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Examiners' report

CORE MATHS A (MEI)

H868

For first teaching in 2016

H868/02 Summer 2023 series

Version 1

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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 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 OCR.

Paper 2 series overview

Candidates demonstrated a good understanding of the specification in their attempts at this paper. Mathematical calculations were presented clearly, and a wide range of diagrams and situations were interpreted correctly. The best responses showed fluency in procedural skills, problem-solving and strategies, applied to both familiar and unfamiliar real-life contexts. Examiners saw many excellent descriptions and interpretations.

Candidates who did well on this paper generally:	Candidates who did less well on this paper generally:
• worked confidently in a range of contexts, • structured their calculations clearly, • worked accurately and considered whether their responses were sensible in context, • used sketches 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 familiar situations, • did not present their calculations clearly and made frequent errors in their workings, • did not support calculations with appropriate sketches, • did not adequately explain or justify given statements, • did not model unstructured questions effectively.

Question 1 (a) (i)

1 An air traffic control strike stopped flights into and out of a country for a week.
Because of the strike, four airlines have to refund all the customers who were intending to fly that week.
One month after the end of the strike, two newspapers published charts to show how the refunds are going. These are shown in **Fig. 1.1** and **Fig. 1.2**.

Fig. 1.1

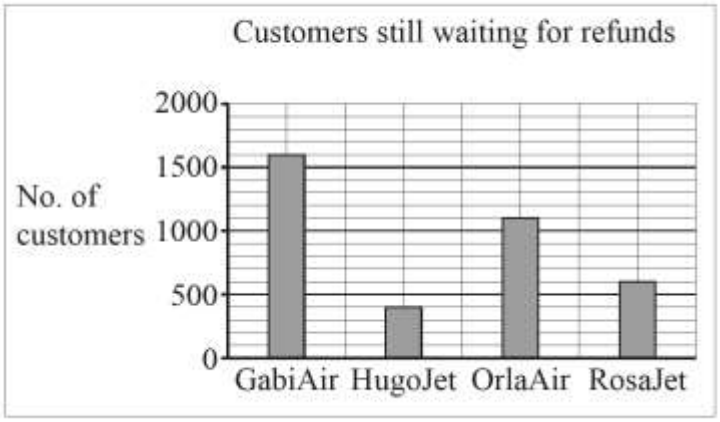
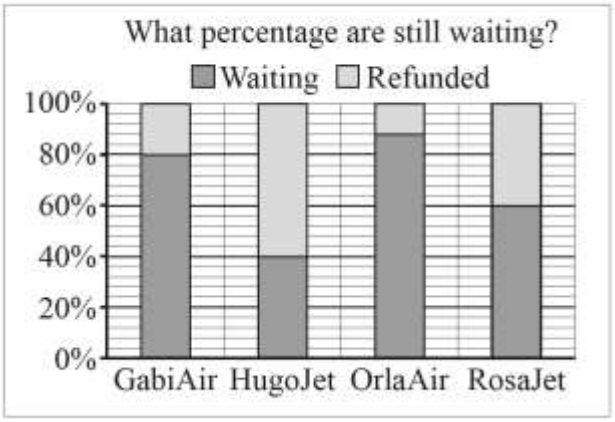


Fig. 1.2



(a) (i) How many GabiAir customers are still waiting for refunds? **[1]**

Most candidates correctly read the value required from the first graph. A common wrong response came from combining the two graphs to work out 80% of 1600.

Question 1 (a) (ii)

(ii) How many GabiAir customers have been refunded? **[2]**

The most successful responses started with the clear statement that 1600 customers awaiting refunds represented 80%. There were then many correct methods for calculating 20% of GabiAir customers. The most common error was to assume that the response to Question 1 (a) (i) represented the total number of customers.

Question 1 (b)

(b) How many HugoJet customers have been refunded? **[2]**

This part again required readings from both graphs, with the 400 HugoJet customers awaiting refunds representing 40%. A common error was to work out 60% of 400.

