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Examiners' report

LEVEL 3 CERTIFICATE

CORE MATHS A (MEI)

OCR Level 3 Certificate in Core Maths A (MEI)

H868

For first teaching in 2016

H868/02 Summer 2025 series

Version 1

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 responses is 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 Teach Cambridge.

Paper 2 series overview

Examiners saw many excellent responses to the contexts presented in this paper. Most candidates were able to identify relevant information from text and diagrams to allow them to construct appropriate calculations. The most successful solutions to problems of an unstructured nature were characterised by using all available information, stating assumptions clearly and presenting work logically. Many candidates worked with confidence on questions based on the pre-release materials.

The most successful candidates skilfully interpreted a wide range of situations, working out what was relevant information as they moved through the paper and applying their maths skills critically to familiar and unfamiliar scenarios.

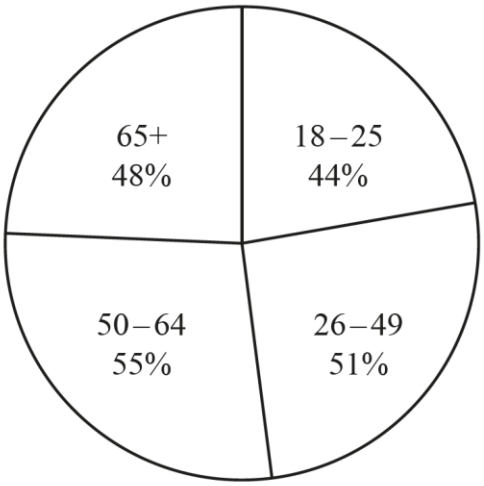
Candidates who did well on this paper generally:	Candidates who did less well on this paper generally:
• structured their calculations clearly • worked confidently and accurately in a range of contexts • selected relevant information from diagrams to support calculations where appropriate • gave clear explanations when asked to critique or justify given statements • demonstrated modelling skills in a variety of situations.	• only worked confidently in routine situations • did not present calculations clearly and made errors in their workings • did not consider whether their answers were sensible for the situation modelled • did not adequately explain or justify given statements • did not model unstructured questions effectively.

Question 1 (a)

1 A council is considering changing the speed limit in their town from 30 mph to 20 mph.

The council does a survey to find out what percentage of adult residents approve of the change. The council displays the results in a pie chart.

The pie chart shows the approval percentage by age group.



(a) State **one** reason why this is **not** an appropriate way to display the data. **[1]**

Nearly all candidates gave a clear justification here. The most common response was to point out that since pie charts represent a fraction or proportion of a whole, the use of percentages here could be confusing.

Question 1 (b)

(b) Suggest a better way to display the data. **[1]**

Most candidates correctly stated that a bar chart would be a better way to represent this data.

Question 1 (c)

(c) A resident says that a journey at 20 mph takes one third longer than the same journey at 30 mph.

Is the resident correct?

Show your reasoning. **[3]**

Most candidates gave a robust response to this scenario by choosing an arbitrary journey distance and presenting calculations for the time taken while driving at each speed. These times were then compared to conclude that the resident was wrong.

Question 2 (a)

