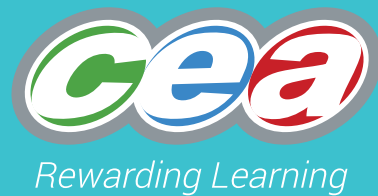


GCSE



Chief Examiner's Report Mathematics

Summer Series 2023



Foreword

This booklet outlines the performance of candidates in all aspects of this specification for the Summer 2023 series.

CCEA hopes that the Chief Examiner's report will be viewed as a helpful and constructive medium to further support teachers and the learning process.

This booklet forms part of the suite of support materials for the specification. Further materials are available from the specification's microsite on our website at www.ccea.org.uk.

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GCSE MATHEMATICS

Chief Examiner's Report

Subject Overview

The papers in this suite were designed to allow candidates of differing abilities to respond positively across a broad range of topics on the specification, while producing differentiation by outcome to allocate appropriate grades as a result. It was felt by the examining team that this was achieved and that, for appropriately entered candidates, the rising gradient of difficulty through the papers did not prevent them from making attempts at nearly all questions. There did not generally appear to be issues with time available for the papers or with the accessibility of the language used for the candidates. Nonetheless, on some papers, there appeared to be a minority of candidates who might have been better entered for the paper aimed at the next lower band of available grades. These minorities often made little progress with the lowest grade questions on the paper and had no idea how to attempt the more challenging concluding questions, leaving them with an unsatisfactory experience in Mathematics. For the vast majority, however, candidates are to be congratulated on mastering many fairly standard examination questions and on demonstrating the knowledge, skills and understanding to tackle problems of a novel nature. This is a testament to the hard work of teachers and pupils in preparation for the examinations, given the challenges and difficulties presented over the last few years of their education. In some areas of the specification, it is evident that the disruption to normal teaching during Covid has left gaps in basic mathematical skills of many pupils. On each paper, it was very gratifying to see the strongest candidates demonstrate excellent skills in answering the most challenging questions at the level available.

Assessment Unit M1

Foundation Tier

Unit Overview

Candidates, in general, found this paper fairly difficult. However, for most of the paper the grading of questions did allow candidates of different abilities to respond positively to the topics examined. Some questions allowed for differentiation between weaker and stronger candidates with the award of part marks for appropriate method and understanding, even if the final answer wasn't produced.

Most candidates attempted the majority of the questions. Questions 1-9, assessing grade G material appeared to be straightforward for many, with only some miscalculations or lack of knowledge shown by a minority of weaker candidates appearing. Questions which required methods to support answers were not always answered with enough reasoning or were misinterpreted on occasion by candidates. Pleasingly, the final question on the paper proved accessible to the majority of candidates and many were awarded at least three of the six marks available.

Gaps in pupil knowledge were evident in some questions, particularly all parts of the circle question and selecting the units of measurement questions. But most candidates were still attempting questions towards the end of the paper and consistently picking up marks throughout the paper.

The level of language used in this paper was appropriate throughout for the candidates sitting it.

Some papers had a lot of blanks, presumably due to lack of knowledge, and there was no evidence to suggest candidates had insufficient time.

As usual, a minority of candidates had no access to the required equipment for this paper, with some clearly attempting calculator questions without a calculator and unable to measure lines or angles due to having neither a ruler nor a protractor.