Assessment for learning

Questions 1 (a) (ii) and 1 (b) are examples of percentage problems where 100% of the quantity (in this case total number of customers) is not known and must be deduced from the information available. Both parts can be modelled using 'reverse percentage' skills.

OCR support

A transition guide with checkpoint tasks to help candidates move from key stage 4 to Core Maths when working with percentages can be downloaded from Teach Cambridge:

Transition guide: Percentages, Checkpoint task: Percentages and Teacher instructions

Question 1 (c)

(c) State whether the following statement is justified, explaining your reasoning.

"There are nearly twice as many customers waiting for refunds from OrlaAir as from RosaJet."

[1]

The best responses correctly compared 1100 and 600 to explain whether or not the statement was justified.

Question 1 (d)

(d) State whether the following statement is justified, explaining your reasoning.

"If they don't speed up with the refunds, it will take GabiAir another 8 months to refund all their customers."

[2]

Nearly all candidates were able to answer this with a clear argument, supported by a relevant calculation.

Question 2 (a) (i) and (ii)

2 This question refers to article A in the pre-release material, "Cold Weather Payments". You can find the article on the insert accompanying this paper.

(a) (i) What was the **minimum** temperature recorded at Andrewsfield on 6 February 2021? **[1]**

(ii) What was the **maximum** temperature recorded at Andrewsfield on 6 February 2021? **[1]**

Nearly all candidates read the correct information from the insert for Questions 2 (a) (i) and 2 (a) (ii).

Question 2 (b) (i)

(b) Some politicians are discussing changes to the rules.
Three possible rules are given below.

For each of the rules, decide whether it would result in a payment for the data shown in the insert and tick the appropriate box.
Explain your reasoning.

2(b)(i)	**Rule A:** The average temperature on each of the 7 consecutive days has to be below 0 °C.		
	☐ Payment	☐ No payment	☐ Can't tell
	Reason		

[2]

There were many incorrect responses here. The most common error was to refer to the mean temperature across all 7 days, rather than pointing out that the average temperature on the first day could not be below zero as all the temperatures were positive.

Question 2 (b) (ii)

2(b)(ii)	**Rule B:** The mean of the temperatures at mid-day (12:00) over the 7 days has to be below 0 °C.
	☐ Payment ☐ No payment ☐ Can't tell
	Reason

[2]

There were many incorrect responses here. To evaluate the effect of this rule change, candidates should have calculated the mean of the seven mid-day temperatures.

Question 2 (b) (iii)

2(b)(iii)	**Rule C:** The temperature on each of the 7 consecutive days has to drop below 0 °C.
	☐ Payment ☐ No payment ☐ Can't tell
	Reason

[2]

There were many incorrect responses here. The most successful responses stated clearly that no payment would be made as the temperatures on 6th February are all above zero.

Question 2 (c)

(c) Alex is thinking about how the current rules for Cold Weather Payments work.
She says, *"If all the temperatures recorded at Andrewsfield from 6 to 12 February 2021 had been 0.5°C higher then it would not have been cold enough for a Cold Weather Payment."*

Determine whether Alex is right.
Show your reasoning. **[2]**

Very few candidates gave the required justification of adding 0.5 to the mean temperature and showing this was still negative.

Exemplar 1

mean for 7 day period = −0.62°C
−0.62°C + 0.5°C = −0.12°C
Still below 0 so there would still have been a Cold Weather Payment

Exemplar 1 shows very clearly the effect of lifting all temperatures by 0.5 degrees. It starts with a reading from the insert, has a calculation and a clear concluding statement. This response was given full marks.

Question 3 (a)

3 This question refers to article B in the pre-release material, "Using a 100 square to represent percentages". You can find the article on the insert accompanying this paper.

A business offered the employees in head office free membership at a gym of their choice.

They monitored the percentage of employees who took up membership and the percentage of employees who had used their chosen gym in the past month.
Fig. 3.1 shows the percentages on 7 June.

