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OCR
Oxford Cambridge and RSA

AS LEVEL

Examiners' report

MATHEMATICS A

H230
For first teaching in 2017

H230/01 Summer 2019 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. 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 exam paper can be downloaded from OCR.

Paper 1 series overview

This is the second series of the reformed decoupled linear AS Maths specification. The standard of work was similar to last year, with marks ranging from about 10 to 70 (out of 75).

The OCR H230/01 AS Pure Mathematics and Statistics paper differs slightly in style from papers from the legacy unitised qualification in the following ways.

- There is a greater emphasis on proof.
- There is a greater emphasis on interpretation, rather than calculation, especially in Statistics.
- It reflects the fact that candidates are expected to have used the Pre-release Large Data Set as a tool for studying statistical concepts and techniques.
- It assumes the use of more powerful calculators than in the past. This affects the paper in two ways.
    - There are fewer marks for certain types of skill, such as calculating binomial probabilities and solving quadratic equations.
    - Some questions contain specific defined 'command words', in particular the instruction '**In this question you must show detailed working**'. In these questions, candidates are required to demonstrate their understanding of the relevant concepts by showing their working, rather than by presenting an answer gained simply by pressing a few buttons. Consequently, in these questions, marks will not be given unless correct working is seen. Remember that this does not preclude candidates from checking their working using the calculator.

	**OCR support**	A poster detailing the different command words and what they mean is available here: https://teach.ocr.org.uk/italladdsup

- The paper is divided into separate Pure Maths and Statistics sections. In each section, the questions are placed approximately in order of increasing difficulty. Consequently, some candidates would be well advised to attempt the first few (easier) Pure Maths questions and the first few (easier) Statistics questions, before attempting the more difficult questions in each section.

Section A overview

As noted in the 2018 report, a common cause of dropped marks in the pure section can be linked to careless manipulation of algebraic terms, especially related to signs and indices.

Pages 9 and 10 of the specification contain explanations of command words such as "Show that . . ." and "Determine . . ." and of the instruction "**In this question you must show detailed reasoning.**" The marking of Questions 3, 6(a), 6(b), 7(b) and 7(c) reflected this new aspect of the specification. Responses which included less than adequate explanation or working did not score full marks. In particular, correct responses given to these questions without justification scored few marks. Trial and improvement was not regarded as an acceptable method in these questions, (and indeed is sometimes treated as unacceptable even in questions not containing such instructions).

In Question 7(c), where the command word is "Determine . . .", responses obtained from graphical calculators, without working as shown in the published mark scheme, scored 2 marks (out of 6 marks), if correct to 3 significant figures.

Question 1 (a)

1 It is given that $f(x) = 3x - \frac{5}{x^3}$.

Find

(a) $f'(x)$, **[3]**

Many candidates answered this question correctly. A few gave $3 + 15x^{-2}$ or $3 - 15x^{-4}$. The most common difficulty was handling the negative index.

Question 1 (b)

(b) $f''(x)$, **[2]**

This question was also answered well by many candidates. As in part **(a)** the most common difficulty was handling the negative index.

Question 1 (c)

(c) $\int f(x)\,dx$. **[3]**

Here again, many correct responses were seen. The most common error was the omission of "+ *c*". As with parts **(a)** and **(b)**, some candidates made errors in the negative index. Some used incorrect notation, with either "∫" or "d*x*", or both, appearing in the response.

Question 2

2 The circle $x^2+y^2-4x+ky+12=0$ has radius 1.

Find the two possible values of the constant k. **[4]**

Some very good responses were seen. In many cases candidates' responses suggested that, although they knew the correct form for the equation of a circle, they were unable to adapt that knowledge to a non-standard question based on this form. Many candidates used $(y + k)^2$ instead of $(y + \frac{k}{2})^2$. Others replaced the "0" on the right hand side by "1" (which is the radius). Many completed the square correctly for both x and y, but equated their constant term to 1 instead of –1. Sign errors were common. Other common errors while completing the square were to write $-\frac{k}{4}$ or $-\frac{k^2}{2}$ or $+\frac{k^2}{4}$ instead of $-\frac{k^2}{4}$. A few candidates attempted to alter the form of the equation to include 1 (which is r^2) on the right hand side, but instead of replacing 12 on the left hand side by 13 they replaced it by 11.

Some candidates began with something like $(x – 2)^2 + (y - b)^2 = 1$ and attempted to equate coefficients with the given form of the equation. Some were successful, while others expanded incorrectly, writing k instead of $2k$, or omitting a term such as –4, in the expanded form.