Poor handwriting is still a cause for concern on a small minority of scripts

- Q1** Most candidates, in Part (a) could take 19% away from 100 to leave 81%, the percentage of the rainforest that had not been destroyed. In Part (b) many candidates struggled to correctly write 78 million in figures, often adding 4 zeros.
- Q2** A mostly well understood and answered question with the majority of candidates awarded marks. Part (a) saw most candidates awarded one mark for finding £10 of electricity should last for five days. Part (b), although still well answered by many candidates, saw some candidates lose the available mark for working with the minimum amount for electricity, rather than gas.
- Q3** Generally, well answered and a large proportion of the cohort gained the available mark in both parts of the question. In Part (a) candidates either substituted '5 tables' into the worded rule or carried on the sequence by drawing the fifth arrangement of tables and seats. Part (b), although less successful than Part (a), was still clearly well understood by candidates and many were able to find that 9 tables are required for 20 people.
- Q4** It is clear that many candidates at this level are unfamiliar with applying basic units of measurement in context and most were unable to choose appropriately for the weight of a coin in Part (a) or the thickness of a smartphone in Part (b). Consistent incorrect responses of 0.6 grams for the weight of a 10p coin and 6cm for the thickness of a smartphone were frequently seen. When a candidate answered Part (a) correctly they generally also answered Part (b) correctly too.
- Q5** Part (a) was well answered with many candidates correctly identifying that the key means ten sales. Some misinterpretation of the question was seen when candidates answered 'Wifi', rather than the numerical value expected. Part (b) proved to be a good discriminator of ability at this level. The symbol for 10 sales was often drawn 15 times suggesting that candidates misread the information given and assumed that week four had sales of 150. For candidates who attempted to answer the question set many did produce 34 correctly for the Week four sales, but careless use of the key in their drawing sometimes led to the loss of a mark.
- Q6** In Part (a) most candidates found this question accessible and gained either two or three of the available three marks for correctly working out the restaurant bill. Poor money notation was penalised one mark if candidates answered £73.3, rather than £73.30. Some candidates made an arithmetical error in one of their calculations but could still access two marks. Part (b) was also answered correctly by many candidates who realised that seven loyalty points would be awarded for spending £38.85 in the restaurant if loyalty points are earned for every £5 spent. Some candidates lost sight of what they were being asked and gave an unrounded answer or inappropriately rounded up to eight.
- Q7** The majority of candidates scored at least two of the three available marks in this question. A mark was sometimes lost for not cancelling 30/50 in Part (a) or for incorrectly cancelling it. Part (b), calculating how much money the club raised by selling bricks, was well answered, even by those who were inaccurate with their work in Part (a), but who benefited from follow through marking.

- Q8** Only the very strongest candidates consistently scored marks across the three parts of this question testing circle knowledge. Part (a), marking a point on the circumference, was poorly attempted by some with no understanding demonstrated. Points were marked inside the circle or omitted altogether on a minority of scripts. Others, possibly knowing what circumference meant, placed their 'X' outside of tolerance and lost the mark. In Part (b), some candidates mixed up radius and diameter, but the majority of the cohort demonstrated understanding by drawing and labelling an appropriate radius on the circle. In Part (c) only a minority of candidates were awarded both marks for correctly measuring the diameter of the circle in mm. Poor use of rulers cost candidates at least one of the two marks on occasion while others were unable to convert their measured length from cm to mm correctly with answers of 640 or 6400 frequently seen, rather than the expected 64.
- Q9** This was a very successful question, allowing weaker candidates to score some or all of the three available marks for extracting information about earthquake activity from a table. Some candidates did, however, misread the questions and sometimes wrote down the depth or magnitude instead of the required information.
- Q10** What should have been a straightforward question for many caused some confusion and once again highlights the importance of candidates carefully reading questions and checking their answers. Three offers, 25% off, $\frac{1}{3}$ off or £50 off, in many cases led to candidates misinterpreting £50 off and treating this as 50% off. Most candidates failed to achieve all three marks but many were awarded two marks for correctly finding 25% of 180 as 45 and $\frac{1}{3}$ of 180 as 60. Some candidates treated the discount as the new price, while others were unable to deal with $\frac{1}{3}$ and incorrectly worked with 30% or 33%.
- Q11** This question challenged pupil understanding of various aspects of number but did allow pupils of differing abilities to score some marks. Many pupils were able to obtain two or three marks in this question. Part (c), $33\% < \frac{1}{3}$ was the part of the question most students struggled with, possibly thinking $\frac{1}{3} = 33\%$ which led to an incorrect response of false. Better candidates had no difficulty with Parts (a) and (b), identifying that $\sqrt{100} = 50$ is false and $52 = 25$ is true.
- Q12** Most candidates sitting this paper knew how to calculate the mean and many were awarded full marks for producing the expected answer of 26. Some candidates were careless in their calculations and if checking of work was done routinely this would have saved the needless loss of marks. A minority of candidates found the median, highlighting the fact that the insert supplied was ignored by some candidates.
- Q13** Many candidates struggled with their understanding of this question which tested knowledge of the base area of a cuboid in context. Scripts were sometimes left blank, or a random weight was placed on the answer line without any working out. In addition, candidates who knew to divide their 'area' by 200 to find the amount of gravel required to cover the base often lost the marks by calculating the volume, instead of the stated base area. Better candidates did find the base area as 2700 cm² and then divided by 200 to produce the correct answer of 13.5 kg of gravel, sometimes rounding their answer to 14, believing it needed to be a whole number of kg. Some candidates found the area of a wrong face while others were unable to make further progress after finding the correct area of 2700 cm².