On 15 June, the offer was extended to **all** employees of the company.
Fig. 3.2 shows the percentages on 5 July in the same year.

Fig. 3.1

7 June
Out of head office employees
71.3% members
40.6% users

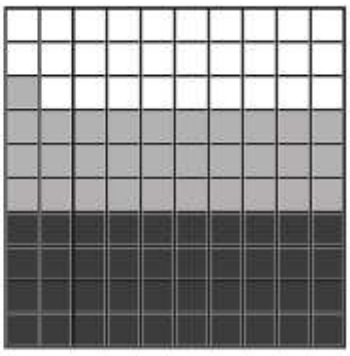
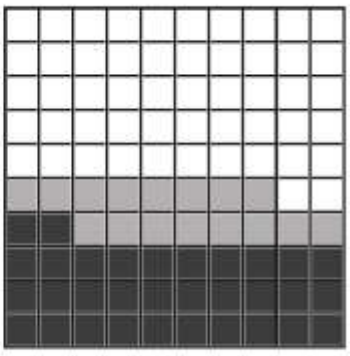


Fig. 3.2

5 July
Out of all employees
48.9% members
32.2% users



(a) Suggest **one** reason why the percentages are lower in **Fig. 3.2** than in **Fig. 3.1**. **[1]**

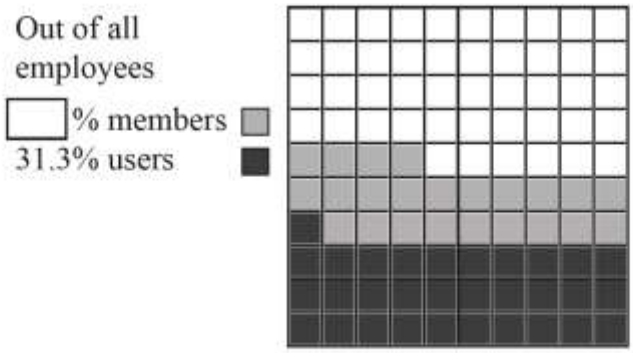
Most candidates realised and were able to explain that the larger number of employees represented in the second diagram could lead to lower percentages even if there was an increase in the number of employees taking up gym membership.

Question 3 (b)

(b) **Fig. 3.3** shows the percentages at a later date.
One number is missing from the label.
The person who drew the chart was given the percentages to one decimal place.

In **Fig. 3.3**, give the smallest and largest possible value of the members' percentage.
Give your answers to **one** decimal place.

Fig. 3.3



[2]

3(b)	**Members' smallest value**
	Members' largest value

The correct responses 54.0 and 54.9 were seen rarely.

Misconception

Presenting information using a 100 square was available as a pre-release for this examination series.

To answer Question 3 (b) successfully, candidates needed to refer to all 3 figures, Fig 3.1, Fig 3.2 and Fig 3.3, to intuit that the '% members' category consistently referred to all the shaded squares in each figure (grey and black).

In Fig 3.3, there were 54 squares shaded leading to truncated values of 54.0 and 54.9. A very common misconception was to just count the 23 grey squares which gave the wrong response, 23.0 to 23.9.