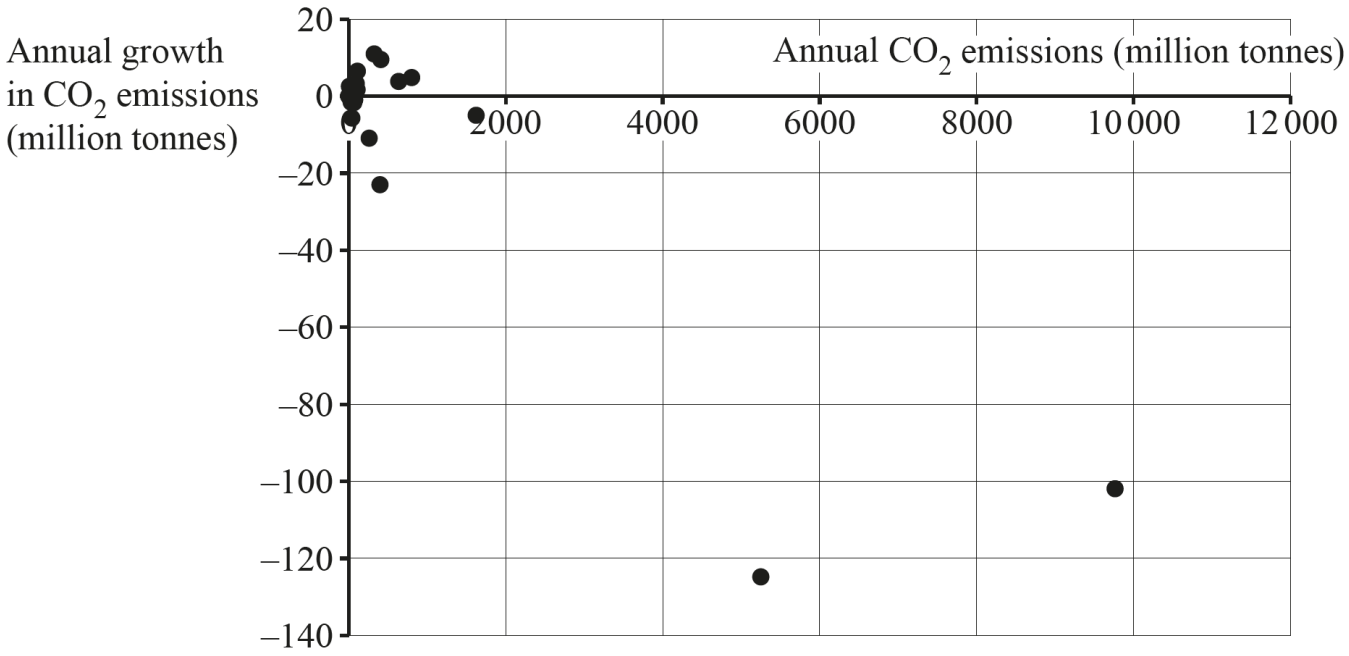
2 This question refers to article A in the pre-release material, **'Carbon dioxide (CO_2) emissions'**. You can find the article on the Insert accompanying this paper.

Fig. 2.1 shows the annual CO_2 emissions and the annual growth in CO_2 emissions for a sample of 30 countries in 2016.

Each point in the scatter diagram represents a country.

(a) Circle the point in **Fig. 2.1** which shows the country that had the greatest **decrease** in its CO_2 emissions. **[1]**

Fig. 2.1



Nearly all candidates correctly circled the lowest point.

Question 2 (b)

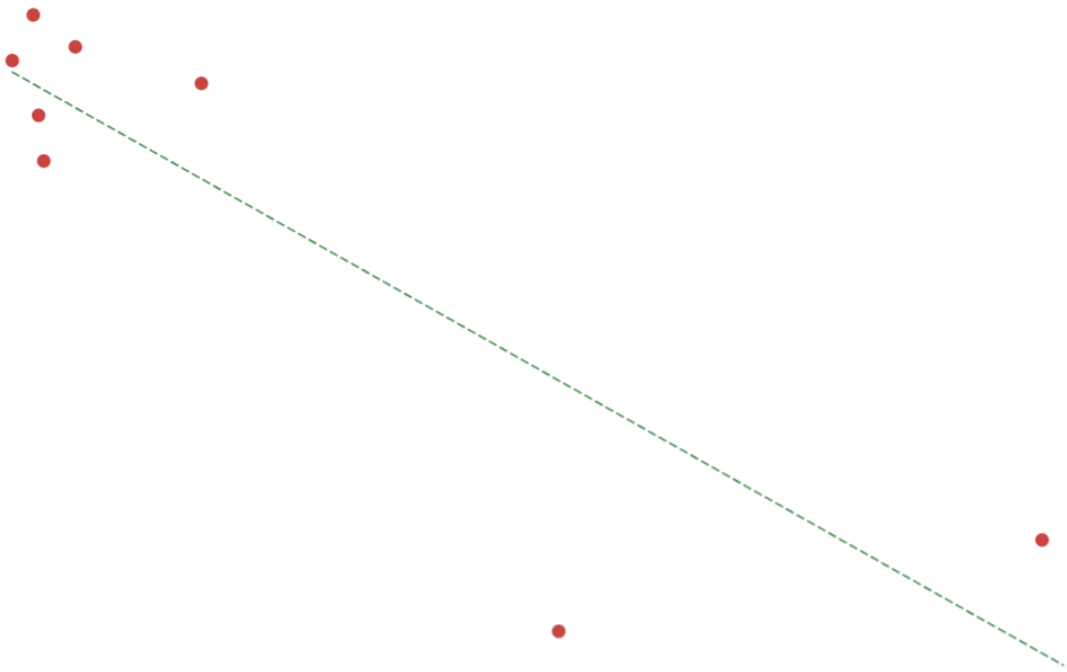
(b) State the type of correlation shown in **Fig. 2.1**. **[1]**

Only a small proportion of candidates correctly identified the scatter graph as showing negative correlation.

