative hypotheses for the test, defining the parameter used. **[2]**

Many candidates were able to state the null and alternate hypothesis correctly, although some used 81% rather than 0.81, or had >0.81. However, a significant number of candidates did not define p correctly. Some candidates referred to the percentage of young adults never donating blood, rather than the probability or proportion or did not mention young adults at all. A few candidates thought it was the probability that they had donated blood.

Question 8 (b)

(b) Write down the probability that the null hypothesis is rejected when it should in fact be accepted. **[1]**

Many candidates did not recognise that this was the significance level.

Question 8 (c)

(c) Assuming the null hypothesis is correct, calculate the expected number of young adults in the sample who had never donated blood. **[1]**

This part was done well.

Question 8 (d)

(d) Calculate the probability that there were no more than 308 young adults who had never donated blood in the sample. **[1]**

This part was found difficult by a few candidates with some not attempting this at all. Those who did attempt it, generally did well.

Question 8 (e)

(e) Determine the critical region for the test. **[3]**

This was answered well by some candidates, but many incorrect answers were also seen. Some candidates did two-tailed critical regions, while others having calculated correct probabilities could not identify the correct region. Some candidates did not give their probabilities to the required accuracy.

Question 8 (f)

In fact, the sample contained 314 young adults who had never donated blood.

(f) Carry out the test, giving the conclusion in the context of the question. **[3]**

Having found the correct critical region in part (e) many candidates did not use it instead finding $P(X \leq 314) = 0.114 > 0.05$. Frequently, after discussing significance, their final statement let them down by either not referring to young adults or stating that it had changed from 81% not decreased, or that that the percentage giving blood was less than 81%. There were also many assertive statements with the words 'prove', 'indicate' or 'conclude' being used instead of 'suggest'.

Question 9 (a)

9 The equation of a curve is $y = 12x - 4x^{\frac{3}{2}}$.

(a) State the coordinates of the intersection of the curve with the y-axis. **[1]**

Most candidates found the correct values however, where marks were not awarded, it was due to candidates not presenting them as co-ordinates as specified in the question.

Question 9 (b)

(b) Find the value of y when $x = 9$. **[1]**

Most candidates were successful in answering this part question.

Question 9 (c)

(c) Determine the coordinates of the stationary point. **[5]**

This question was well answered with many candidates gaining full marks. Common errors were slips in differentiating or mistakes with signs when rearranging. Frequently √-2 was seen. Some candidates had difficulty solving √x=2.

Question 9 (d)

(d) Sketch the curve, giving the coordinates of the stationary point and of any intercepts with the axes. **[3]**

The most common graph extended incorrectly into the third quadrant and many candidates lost a mark by not giving the coordinates of the stationary point or any intercepts with the axes. A few candidates plotted the point (4,16) in the fourth quadrant which resulted in 0 marks as their graph was upside down.

Question 10

10 In this question you must show detailed reasoning.

The equation of a curve is $y = 12x^3 - 24x^2 - 60x + 72$.

Determine the magnitude of the total area bounded by the curve and the x-axis. **[9]**

Most candidates were able to achieve some marks on this question. Some made effective use of their calculator to draw the graph of the function and hence find factors and roots while others achieved these values from use of the factor theorem, and then algebraic division. Many candidates were able to integrate correctly, but a few candidates did have a term incorrect, or had divided by 12 before integrating therefore losing accuracy marks.

If successful in integrating, some candidates were then able to substitute and subtract, using the correct limits, to achieve full marks. However, arithmetic errors were also seen when substituting limits and some candidates had difficulty with the area under the x axis being calculated as negative. Some candidates sometimes differentiated while there were also some NRs seen. A few candidates just integrated the function, with others just factorising and finding the roots and progressing no further.

The better responses were always obtained from a sketch of the function as seen in the following example.

Exemplar 3

10

~~When y = 0~~ $12x^3 - 24x^2 - \cancel{16}\,60x + 72 = \cancel{0}\ y$

$12(x^3 - 2x^2 - 5x + 6) = \cancel{0}\ y$

When $f(1) = (1)^3 - 2(1)^2 - 5(1) + 6$

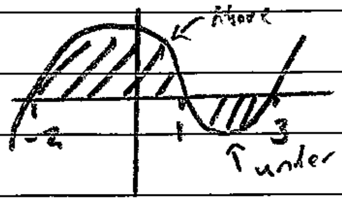
$= 1 - 2 - 5 + 6$

$= 0 \quad \therefore \quad x - 1$ is a factor

$$\begin{array}{r} x^2 - x - 6 \\ x - 1 \,\big)\, x^3 - 2x^2 - 5x + 6 \\ -\ \underline{x^3 - x^2} \downarrow \\ -x^2 - 5x \\ \underline{-x^2 + x} \\ -6x + 6 \\ \underline{-6x + 6} \\ 0 \end{array}$$