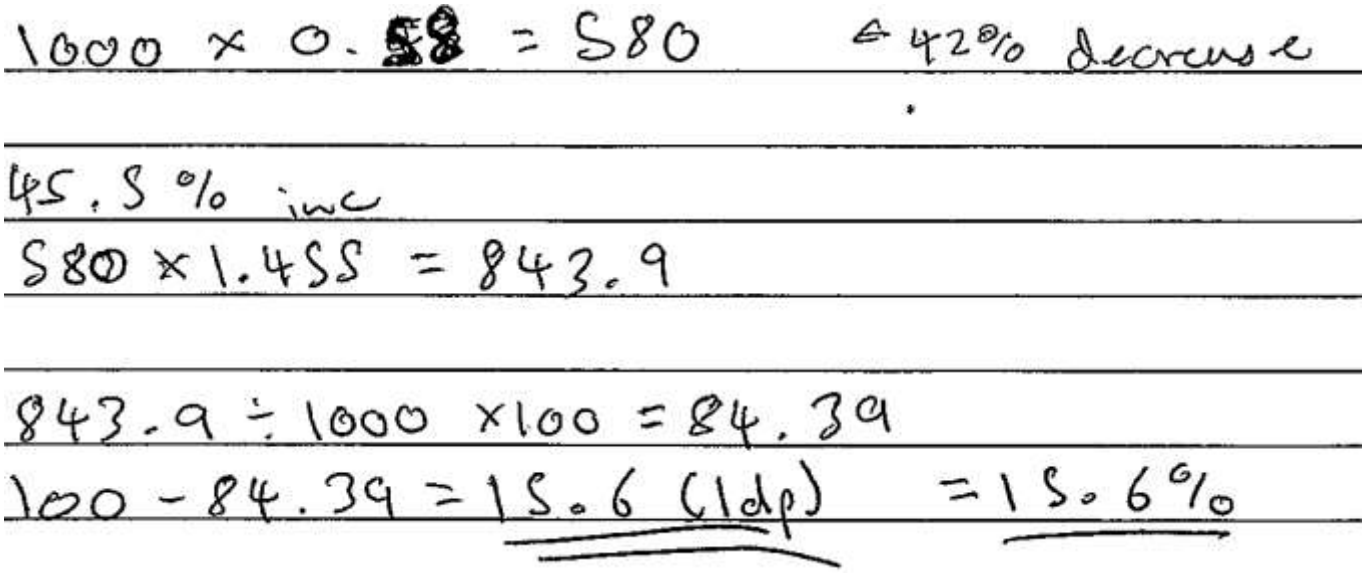
Question 3 (c)

(c) From the start of August to the end of August, company sales fell by 42% due to holidays. From the start of September to the end of September in the same year, sales rose by 45.5%.

Show that the overall change, from the start of August to the end of September, was a decrease and give the percentage decrease to **one** decimal place. **[4]**

Candidates who were successful in this part of the question generally used multipliers or started with an easy number for the original number of sales, or a combination of both these strategies. A few candidates did not gain the final mark because they did not give the overall percentage decrease, as requested, to one decimal place.

Exemplar 2



In Exemplar 2, the candidate starts with 1000 sales which is first reduced by 42% and then increased by 45.5% giving 843.9 sales. The percentage change is calculated, and the overall reduction is presented clearly as a percentage to one decimal place. This response was given full marks.

Question 4 (a)

4 A local council is deciding what to do with 50 hectares of land.
A hectare is $10\,000\,m^2$.

(a) One councillor suggests planting trees on the land.
He says it would be possible to plant 20 million trees on the land.

Decide whether it is realistic to have 20 million trees on 50 hectares.
Show your reasoning. **[3]**

Most candidates were able to present a clear calculation and were given 2 or 3 marks here. The two main approaches seen were to assume a size for a typical tree and work out how many could fit into 50 hectares, or to work out how much space there would be for each tree if 20 million were planted in the given plot of land.

A few candidates lost track of whether they were working with trees per unit area or area per tree, and occasionally candidates forgot to convert hectares into square metres using the conversion given.

Exemplar 3

How big do the trees get and how much space do they need?

$50 \times 10,000 = 500,000\ m^2$ of land

$500,000 \div 20,000,000 = 0.025\ m^2$

unrealistic each tree would have to be able to take up only $0.025\ m^2$ of land.

In this response the candidate deals with the conversion of hectares at the beginning, and states clearly that they are considering how much space there will be per tree if 20 million are planted as proposed. It finishes with a clear statement that $0.025m^2$ is not a realistic amount of land in which one tree can grow. This response was given full marks.

Question 4 (b)

(b) Another local councillor says that young people find it difficult to buy a house in the area.
She suggests building affordable houses on the land.
Each house would be suitable for a small family.
There will be no blocks of flats, just individual houses.