Misconception

Although there is a clustering of points in one part of the graph, when the other two points in the data set are considered along with the cluster, there is a clear trend showing negative correlation.

When working on correlation in various contexts, it may be helpful to screen out nearly all of the information to help candidates visualise the trend. This adapted version of Fig. 2.1 is showing a clear negative correlation between emissions and growth in emissions.



Questions 2 (c) and 2 (d)

(c) Explain briefly what is meant by "regression to the mean" in the context of annual CO_2 emissions. **[1]**

(d) What feature in **Fig. 2.1** suggests that there might be regression to the mean? **[1]**

Very few candidates were able to give a relevant description of regression to the mean in this context. The simplest way to do this would be with reference to either or both of the points in Fig. 2.1 that show countries with very high emissions and also very large reductions in their emissions.

Question 2 (e)

(e) A student says that the units shown on the vertical axis of **Fig. 2.1** are wrong and should be % rather than million tonnes.

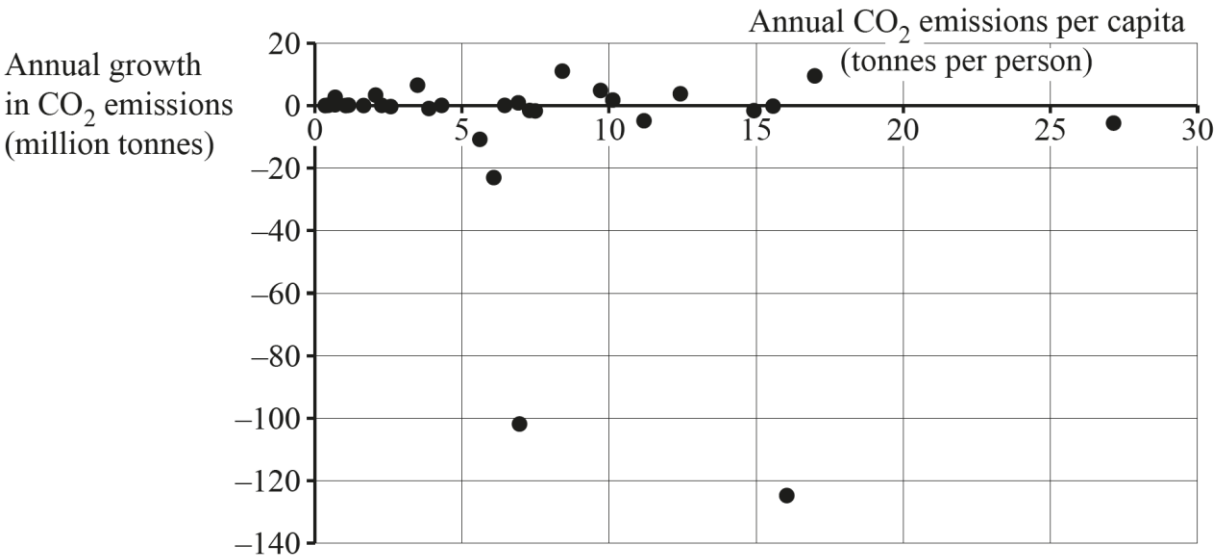
Explain, with reference to these data, why the student must **not** be correct. **[1]**

Very few candidates were able to recognise that you cannot reduce a quantity by more than 100%.

Question 2 (f)

(f) **Fig. 2.2** shows the annual CO_2 emissions **per capita** and the annual growth in CO_2 emissions for the same 30 countries as **Fig. 2.1**.

Fig. 2.2



Estimate the population of the country which had the greatest **decrease** in its CO_2 emissions.

Use the data in **Fig. 2.1** and **Fig. 2.2**. **[3]**

Many candidates correctly identified the lowest point from Fig. 2.2, with a value of 16 tonnes for per capita emissions. Very few were able to connect this with Fig. 2.1 to obtain the corresponding emissions of around 5200 million tonnes for this country in order to calculate an estimate of the population.