Question 3 (a) (i)

3 **In this question you must show detailed reasoning.**

(a) The polynomial $f(x)$ is defined by $f(x) = 2x^3+3x^2-8x+3$.

(i) Show that $f(1) = 0$. **[1]**

Almost all candidates answered this question correctly.

Question 3 (a) (ii)

(ii) Solve the equation $f(x) = 0$. **[4]**

Question 3 contained the instruction "**In this question you must show detailed reasoning**". In this part it was apparent that some candidates used their calculators to obtain the answers and then attempted to add some sort of explanation to disguise this fact. For example, factors $(x–1)(x + 3)(x – \frac{1}{2})$ were sometimes seen without being preceded by $(x – 1)(x + 3)(2x – 1)$. In some cases the correct responses were seen, but were preceded by "fudged" working. However, the majority of candidates did show detailed reasoning and were able to obtain full marks. Most candidates used the help provided in part **(a)** and began with the factor $(x – 1)$. Interestingly, the most common method for obtaining the quadratic factor was algebraic long division. Others used the equating coefficients method. These rather laborious methods usually produced the correct result, but took far more time than the inspection method which was used by a minority of candidates.

Question 3 (b)

(b) Hence solve the equation $2\sin^3\theta+3\sin^2\theta-8\sin\theta+3=0$ for $0°\leqslant\theta<360°$. **[5]**

Most candidates recognised the significance of the word "hence" and used their response to the previous part. Most were successful. Many lost a mark, however, because they simply ignored the root $\sin\theta = -3$, without comment, or just placed a cross beside this response. Because of the "**detailed reasoning**" instruction, some explanation was required such as " $\sin\theta$ only takes values between –1 and 1" or "$\sin\theta = -3$ is impossible". A few gave an incorrect explanation such as that $\sin\theta = -3$ is invalid because it is negative. A few candidates gave extra solutions such as 210° or 270° or 180°.

Question 4 (a)

4 (a) Find the coordinates of the stationary points on the curve $y=x^3-6x^2+9x$. **[4]**

Many correct responses were seen. Some candidates made arithmetical errors in finding the values of *y*. A few candidates did not differentiate but attempted to solve $x^3 - 6x^2 + 9x = 0$. This can lead to finding one turning point, but not the other. In this case it was fortuitous for them that the minimum was identifiable in the form of a repeated root.

Question 4 (b)

(b) The equation $x^3-6x^2+9x+k=0$ has exactly one real root.

Using your answers from part **(a)** or otherwise, find the range of possible values of k. **[2]**

Most candidates did not recognise that this question is actually about translating a curve in the *y*-direction. Some recognised that the key point is the position of the curve, but only gave the response $k > 0$. Others took the hint from the instruction "Using you answers from part **(a)**...." and substituted $x = 1$ and $x = 3$ into either $x^3 - 6x^2 + 9x$ or $x^3 - 6x^2 + 9x + k$. This can lead to a correct method, but very few candidates used the results correctly. Some just gave $k = 0$ and $k = -4$. Others gave $-4 < k < 0$. A few gave the correct response but attempted to combine the two inequalities into one, giving $-4 > k > 0$.

Some candidates tried to use a "discriminant" obtained somehow from the cubic equation.

Question 5 (a)

5 (a) Prove that the following statement is **not** true.

m is an odd number greater than $1 \Rightarrow m^2 + 4$ is prime. **[1]**

The method of proof by counter example was clearly well understood by most candidates. A few attempted to use an algebraic method, not recognising that such a method cannot deal with whether a number is prime or not. Some candidates gave a correct counter example, such as $9^2 + 4 = 85$, but then only stated that 85 is not prime. The question begins with the word "Prove", and because it is a question about proof, it was necessary to show that 85 is not prime, rather than just stating this as a fact.

Question 5 (b)

(b) By considering separately the case when n is odd and the case when n is even, prove that the following statement **is** true.

n is a positive integer $\Rightarrow n^2 + 1$ is not a multiple of 4. **[4]**

Candidates generally used one of two methods.

1. Let $n = 2r$ and $2r + 1$. Candidates who used this method often succeeded. However, many lost the last mark by giving an inadequate explanation as to why $4r^2 + 4r + 2$ is not divisible by 4, or by simply stating this without explanation. Some gave as their explanation that $\frac{4r^2+4r+2}{4} = r^2 + r + \frac{1}{2}$. Unless there was further explanation, this did not quite gain the final mark.