Estimate how many houses could be built on 50 hectares. **[6]**

Many candidates did well on this question, choosing sensible dimensions for a house and allowing space for roads and gardens within the overall plot of land. Calculations were generally clear and nearly all candidates used rounded answers and estimation appropriately. Some started with infeasibly small or large houses, which led to unrealistic responses. An awareness of everyday measures underpins this qualification and should form part of teaching through practical tasks or data collection and analysis.

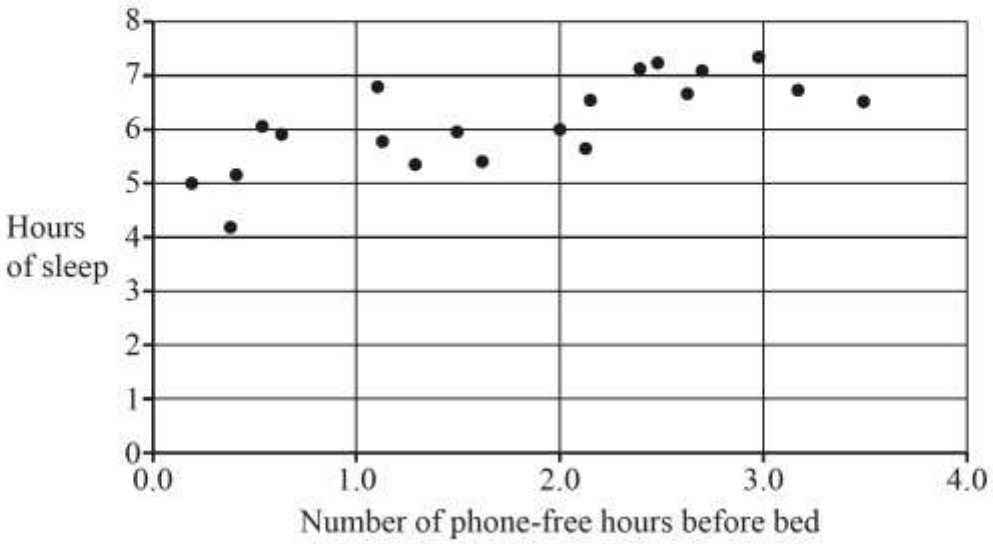
Question 5 (a)

5 As a pilot project a researcher asks a group of 20 adults for two items of information about their sleep on one particular night:

- How many hours of sleep they had.
- When they last used their phones before going to bed.

The data are shown in **Fig. 5**.

Fig. 5



(a) Circle the point in **Fig. 5** that shows the data for the adult who got the least sleep. **[1]**

Most candidates correctly circled the lowest point.

Question 5 (b)

(b) What kind of correlation is shown in **Fig. 5**? Tick the correct box. **[1]**

5(b)

	Positive correlation
	Negative correlation
	No correlation

Most candidates gave a correct response to this question, but some occasionally wrongly stated that there was no correlation.

Question 5 (c)

(c) Give **one** reason why the data do **not** provide clear evidence that using your phone close to bed-time reduces the amount of sleep. **[1]**

Many successful responses were seen which referred to people in the scatter diagram who used their phone close to bedtime, but still got more sleep than many who had not used their phone for several hours. Another successful argument was that there was not much variation overall with most people having 5 to 7 hours sleep.

Question 5 (d)

To investigate this situation further, the researcher recruits 400 people for a randomised controlled trial.

Group A will **not** be allowed to use their phones in the three hours before going to bed.
Group B will be asked to use their phones in the three hours before going to bed.

Phone use and hours of sleep will be recorded automatically for each person.

(d) Briefly describe **one** method of allocating the 400 people to the two groups at random. **[1]**

Many candidates had a good idea but did not give a complete method. A complete method should explain clearly how randomised selections and allocations to groups would be achieved. Many candidates referred to technology such as random number generators without describing how they would be used to create two random groups.