- Q14** A straightforward question testing understanding of division in context which was accessible to and well answered by many candidates. Most candidates who divided £100 by £7.99 in Part (a), rounded their answer for the number of video games that could be downloaded to 12, while a minority lost a mark for rounding up to 13. Candidates answering Part (a) correctly mostly were able to correctly find the money left over as £4.12. This was another question where it was evident some candidates did not have access to a calculator.
- Q15** The majority of the cohort found this question difficult. Candidates struggled to substitute into the formula correctly to find the time required to cook a turkey. Only a small minority of candidates managed to obtain the correct time of 265 minutes in Part (a). The incorrect response 65 (achieved from adding 20 and 45, rather than multiplying 20 by 11 and adding 45) was consistently seen. Some pupils incorrectly answered Part (a) but obtained a follow through mark in Part (b) when changing their answer into hours and minutes correctly.
- Q16** In Part (a) the plotting of the co-ordinates was answered well, though some candidates made the repeated error of plotting each pair of co-ordinates as (y, x). In Part (b) it was evident that many candidates were unclear of what a trapezium looked like. Better candidates were awarded the available mark for identifying the final vertex correctly.
- Q17** Just under half of the candidates were able to measure the sector angle within tolerance in Part (a)(i) but some candidates read the wrong scale on their protractor and answered with an acute angle, showing a lack of understanding of acute and obtuse angles or a failure to check the appropriateness of their answer. It was clear some candidates had no access to a protractor and had to resort to guessing the size of the required angle. In Part (a)(ii) only the very strongest candidates were able to change their angle, contextually, into the amount of money spent on 'online advertising'. Common incorrect approaches saw candidates dividing by 100 rather than 360 when changing their angle to an amount of money or dividing £18000 by their angle. In Part (b) candidates continued to struggle with the required contextual interpretation of the information shown on the pie chart. Responses were often blank or poorly answered, showing a lack of understanding of what was required. Better candidates however did manage to get at least one of the two parts, (b)(i) and (ii), correct.
- Q18** This question on a salesperson's pay allowed for discrimination by ability, with better candidates gaining all four marks. It was pleasing to note that up to two marks were accessible to many in the cohort. Candidates frequently struggled to correctly total Debbie's hours worked as 36 but follow through marking allowed for two marks if candidates correctly applied the required method to their calculated hours. Weaker candidates were unable to demonstrate understanding of what was being asked and in some cases added the hourly rate of pay to the sales bonus and divided this into the total pay. It is disappointing to see candidates at this level unable to work out how many hours there are between 8 am and 4 pm and between 8 am and 12 noon.
- Q19** This question was another good discriminator by ability with a small minority of candidates awarded all four of the available marks for correctly assessing and reporting on the highest response rate to a survey issued using four different methods. Many candidates misunderstood what was being asked and worked out the difference between the surveys issued and the responses received rather than examining the proportion of responses received. Pleasingly, many candidates realised that half the respondents to surveys by text and online responded and they were awarded marks for progressing this far.