$\therefore\ y = 12(x-1)(x^2 - x - 6)$

$= 12(x-1)(x-3)(x+2)$



$\therefore A_1 = \int_{-2}^{1} 12x^3 - 24x^2 - 60x + 72\ dx$

$= [3x^4 - 8x^3 - 30x^2 + 72x]_{-2}^{1}$

$= [3(1)^4 - 8(1)^3 - 30(1)^2 + 72(1)] - [3(-2)^4 - 8(-2)^3 - 30(-2)^2 + 72(-2)]$

$= 37 - -152$

$= 189$ square units

$A_2 = \int_{1}^{3} 12x^3 - 24x^2 - 60x + 72\ dx$

$= [3x^4 - 8x^3 - 30x^2 + 72x]_{1}^{3}$

$= [3(3)^4 - 8(3)^3 - 30(3)^2 + 72(3)] - 37$ (from above)

$= \cancel{54}\ -27 - 37$

$= -64$

$= 64$ square units (under x axis

$\therefore$ Total area $= 189 + 64$

$= 253$ square units

Question 11 (a)

11 The pre-release material contains information about the Median Income of Taxpayers and the Percentage of Pupils Achieving at Least 5 A*– C grades, including English and Maths, at the end of KS4 in different areas of London.

Alex is investigating whether there is a relationship between median income and the percentage of pupils achieving at least 5 A* – C grades, including English and Maths, at the end of KS4. Alex decides to use the first 12 rows of data for 2014 – 5 from the pre-release data as a sample. The sample is shown in **Fig. 11.1**.

Area	Median Income of Taxpayers	Percentage of Pupils Achieving at Least 5 A*– C grades including English and Maths
City of London	61100	#N/A
Barking and Dagenham	21800	54.0
Barnet	27100	70.1
Bexley	24400	55.0
Brent	22700	60.0
Bromley	28100	68.0
Camden	33100	56.4
Croydon	25100	59.6
Ealing	24600	62.1
Enfield	25300	54.5
Greenwich	24600	57.7
Hackney	26000	60.4

Fig. 11.1

(a) Explain whether the data in **Fig. 11.1** is a simple random sample of the data for 2014 – 5. **[1]**

Many candidates did not know what a simple random sample is, while others described how to take a random sample.

Question 11 (b)

(b) The City of London is included in Alex's sample.

Explain why Alex is not able to use the data for the City of London in this investigation. **[2]**

Candidates found it difficult to gain 2 marks here. Most responses here referred to the outlying nature of the income value for the City of London, rather than the missing grades value. Those who spotted the missing value were unable to explain why it was a problem. There was also confusion, probably, due to the fact that they were not familiar with the large data set, as to what was meant by the City of London with many thinking that it referred to all of London rather than one borough.

Misconception

Many candidates thought the City of London referred to the whole of London rather than a particular area.

Question 11 (c)

Fig. 11.2 shows a scatter diagram showing Percentage of Pupils against Median Income for all of the areas of London for which data is available.