Question 5 (e)

(e) Why is it important to allocate the people to the groups at random? **[1]**

Most candidates were able to explain in context why random allocation was important to reduce bias in the creation of groups.

Question 5 (f)

(f) Why is it **not** possible for this to be a blinded trial? **[1]**

Most candidates gave the straightforward response that participants needed to know whether they could use their phones before sleeping.

Question 5 (g)

(g) Give **one** advantage of recording phone use and hours of sleep automatically. **[1]**

Most candidates realised that automatic recording would eliminate human error and/or the possibility of participants making up results if they forgot to record their data.

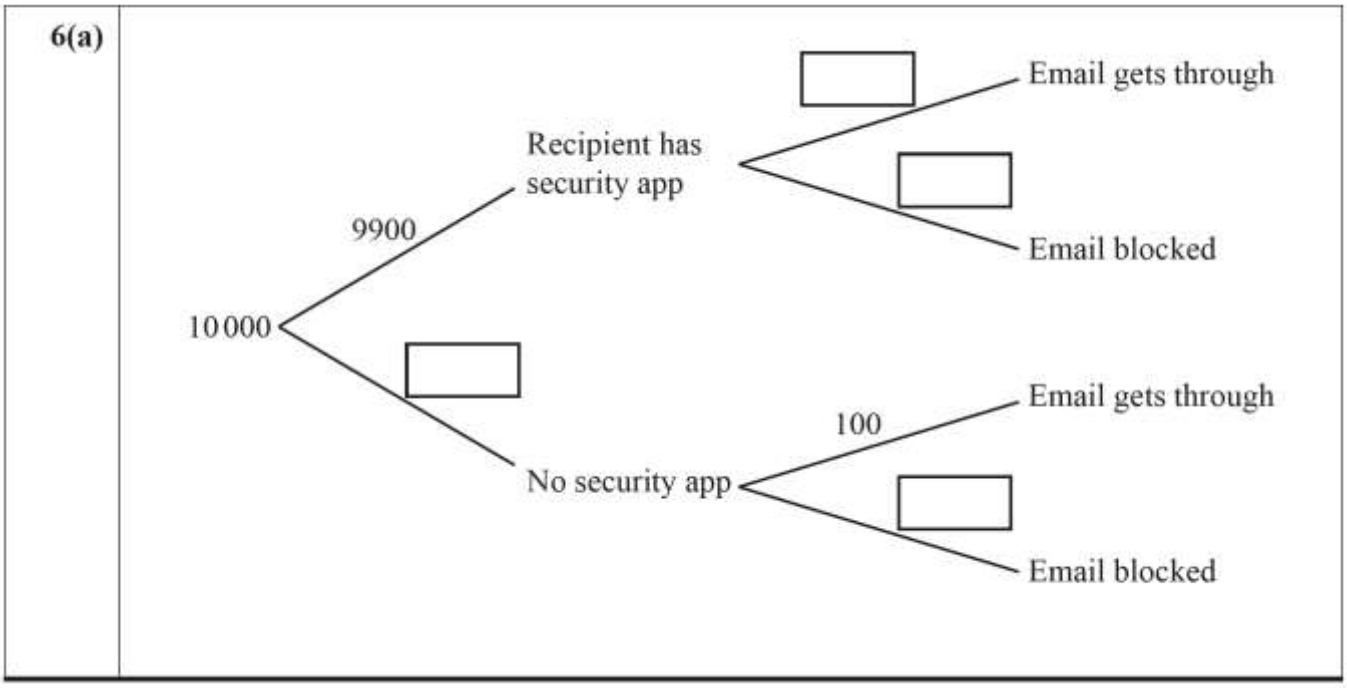
Question 6 (a)

6 Scam emails are designed to fool the people receiving them into giving money to the sender. A security app provides protection against them.

Assume:

- If installed, the security app blocks 98% of scam emails.
- 99% of scam emails go to people who have the security app installed.
- Without the security app, all scam emails get through.