- Q20** The majority of candidates at this level, in Part (a), did not know how to express the perimeter of the triangle as an expression. Those that showed some understanding often failed to simplify their expression as instructed. Others correctly produced $4a + 6$ but then failed to add $b - 5$, giving an answer of $4a + 6b - 5$. Quite a few responses were left blank. Common incorrect approaches included incorrectly evaluating $2a + 3$ as $5a$ and $b - 5$ as 4 . In Part (b) only the very best candidates were able to earn any of the three available marks for finding the value of a by solving the equation $4a + b + 1 = 30$ or by setting their expression in Part (a) equal to 30 . The most common incorrect response was $a = 10.5$, from assuming the base is 9 and the equal sides total 21 , leading to each side becoming 10.5 .
- Q21** Knowledge of the terms qualitative, discrete and continuous at this level is rare and the three parts to the question appeared to be mostly guessed.
- Q22** Part (a), calculating the volume of an open box presented as a net, was answered well by a small minority of stronger candidates only. Candidates were asked to provide units with their answer but this was often missing or incorrectly given as cm^2 . A lot of candidates failed to apply the correct volume formula, possibly not recognising how the net given related to a cuboid, with many working with areas and summing these. In Part (b) very few marks were awarded across the cohort as candidates were mostly poorly prepared to answer questions on calculating the total external surface area of the box. It was clear that candidates in general were confused by the term external surface area.
- Q23** Most candidates found Part (a), of this question on train timetables, accessible and gained some of the three available marks. Candidates, in general, managed to work out the time of arrival at the train station but only the stronger candidates were able to figure out which train should be taken. Some candidates are working with 100 minutes in an hour, which is disappointing at this level. Part (b) was a good discriminator of ability and once again highlighted the fact that candidates are not referring to the provided help-sheet insert. Candidates who knew to divide distance by time to calculate average speed often worked with inappropriate times, with few able to convert 45 minutes to 0.75 hours and some using 24 hour times, such as 1424 .
- Q24** Calculating percentage loss is challenging for candidates at this level and proved to be a good discriminator by ability. Better candidates did gain three marks for correctly calculating the loss as 70% . Quite a few candidates worked with $\text{£}54$, the price the phone sold for, rather than $\text{£}126$ which was the loss.
- Q25** Another challenging question at this level as most candidates have little understanding of solving equations that involve multiplying across a bracket. Only the very best candidates earned any of the three available marks for showing appropriate method. A number of candidates attempted to solve the equation using a trial and improvement approach but with little success.
- Q26** This was another challenging question for candidates at this level, as many have poor understanding of angle theory, particularly when they are asked to provide reasons for the angles they find. Frequently, the correct answer, 'isosceles', was given but without appropriate method no marks could be awarded. Candidates received no credit for referring to alternate angles as 'Z' angles.
- Q27** This Venn diagram question was answered well by better candidates only who earned three marks for their answer of eight, the number of customers taking neither salt nor vinegar on their chips. Unfortunately most candidates misunderstood the information presented to them and took 'salt only' as 22 , ignoring the fact that 6 of this 22 also took vinegar. This led to a common incorrect response of two, which gained no marks.

- Q28** Most candidates had a good idea how to produce a stem and leaf diagram in Part (a) but in common with previous examination series, a key was often omitted. Some candidates failed to order their data and others left out data from their diagram, again highlighting the general lack of checking of work. In Part (b) few candidates realised the median would decrease with the addition of the new employee aged 34. Some candidates attempted to find the new median and compare it with the original median but were on the whole unsuccessful.
- Q29** It was pleasing to see candidates still attempting questions at the end of the paper and particularly heartening to see so many awarded at least three of the six available marks available across both parts of the question. Part (a), calculating the total cost to a tuck shop for its purchases, was answered well by many candidates across the cohort and two marks were awarded frequently for the correct total of £146. Part (b) was more challenging but many candidates were awarded one mark for correctly producing £172.50, the money raised through Special Deal sales. Only the very strongest candidates were able to gain further marks for working towards and finding the tuck shop's profit for the day.

Assessment Unit M2 Foundation Tier

It was pleasing to note that most candidates were able to make an attempt at all the questions, with no indication that lack of time was an issue.