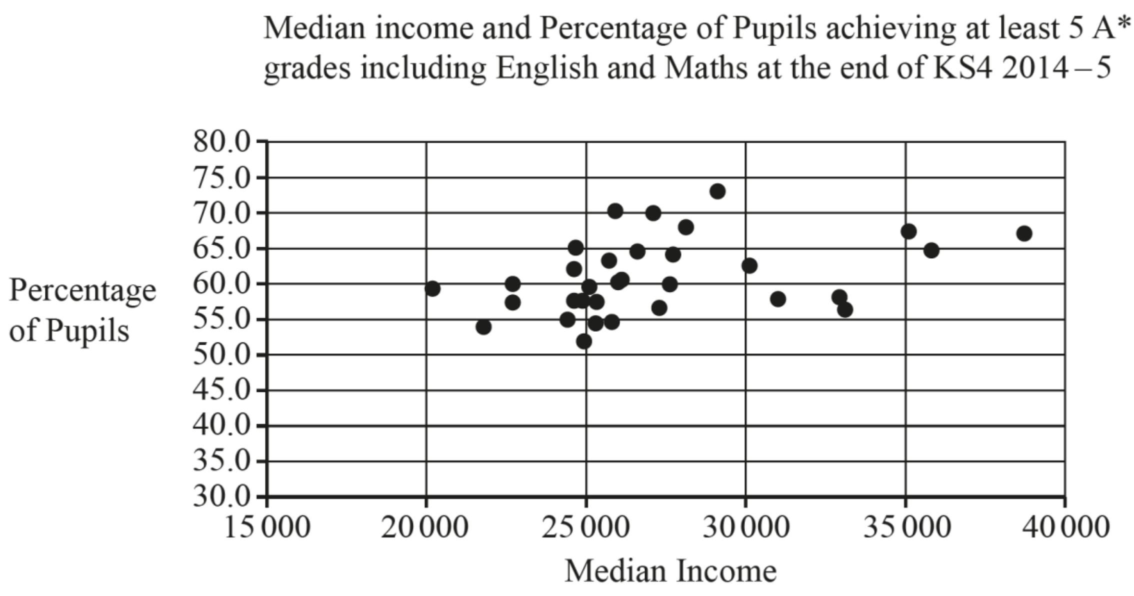


Fig. 11.2

Alex identifies some outliers.

(c) On the copy of **Fig. 11.2** in the Printed Answer Booklet, ring three of these outliers. **[1]**

Some candidates wrongly selected a wide variety of points on this plot.

Question 11 (d)

Alex then discards all the outliers and uses the LINEST function on a spreadsheet to obtain the following model.

$P = 0.0009049M + 37.38$,
where P = percentage of pupils and M = median income.

(d) Show that the model is a good fit for the data for Hackney. **[1]**

Many candidates were able to calculate a value for *P* using the value for *M* in the table for Hackney but then did not compare with the actual value.

Question 11 (e)

(e) Use the model to find an estimate of the value of P for City of London. **[1]**

Answered well by most candidates.

Question 11 (f)

(f) Give **two** reasons why this estimate may not be reliable. **[2]**

Many candidates gave long, wordy answers without explaining the issues of extrapolation or the use of an outlier.

Question 11 (g)

Alex states that more than 50% of the pupils in London achieved at least a grade C at the end of KS4 in English **and** Maths in 2014 – 5.

(g) Use the information in **Fig. 11.2** together with your knowledge of the pre-release material to explain whether there is evidence to support this statement. **[1]**

Many candidates did not get a mark for this part question, not referencing English and Mathematics or the diagram.

Supporting you

Post-results services

If any of your students' results are not as expected, you may wish to consider one of our post-results services. For full information about the options available visit the OCR website.

Keep up-to-date

We send a weekly roundup to tell you about important updates. You can also sign up for your subject specific updates. If you haven't already, sign up here.

OCR Professional Development

Attend one of our popular CPD courses to hear directly from a senior assessor or drop in to a Q&A session. Most of our courses are delivered live via an online platform, so you can attend from any location.

Please find details for all our courses on the relevant subject page on our website or visit OCR professional development.

Signed up for ExamBuilder?

ExamBuilder is the question builder platform for a range of our GCSE, A Level, Cambridge Nationals and Cambridge Technicals qualifications. Find out more.

ExamBuilder is **free for all OCR centres** with an Interchange account and gives you unlimited users per centre. We need an Interchange username to validate the identity of your centre's first user account for ExamBuilder.

If you do not have an Interchange account please contact your centre administrator (usually the Exams Officer) to request a username, or nominate an existing Interchange user in your department.

Active Results

Review students' exam performance with our free online results analysis tool. It is available for all GCSEs, AS and A Levels and Cambridge Nationals.

It allows you to:

- review and run analysis reports on exam performance
- analyse results at question and/or topic level
- compare your centre with OCR national averages
- identify trends across the centre
- facilitate effective planning and delivery of courses
- identify areas of the curriculum where students excel or struggle
- help pinpoint strengths and weaknesses of students and teaching departments.

Find out more.

Need to get in touch?

If you ever have any questions about OCR qualifications or services (including administration, logistics and teaching) please feel free to get in touch with our customer support centre.

Call us on
01223 553998

Alternatively, you can email us on
support@ocr.org.uk

For more information visit
- **ocr.org.uk/qualifications/resource-finder**
- **ocr.org.uk**
- **/ocrexams**
- **/ocrexams**
- **/company/ocr**
- **/ocrexams**

We really value your feedback

Click to send us an autogenerated email about this resource. Add comments if you want to. Let us know how we can improve this resource or what else you need. Your email address will not be used or shared for any marketing purposes.

I like this **I dislike this**

Please note – web links are correct at date of publication but other websites may change over time. If you have any problems with a link you may want to navigate to that organisation's website for a direct search.