Question 3 (a)

3 A first class university degree is the highest grade available.

The table below shows the percentage of degrees in England which were first class in each of the academic years ending 2012 to 2016.

Each percentage has been rounded to the nearest whole number.

Academic year ending	2012	2013	2014	2015	2016
% degrees which were first class	17	19	21	23	25

(a) Find the percentage point increase in the percentage of first class degrees from 2012 to 2016. **[1]**

This was nearly always answered correctly.

Question 3 (b)

(b) Show that the percentage of first class degrees has risen by approximately 47% from 2012 to 2016. **[2]**

Nearly all candidates formed an appropriate calculation to justify this increase.

Questions 3 (c) and 3 (d)

(c) A journalist assumed the trend in the table would continue and wrote this headline about the data:

'All degrees will be first class by _____'

Work out the missing year for the headline.

Show your working and assumptions clearly. **[3]**

(d) Suggest **one** reason why the journalist's prediction is very unlikely to happen. **[1]**

Most candidates used the 2% increase per year to model 2054 as the year in which all degrees awarded would be first class if this trend were to continue and went on to explain why this would be very unlikely.

Question 4

4 Mia has been given a £30 voucher to spend in an online shop.

She wants to spend the whole voucher without adding any extra money to it.

Mia can choose one of two options, A or B, for a special offer.

Option A: The value of the voucher is increased by 20%.
Option B: Prices are reduced by 20%.

Which option is better value for Mia?

Show your working. **[5]**

Nearly all candidates correctly worked out the value of the voucher under option A as £36. Many also presented appropriate calculations to determine the value £37.50 as the amount of goods that could be purchased with option B. Some did this very efficiently in a single calculation using reverse percentage skills, while others worked towards this value in a logical way. Less successful responses did not obtain an appropriate value for option B to compare with '£36' or chose items where Mia would have to add money to the voucher.

Question 5

5 **Fig. 5.1** is a design made by joining the midpoints of the sides of an equilateral triangle ABC.

This makes a smaller equilateral triangle.

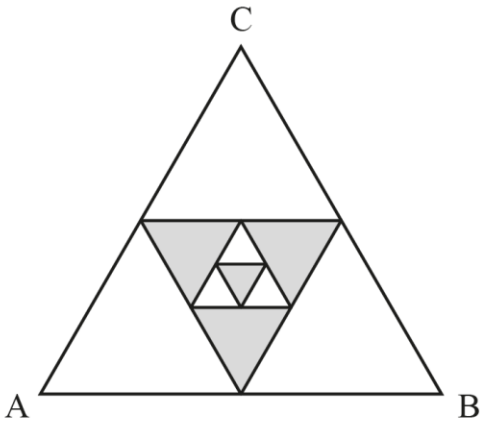
The process is repeated with the new triangle and then one more time.

The design is then shaded as shown.

What fraction of the original triangle ABC is shaded?

You must show clearly how you have arrived at your answer. **[4]**

Fig. 5.1

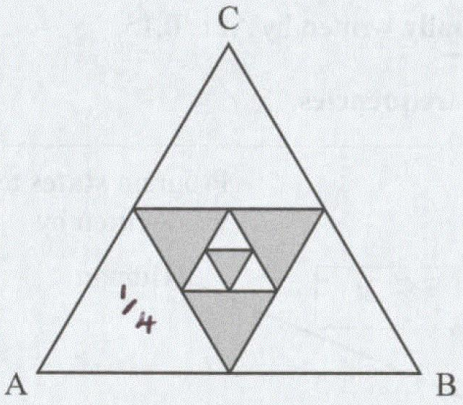


Many good attempts were seen to determine the shaded area of the shape. Some were simple and effective and used further sub-divisions to show clearly that the whole shape was comprised of 64 smaller congruent equilateral triangles of which 13 were shaded, giving 13/64 as the shaded fraction.

In the exemplar below, the candidate has developed a fully reasoned solution which considers fractions at every stage of their working. Each stage is described clearly with reference to the diagram, with the final answer (13/64) coming from the addition of the small central triangle (1/64) to the three larger shaded triangles (each with an area of 1/16).