In general the Quality of Written Communication was good, with clear numerical methods shown, allowing candidates to access some marks in questions where they did not get the correct answer. However, where written explanations were required, some candidates were unable to make their answer clear and concise.

The only equipment required for this paper, other than a calculator, was a protractor. It is difficult to know whether pupils didn't have a protractor, or didn't know how to use it. It was again evident that some pupils think that 'show your working' means they have to show a written pencil and paper calculation, rather than using their calculator and simply showing what they have typed into it.

- Q1** While most candidates were able to work out the 25% correctly, a concerning number converted $\frac{1}{3}$ to either 30% or 33%, making their answer inaccurate. Another common error was to mistake £50 for 50%, leading to an incorrect conclusion.
- Q2** It is always difficult to know whether candidates knew what they were doing with this question, or if they simply guessed. Parts (a) and (b) were correct more often than Part (c), with the same confusion regarding $\frac{1}{3}$ that occurred in Question Number 1.
- Q3** The most common error here was to find the volume rather than make any attempt to find an area. Some candidates got the 13.5 and then rounded to 14, possibly thinking the gravel could only be purchased in 1kg bags.
- Q4** This was generally well done with few errors. It was pleasing to note a reduction of cases where candidates forgot to press '=' before they divided. Very few divided by anything other than ten, possibly because the ten was stated in the body of the question.
- Q5** Most candidates did the division correctly, although some used an estimation method and divided by £8 rather than £7.99. In Part (a) it didn't affect the final answer, but it is something for teachers to be aware of and highlight for future years.
- In part (b) some candidates used £8 instead of £7.99 again, which this time did cost them a mark.
- Q6** It was clear that a significant number of candidates simply had no idea what the formula meant, which is disappointing as it was straightforward. When trying to convert the time to hours and minutes, many simply removed the first digit as the hours and left the remaining digits as the minutes. For example, 265 became 2 hours 65 minutes.
- Q7** Mixing up the x and y coordinates was the most common error in Part (a), although the vast majority were able to answer correctly. Part (b) was less well done, with some candidates either unable to identify a trapezium, or unable to write down the coordinates correctly.
- Q8** An angle of around 70 degrees was common, with candidates reading from the wrong scale on their protractor. Few were able to get a correct answer to Part (a)(ii) which was disappointing as candidates should know how to read and interpret pie charts numerically.

Q9 There were a pleasing number of correct answers with clear and concise working shown. It was disappointing that a significant number of candidates did not know how to correctly find the number of hours worked. Candidates should be taught that, in questions like this, a decimal answer is impossible and should highlight to them that they have made an error.

Q10 The best approach for this question was from candidates who quickly realised that the method most likely to get a response could not be Online or Post as they were responded to half or less than half of the time. Some candidates lost the final mark for failing to clearly articulate that the reason Face to Face was the best was not because it 'had the most responses', but rather that it generated responses for more than half of the surveys issued.

There was evidence of candidates having difficulty calculating both the 75% and the 30%, even though the 30% came from 30 out of 100.

Q11 The fact that there were two variables caused confusion for many, particularly as there was only a single 'b'. There were two common approaches to Part (b), with one leading to more success than the other. The more successful method was from candidates who ignored Part (a) and started by saying that the bottom side was 4, meaning both the other sides had to be 13. However, some of those candidates went no further.

Q12 This appeared to be a topic that hadn't been well covered, as few candidates got any correct, never mind all correct. Teachers should ensure that all material on the specification is taught.

Q13 Most candidates in Part (a) were able to get the 1350 or 1.50pm correct, but knowledge of how to read a timetable cost them the final mark. The next train left at 1424, meaning a 34 minute wait, rather than the variety of other incorrect answers offered.

The simplest approach in Part (b) was to say that if it travelled 54 miles in 45 minutes, then it travelled 18 miles in 15 minutes and therefore 72 miles per hour. Many who tried to use the formula failed to convert the 45 minutes into 0.75 hours, often generating answers of either 1.2 or 12, which they should have realised were both impossible, given the information in the question.