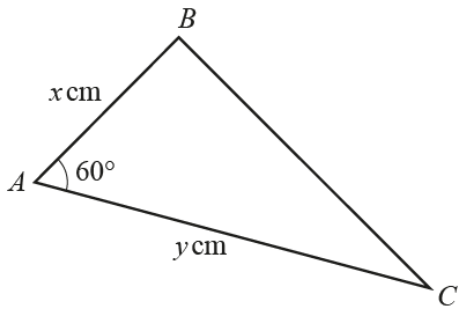
A few candidates made things unnecessarily complicated by letting $n = 2r + 1$ and $2r + 2$

2. Let n be even, so n^2 is even and therefore $n^2 + 1$ is odd and cannot be a multiple of 4. Many candidates gave this explanation. But when considering $(n + 1)^2 + 1$, not many candidates could explain why $n^2 + 2n + 2$ is not a multiple of 4.

Some candidates only considered numerical examples. In a question requiring proof, this method is unacceptable except in the case of proof by counter example (and possibly in a simple case of proof by exhaustion).

Question 6 (a)

6



The diagram shows triangle ABC, with $AB = x$ cm, $AC = y$ cm and angle $BAC = 60°$. It is given that the area of the triangle is $(x+y)\sqrt{3}$ cm^2.

(a) Show that $4x + 4y = xy$. **[2]**

Most candidates answered this question correctly. A few used a verification method, rather than a linear proof, which was accepted if the mathematical argument was clear. In general it is worth noting that for questions involving "Show that . . " using the given answer as a starting point is not guaranteed to gain full marks. Some candidates made errors such as $\frac{1}{2}xy\frac{\sqrt{3}}{2} = \frac{\sqrt{3}}{4}x \times \frac{\sqrt{3}}{4}y$, but attempted to "fudge" the remaining steps to arrive at the given equation.

Question 6 (b)

When the vertices of the triangle are placed on the circumference of a circle, AC is a diameter of the circle.

(b) Determine the value of x and the value of y. **[4]**

Many candidates recognised that angle $ABC = 90^0$ and some of these went on to obtain a correct trigonometrical equation involving x and y. (Some gave it in the form $\frac{x}{\sin 30^o} = \frac{y}{\sin 90^o}$ rather than the simpler $\cos 60^0 = \frac{x}{y}$). Many then went on to use the result from part **(a)** and obtained the correct responses. Others started again, substituting $y = 2x$ into $\frac{1}{2}xy\frac{\sqrt{3}}{2} = (x + y)\sqrt{3}$. Some of these candidates made subsequent algebraic or arithmetical errors. Candidates who used the result proved in part **(a)** were more often successful.

The command word 'Determine' was used in this question; indicating that justification should be given for any results found. A trial and improvement approach gained only one mark if the correct responses were seen.

There were also many candidates who attempted wholly incorrect methods using, for example πr^2.

Question 7 (a)

7 **(a)** Write down an expression for the gradient of the curve $y = e^{kx}$. **[1]**

Many correct responses were seen. Some incorrect responses were kxe^{kx}, kxe^{kx-1}, xe^{kx}, kxe and kx. A significant minority of candidates found ln y instead of $\frac{dy}{dx}$. Some candidates differentiated correctly but then wrote $y = ke^{kx}$.

Question 7 (b)

(b) The line L is a tangent to the curve $y = e^{\frac{1}{2}x}$ at the point where $x = 2$.

Show that L passes through the point (0, 0). **[4]**

Many candidates correctly used their response to part **(b)** to find the gradient of the curve at $x = 2$. But then a large minority found the negative reciprocal and used this as the gradient of the tangent.

Most candidates used one of the two usual methods for the equation a straight line. Some used the form $y = mx + c$, although a few found $c = 0$ without stating explicitly the equation of the tangent. This was not regarded as an adequate response to the instruction "Show that . . ." Others found the equation correctly and stated (rather than showed) that the line passed through O. These were allowed the final mark because the equation concerned was so simple. However, in similar questions in the future, the corresponding mark might be withheld if no explanation is given.

Some candidates, having differentiated correctly in part **(a)**, substituted $k = \frac{1}{2}$ into their $\frac{dy}{dx}$, but did not substitute $x = 2$. In some cases, they went on to try to find the equation of the tangent, with their gradient still given as a function of x; thus: $y - e = \frac{1}{2}e^{\frac{1}{2}x}(x - 2)$. Other candidates appeared not to recognise that their response to part **(a)** could be used in part **(b)**, and they started from scratch.