Exemplar 1

5 **Fig. 5.1**



ABC = 1

↳ split in 4, so small triangle = 1/4, then split into 4 again = 1/4 × 1/4 = 1/16 × 3 = 3/16

3/16 = three larger shaded triangles

none shaded triangle which = 1/16 of ABC is split in 4, so = 1/16 × 1/4 = 1/64

1/64 + 3/16 = 13/64

Question 6 (a)

6 A computer program is being developed to identify text written by AI (Artificial Intelligence).

The program reads text and states whether it was written by a human or AI.

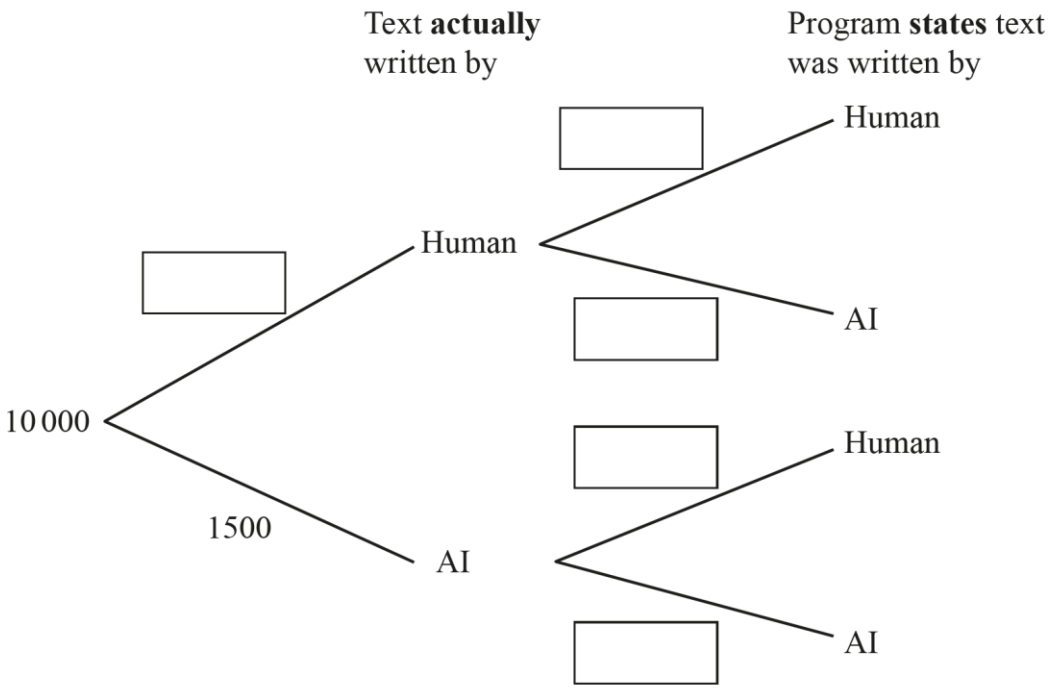
The probability of the program being correct or **not** correct depends on whether the text was actually written by a human or AI.

- When the program reads text that was actually written by a human, the probability it **correctly** states it was written by a human is 0.9.
- When the program reads text that was actually written by AI, the probability it **correctly** states it was written by AI is 0.25.

(a) The program is tested on a sample of 10 000 texts.

The probability that a text in the sample was **actually** written by AI is 0.15.

Complete the tree diagram to show the **expected frequencies**. **[3]**



Most candidates completed the diagram correctly, but occasionally probabilities were seen rather than the expected frequencies.

Question 6 (b)

(b) Calculate the probability that the program states a randomly selected text in the sample was written by AI. **[2]**

Most responses identified and used the appropriate expected frequencies in forming the required probability.

Question 6 (c)

(c) Calculate the probability that a text the program states was written by AI was actually written by AI. **[2]**

Assessment for learning

Candidates were less successful in identifying the relevant expected frequencies to form the required conditional probability in this part. While formal language and notation is not required for conditional probability, candidates should be encouraged to consider the 'reduced sample space' which in this context is 'texts identified as AI' (850 + 375). The probability that the texts were actually written by AI is then formed as $\frac{375}{850 + 375}$.

Question 6 (d)

(d) Comment on whether the program is a good way to identify text that has been written by AI.

Use data from this question in your answer. **[1]**

The most successful attempts correctly referred either to probabilities using candidates' answers from Question 6 (c) or a relevant probability from the design of the text-checking program.

Question 7 (a)

7 This question refers to article B in the pre-release material, **'Free childcare for working parents'**.
You can find the article on the Insert accompanying this paper.