(a) Based on the information above, complete the tree diagram to show outcomes for a representative 10 000 scam emails sent. **[3]**



Most candidates were able to correctly complete the frequency tree.

Question 6 (b)

(b) What proportion of scam emails get through? **[2]**

Most candidates used appropriate values from their frequency tree to calculate the proportion correctly. Candidates' frequencies from Question 6 (a) were followed through, allowing them to be given marks here.

Question 6 (c)

(c) A scam email gets through.
What is the probability that the recipient has the security app? **[2]**

Question 6 (c) was not answered successfully by many. Candidates did not identify which values were needed from the frequency tree to form the required probability. As in Question 6 (b), there was full follow-through from the responses to Question 6 (a).

OCR support

A topic exploration pack with learner activities to help candidates understand how to work with tree diagrams and conditional probability can be downloaded from Teach Cambridge:

Topic exploration pack: Medical testing and the learner activity

Question 6 (d)

A news report makes the following claim.

Most people who get scam emails already have security apps installed

(d) Using the data in this question, comment on whether the claim is likely to be true. **[1]**

Most candidates were able to explain that the statement was correct using the data in the question.

Question 6 (e)

(e) Using the data in this question, comment on whether it is worth having the security app installed. **[1]**

Less successful responses did not use the data in the question and just made a general statement about security apps.

Question 7 (a)

7 A psychologist investigated whether background music affects people's ability to learn.

- The psychologist asked volunteers to memorise a list of 20 words without background music and a different list of 20 words with background music.
- The volunteers were tested to see how many words they remembered.
- Some of the volunteers memorised the list without background music first and others memorised the list with background music first.

(a) Give **one** reason why it is a good idea to ask some people to memorise with background music first and others to memorise without background music first. **[1]**

Many candidates realised that the order of doing the tasks could make a difference, showing good understanding of experimental design. However, some candidates misunderstood the situation, thinking that the same list of words was being memorised twice.

Question 7 (b) (i)

(b) The psychologist conducted the investigation with a small sample of 8 people to check that it worked.
The table shows the number of words each person got correct.

Person	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**
Without music	6	5	16	9	7	6	8	14
With music	12	5	17	8	11	7	8	12

People who did equally well on both lists were **not** included in the psychologist's analysis of the data.

(i) How many people **were** included in the analysis? **[1]**

Most candidates stated the correct number of 6 here, but a few had not read the question carefully enough and gave all the participants.

Question 7 (b) (ii)

(ii) How many people did better with background music? **[1]**

Most candidates were able to give a correct response of 4.

Question 7 (b) (iii)

(iii) Does your answer to part **(b)(ii)** prove that people learn better with background music?
Give **one** reason to justify your answer. **[1]**

Some candidates accepted that the results from a very small sample of 8 people could not provide definitive proof of something.

Question 7 (c) (i)

(c) The psychologist then conducts the investigation with a larger number of people.
196 people are included in the analysis.

Assume that background music makes no difference.
Imagine lots of random samples of 196 people are taken and the number of people who did better with background music is counted in each sample.

(i) What will be the mean number of people who did better with background music in the samples? **[1]**

Most candidates intuitively wrote the correct response as half of the number of people.

Question 7 (c) (ii)

(ii) What will be the standard deviation of people who did better with background music in the samples? **[2]**

There were not many successful responses to Question 7 (c)(ii). Many candidates stated that the standard deviation would be 0, which showed a lack of understanding of variability within data.

Successful responses usually showed a calculation using the correct rule of $\frac{\sqrt{n}}{2}$ for this model.

Question 7 (c) (iii)

The psychologist will conclude that background music makes **no** difference if the number of people who did better with music is less than three standard deviations away from the mean.

(iii) How many people doing better with background music will lead the psychologist to conclude that music makes **no** difference? **[3]**

Candidates who did not have answers of 0 to the earlier parts of the question were often given at least 1 follow-through mark for calculating the number of people at three standard deviations above the mean. Very few candidates realised that three standard deviations below the mean was another option that should also be considered.

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