A common error was to find the gradient, not of the tangent, but of the line joining the origin to the point where $x = e$. The relevant marks were not gained despite the fact that these are, fortuitously, the same line.

Question 7 (c)

(c) Find the coordinates of the point of intersection of the curves $y = 3e^x$ and $y = 1 - 2e^{\frac{1}{2}x}$. **[6]**

Erratum notice

Turn to **page 4** of the **question paper** and look at **question 7(c)**.

Cross out the word 'Find' and replace it with 'Determine'.

The beginning of the question should now read:

'Determine the coordinates …'

The majority of candidates wrote a correct equation, $3e^x = 1 - 2e^{\frac{1}{2}x}$, but then proceeded to attempt to take the logarithms of both sides. Their attempts were invariably incorrect. A few candidates wrote a correct first equation but then attempted to combine the exponential terms, obtaining equations such as $5e^{\frac{3}{2}x} = 1$.

Some candidates recognised the "hidden" quadratic equation. Of these candidates, some did not substitute, but obtained the equation $3(e^{\frac{1}{2}x})^2 + 2e^{\frac{1}{2}x} - 1 = 0$ and generally succeeded. However, many who substituted, for example $u = e^{\frac{1}{2}x}$, often made errors such as obtaining $2u^2 + 3u - 1 = 0$ or $(3u)^2 + 2u - 1 = 0$.

The correct method leads to $e^{\frac{1}{2}x} = \frac{1}{3}$ or -1. To gain full marks candidates had to indicate in some way that the equation $e^{\frac{1}{2}x} = -1$ has no solutions.

Some candidates used a graphical calculator either from the start or after abandoning the incorrect logarithm method. In some cases, correct responses were seen, but preceded by incorrect working. Because the command word in this question is "Determine" rather than "Find", answers obtained in this way, without working equivalent to that shown in the mark scheme, were not given full credit. They scored 2 marks (out of 6 marks), if correct to 3 significant figures

The best solutions worked with exact values, expressed in terms of e. Working in terms of decimals was accepted, but the final response needed to be correct to 3 significant figures. It is worth noting that similar questions in the future might explicitly require candidates to work with exact values and in such questions, working and/or responses in terms of rounded decimals would be penalised.

?	**Misconception**	A possible misconception may be that candidates expect all equations involving exponentials will be solved by using logarithms from the start.

Section B overview

In this section, where a question required a written comment, some candidates answered clearly and correctly. However, in many cases, the comment was not expressed clearly enough to gain the mark. In Question 10 particularly, some candidates' responses did not address the precise question that was asked. Another common problem is candidates giving a generic definition, rather than attempting to explain why this applies in the context of the question. The reformed statistics criteria does have an increased emphasis on interpretation and centres would be well advised to spend time discussing the values obtained alongside developing the calculations skills.

Question 8 (a)

8 **(a)** Joseph drew a histogram to show information about one Local Authority. He used data from the "Age structure by LA 2011" tab in the large data set. The table shows an extract from the data that he used.

Age group	0 to 4
Frequency	2143

Joseph used a scale of 1 cm = 1000 units on the frequency density axis.

Calculate the height of the histogram block for the 0 to 4 class. **[2]**

The vast majority of candidates used a class width of 4. The correct class width is 5, because "Age group 0 to 4" is shorthand for 0 ≤ age < 5. Some candidates did not use the class width but just divided the frequency by 1000. A few multiplied the frequency by the class width.

Question 8 (b)

(b) Magdalene wishes to draw a statistical diagram to illustrate some of the data from the "Method of travel by LA 2011" tab in the large data set.

State why she cannot draw a histogram. **[1]**

Any response that stated or implied that "Method of travel" is non-numerical was accepted. However such responses were few and far between. Many and various incorrect or inadequate responses were seen, including the following. "There are no class widths", There are no ranges", "The data is not grouped", "The data is discrete", "The data is not continuous", "There is too much data for a histogram", "The frequency density would be difficult to display", "You cannot calculate the frequency density", "There is no gap between the bars" and "There is insufficient information to draw a histogram".

Question 9 (a)

9 The table shows information about the number of days absent last year by students in class 2A at a certain school.

Number of days absent	0	1	2 to 4	5 to 10	11 to 20	21 to 30	More than 30
Number of students	7	12	9	1	0	1	0

(a) Calculate an estimate of the mean for these data. **[2]**

Most candidates used the correct method. Some used incorrect mid points, or even end points. Some thought that 7 × 0 = 1. A large minority found $\frac{\Sigma f}{7}$.