(a) Riley works 10 hours each week and is paid £10.42 per hour.

Show that Riley will **not** be able to get free childcare for her three-year-old child. **[1]**

Most candidates gave a good supporting calculation to identify that Riley did not earn enough to qualify for free childcare.

Questions 7 (b) and 7 (c)

(b) Estimate the probability that a person chosen at random from the UK population is a child aged over 9 months and less than 5 years.

State clearly any assumptions you make. **[3]**

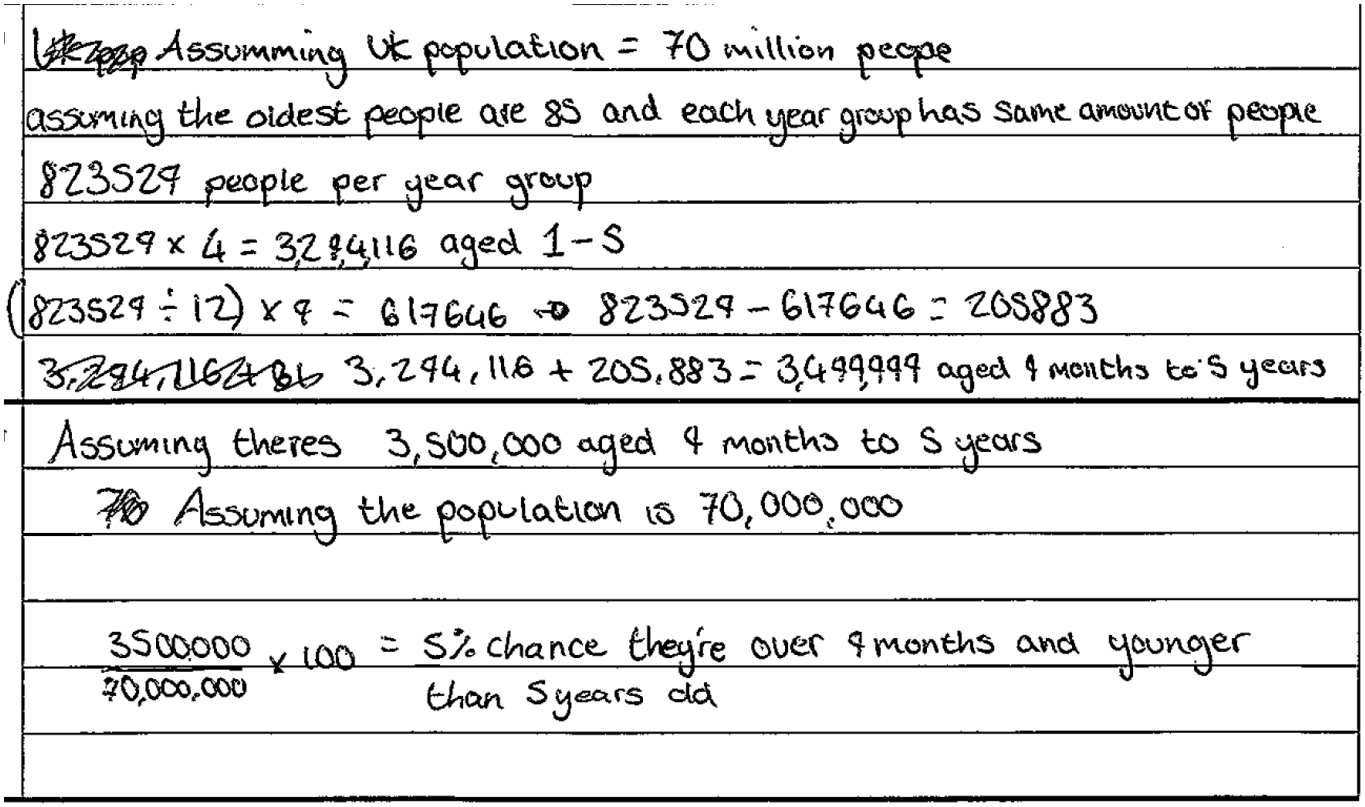
(c) Estimate the number of children in the UK aged over 9 months and less than 5 years.

State clearly any assumptions you make. **[2]**

Various strategies were seen in response to Questions 7 (b) and 7 (c). Nearly all candidates scored at least 2 marks across these questions by stating the UK population and for an estimate of the number of children aged between 9 months and 5 years that fell within the range required. More successful attempts included clear reasoning to describe how the proportion of children had been established in Question 7 (b).