Question 9 (b)

(b) Find the median of these data. **[1]**

Most candidates answered correctly. Some found the 15th value, rather than the mean of the 15th and 16th values, but this error was condoned. A few found the median of the frequencies. This unfortunately gives the correct response, but it did not gain the mark.

Question 9 (c)

The headteacher is writing a report on the numbers of absences at her school. She wishes to include a figure for the average number of absences in class 2A. A governor suggests that she should quote the mean. The class teacher suggests that she should quote the median, because it is lower than the mean.

(c) Give another reason for using the median rather than the mean for the average number of absences in class 2A. **[1]**

Surprisingly this question was less well answered than similar questions on Paper S1 in the past. Many candidates gave spurious reasons such as that the median is an integer whereas the mean is not, or the median is the same as the mode, or the median is not an estimate, or the median is the middle value, or the median is easier to calculate. Many others quoted from the text book that the median is less affected by outliers, but did not consider whether there are actually any outliers in this case. To gain the mark the response had to be in the context of the question, stating that there is an actual outlier, and to specify which candidate this is.

Question 10 (a)

10 The table shows extracts from the "Method of travel by LA" tabs for 2001 and 2011 in the large data set.

Local authority (LA)	All people in employment	Underground, metro, light rail, tram	Train	Bus, minibus or coach	Motorcycle, scooter or moped	Driving a car or van
LA1 2001	79226	14369	5235	20575	1227	16052
LA1 2011	118556	22486	8336	30541	1220	12445
LA2 2001	203614	190	1062	15327	1256	121690
LA2 2011	227894	323	1865	13732	1038	146644
LA3 2001	42993	35	482	4363	274	24105
LA3 2011	49014	33	828	3380	191	28981
LA4 2001	101697	65	693	21758	846	45407
LA4 2011	123218	2495	1315	24275	763	54020

(a) In one of these four LAs a new tram system was opened in 2004.

Suggest, with a reason taken from the data, which LA this could have been. **[2]**

Most candidates saw the point and answered well. Some chose LA1 with a reason for which there is only a small amount of evidence in the data. For example: "LA1, because the number using underground, etc. increased by more than 8000 and the number driving decreased," or "LA1 because the increase in numbers using tram, etc. was the greatest out of the four LAs". Answers such as these were given no credit because they ignore the changes in total population and, more especially, the evidence for LA4 is overwhelmingly much stronger. The change in proportion is the one which matters most in this context, rather than the absolute change in number.

Question 10 (b)

(b) Julian suggests that the figures for "Bus, minibus or coach" for LA1 show that some new bus routes were probably introduced in this LA between 2001 and 2011.

Use data from the table to comment on this suggestion. **[2]**

This question required more subtlety than part **(a)**. Many candidates only considered the absolute increase in numbers using bus, etc. in LA1 and these candidates gained no marks. The key point was that there was also an increase in the total number of employees, and that this by itself could have accounted for the increase in bus usage. (In fact the percentage increases for all employees and for bus, etc. are almost identical, although candidates were not required to give this much detail.) This fact means that there is little evidence to support Julian's suggestion.

Many candidates answered the question as if it concerned simply the increase in bus usage. In fact the question is not about increased bus usage, but is about the possibility of new bus routes having been introduced.

Question 10 (c)

(c) In one of these four LAs a congestion charge on vehicles was introduced in 2003.

Suggest, with a reason taken from the data, which LA this could have been. **[2]**

Most candidates correctly identified LA1, but in their justification many candidates referred only to the decrease in numbers driving. These scored 1 mark. To gain the other mark candidates needed to give a comment adding further support to their choice of LA1. For example, they could note that the decrease in driving numbers happened despite an increase in the total number of employees in LA1. Or they could note that the decrease in numbers driving in LA1 was unique - none of the other three LAs showed a similar decrease. Or they could note that, alongside the decrease in driving numbers in LA1, there was an increase in numbers using each of tram, train and bus.

Question 11 (a)

11 It is known that, under the standard treatment for a certain disease, 9.7% of patients with the disease experience side effects within one year.

In a trial of a new treatment, a random sample of 450 patients with this disease was selected and the number X who experienced side effects within one year was noted.