In the exemplar below, the critical step in demonstrating a secure quantitative understanding of the situation is to make a reasonable assumption for UK life expectancy (85 years). Once this has been established, the population can be modelled across all age groups. The candidate then breaks the population down into year groups to determine the number of children in the age bracket required, with a further sub-division of the 0-1 year olds to form their final proportion. Very few fully correct and reasoned responses like this were seen to Questions 7 (b) and 7 (c).

Exemplar 2



Question 7 (d)

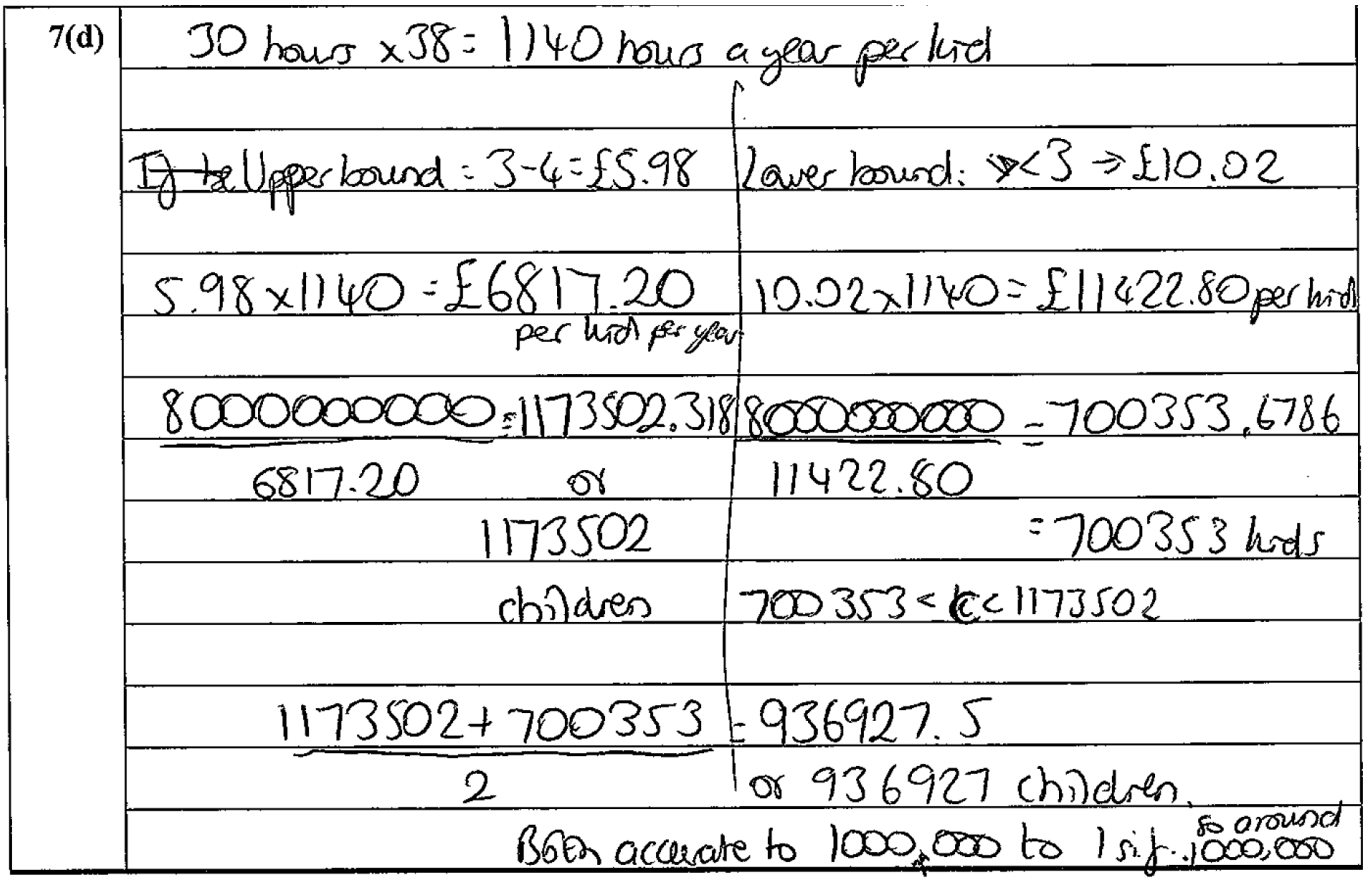
(d) The government plan to allocate £8 billion per year for the free childcare in England.