(a) State one assumption needed in order to use a binomial model for X. **[1]**

Many candidates attempted to give an assumption in context referring to, for example, other conditions that might cause side effects, or patients being in the same hospital, or there being only two outcomes: side effects or no side effects. These generally did not address the main point. Many others addressed the main point, but did so just by quoting by rote from the text book, without reference to context.

The mark was gained by a statement equivalent to one of the following. "Whether a patient experiences side effects is independent of whether any other patient does so." or "The probability that a patient experiences side effects is the same for each patient." or "Patients form a random sample from the population of people with the disease." Many gave roughly the following statement: "The probability that a patient experiences side effects is independent of other patients." This is not quite correct since it is the events that need to be independent, not the probabilities.

Some candidates referred to the probability of a patient getting the disease, rather than experiencing side effects.

Some candidates used the words constant, random and independent but not in the correct way.

Some candidates gave assumptions that were possibly relevant to the experimental design, but not relevant to the binomial distribution in particular, for example: We need to assume that the patients are telling the truth, and we need to assume that it is the medication that is causing the side effects.

It is worth noting that two of the conditions for a binomial distribution (Repeated trials and only two possible outcomes to each trial) are not "assumptions" that need to be made in a particular context. They are conditions that are built into the context.

Question 11 (b)

It was found that 51 of the 450 patients experienced side effects within one year.

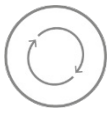
(b) Test, at the 10% significance level, whether the proportion of patients experiencing side effects within one year is greater under the new treatment than under the standard treatment. **[7]**

Many candidates had clearly been well prepared for hypothesis test questions. However, a few candidates appeared to have no familiarity at all with this topic.

Many candidates lost a mark because they correctly stated the hypotheses in terms of p, but did not define p. A few gave incorrect forms of the hypotheses such as H_0: P(X = 0.975) and P(H_0 = 0.975). A few used 0.1 in their hypotheses instead of 0.097.

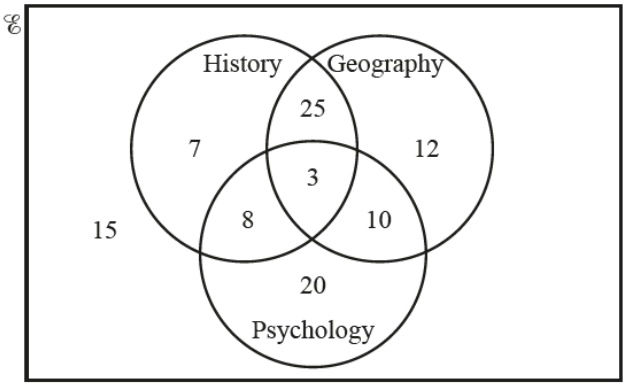
Most candidates used the correct binomial distribution and some stated that they were finding P($X \geq 51$). However, the calculations that many carried out were incorrect. Many actually calculated 1 – P($X \leq 51$) or P($X \leq 51$) or P($X \leq 50$) or P(X = 51) or P(X = 50).

Most candidates gave a conclusion referring to H_0 and a conclusion in context, and many of these were correct. Some candidates gave their conclusion as "There is evidence to accept H_0" or "There is evidence to reject H_1" rather than "There is insufficient evidence to reject H_0". These forms of the conclusion are not quite correct. Some gave the opposite to the correct conclusion. For example: "0.138 > 0.1 so reject H_0". A few compared their calculated probability with 0.097 instead of 0.1. A few gave their contextual conclusion in a definite form, for example "The proportion experiencing side effects under the new treatment is not greater than under the standard treatment." These lost the final mark.

	**AfL**	A common issue in hypothesis tests is candidates not securing the final marks for their conclusion, which need to be non-assertive and in context. Spec reference 2.05a gives examples of how the conclusion should be worded.

Question 12

12 The Venn diagram shows the numbers of students studying various subjects, in a year group of 100 students.



A student is chosen at random from the 100 students. Then another student is chosen from the remaining students.

Find the probability that the first student studies History and the second student studies Geography but not Psychology. **[4]**

Most candidates found P(1st studies History) × P(2nd studies Geography but not Psychology) = $\frac{43}{100} \times \frac{37}{99}$ or possibly $\frac{43}{100} \times \frac{36}{99}$. These methods do not take into account the possible overlaps between the two events. The two events need to be separated into different cases. In order to gain any marks, candidates needed to show products such as $\frac{25}{100} \times \frac{36}{99}$ or $\frac{3}{100} \times \frac{37}{99}$. Full details can be found in the published mark scheme.

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