Calculate an estimate for the number of children who could be given 30 hours free childcare per week in term time. **[4]**

Nearly all candidates presented some relevant work in Question 7 (d) that partially modelled the allocation of the government's budget for free childcare. This question was based on the pre-release material, and it is expected that students will be familiar with the scenario. More successful responses fell clearly into two categories, either multiplying hourly rate by hours and then weeks, or dividing the budget by weeks and hours and rates.

In the exemplar below, the candidate uses the multiplication approach, recognising that the two rates of £5.98 and £10.02 will represent upper and lower bounds to the problem. Each case is modelled logically to obtain estimates of the number of free childcare places that could be provided, with a final estimate from averaging the two numbers obtained. In many other responses, candidates made a clear and robust simplifying assumption to work with an average rate of £8 throughout.

Exemplar 3



Question 7 (e)

(e) State **two** reasons why the answer to part **(d)** is less than the answer to part **(c)**. **[2]**

Most candidates gave at least one good answer in context, using information from a relevant part of the question, or from their own quantitative understanding of this context such as 'the budget was set too low'.

Question 8 (a)

8 Lecturers at a university want to know whether learning from computer-based study is as effective as learning by attending traditional lectures.

The university has 1250 students on a particular course.

The lecturers randomise students into two groups:
- Group A learns by attending traditional lectures.
- Group B learns from computer-based study.

When both groups have completed their learning, they are given the same test.

(a) Describe a suitable method for allocating the 1250 students to the two groups at random. **[1]**

The most successful responses chose a randomised approach and described exactly how the selection of the two groups would be carried out. Responses that fell short often did not describe how the two groups would be selected from their random process.

Question 8 (b)

(b) Explain why it is important to allocate the students to the groups at random. **[1]**

There were many good answers here in context. Statements without any context for the selection of students to create different study groups, such as 'to avoid bias', were not accepted.

Question 8 (c)

(c) Explain why it is **not** possible for this to be a double-blind trial. **[1]**

Most candidates correctly noted that all students would need to know which group they were in if selected to take part in the trial.

Question 8 (d)

(d) A student suggests that it would be better to have three groups in the trial:

- Groups A and B would be as already described.
- Group C would be the control group and would **not** be taught anything.

Is the student correct in saying these three groups would be better than the original two?

Explain your answer. **[1]**

Most candidates correctly identified that to compare the two study methods, only one group for each kind of study would be required. No other 'control' group would be relevant.

Question 8 (e) (i)

(e) Another course at the university has 729 students on it.

Students on this course experience a mixture of computer-based study and lectures.

All 729 students are asked which method of learning they prefer. They have to choose one or the other.

Consider lots of groups of 729 students being asked which of the two learning methods they prefer.

Imagine the students do **not** really have a preference but have to choose one method.

(i) What will be the mean number of students who choose lectures? **[1]**

Misconception

While 364.5 students was the most common correct answer for the mean, some candidates wrongly gave the answer as 364 or 365, presumably from the misconception that the mean had to be a whole number of students.

OCR support

Section check in tests feature questions on a single section of the specification and can be used as formative assessments.

For support with working with statistics, download the Statistics section check in test from Teach Cambridge.

Question 8 (e) (ii)

(ii) What will be the standard deviation of the number of students who choose lectures? **[2]**

There were an encouraging number of correct answers here, that used the formula given in the specification for this type of statistical experiment as $\frac{\sqrt{n}}{2}$. Occasionally this formula was not used appropriately, with candidates using their mean from Question 8 (e) (i) rather than the number of trials (729).

Question 8 (e) (iii)

The lecturer in charge of the course thinks that students are just as likely to choose each of the methods.

The lecturer will conclude that students are **not** just as likely to choose each of the methods if the number of students choosing lectures is more than two standard deviations above or below the mean.

(iii) How many students need to choose lectures so that the lecturer will conclude that students are **not** just as likely to choose each of the methods? **[4]**

A significant proportion of candidates did not score any marks in response to this part. A minority of candidates scored 2 marks by determining the number of students at two standard deviations either above or below the mean. The most successful candidates worked out values both above and below the mean to obtain the fully correct answer for this statistical experiment.

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