Q14 Almost no candidates scored full marks in this question, with very few giving reasons for each angle found, as requested. Some were able to secure the first two marks for working out the angles and type of triangle correctly, without giving reasons.

Q15 The most common wrong approach was to simply work out what percentage £54 was of £180 without doing any subtraction. A number of candidates who didn't know how to work out the percentage still secured the first mark for finding the loss of £126.

Q16 It was disappointing to note the number of candidates unable to correctly multiply out the bracket. The most common approach was to simply subtract 2 from the 22 and divide by 4.

Q17 Many candidates started by putting 22 into the Venn diagram, meaning they couldn't possibly get the correct answer. Those who started off correctly generally went on to get it right.

Q18 While Part (a) was generally well done, some candidates chose to multiply together all three of the numbers given in the question. Those who knew what they were doing generally went on to get Part (b) correct, although a disappointing number made no valid attempt whatsoever.

- Q19** As is always the case in this type of question, the main errors were either missing values, failure to order, or no key. Most candidates made a reasonable attempt at trying to draw the diagram. In Part (b) there was a tendency to try and work out what the two medians were, rather than simply say what affect the new worker would have on the median.
- Q20** Some candidates chose to work with simple interest for Option A, working out 3.5% and then doubling it. As a result, there were more correct answers seen for Option B, even though it was a more difficult calculation. A small number of candidates used a depreciation method rather than a compound interest method.
- Q21** While many candidates were able to correctly find the delivery charge, little was correct after that. The most common incorrect gradient was 1.5. Even some of those who correctly calculated the gradient were unable to clearly articulate what it represented. Answers such as ‘the price gets bigger the more days you have it’ were common, but incorrect, as they did not mention what the gradient represented.
- Q22** The most common mark awarded was for the ‘ $-14y$ ’, with many candidates failing to get the squared term, or realise that the two terms in x could be combined.
- Q23** While Part (a) was generally well attempted, missing and incorrect units were common. In Part (b) there was a tendency for candidates to find the volume rather than the surface area, while a significant number found only the area of the large rectangle down the middle of the diagram given. In some cases candidates did not realise it was an open box and incorrectly added the ‘top’ face. Very few candidates realised that Part (c) was testing Pythagoras’ theorem. Those who did generally got the answer correct.
- Q24** The inclusion of the blank columns encouraged candidates to find and use the midpoint of each group. As in previous years some candidates knew they had to find the midpoint, but did not know how to do so. Upper boundaries, lower boundaries and values that were a consistent number above or below the boundaries were common. It was pleasing to note that fewer candidates went on to unnecessarily round their answer to a whole number. In Part (b) some candidates wrote a sentence describing the relationship rather than a single word stating the type of correlation.
- Q25** Some candidates were able to make an attempt at finding the area of the smaller circle, but then struggled to find the radius, and therefore the area, of the semicircle. Of those who did, some tried to show equality by dividing by two, rather than subtraction as required.

Assessment Unit M3

Higher Tier

Unit Overview

The performance by candidates on this paper was average with most scores bunched in the middle band of 45%-65%. Some but not too many candidates were able to secure very high scores, but at the other end of performance, a significant number struggled to recognize or respond successfully to many questions beyond Question 15. In many scripts there were blank spaces for questions in the latter third of the paper rather than any real attempt. There was evidence to suggest many candidates had been entered at a level beyond their ability, where M2 would have been a more appropriate choice of entry. For those who were answering positively until the end of the paper, there was little to suggest that M4 would have been a better choice of entry, rather than the overlap M3/M4 questions provided enough challenge to differentiate candidates at this level of entry. There was also evidence that the effects of Covid are still reflected in classroom delivery where some topics clearly been omitted – this is due to lost delivery in Key Stage 3 years. The standard of responses varied right from the outset of this paper. There is continued evidence that some M3 topics which are fairly standard exam questions are now well mastered – this was most notable in the success of drawing the pie chart (Question 4), in the stem and leaf diagram (Question 12), the estimate of the mean from the grouped frequency table (Question 17) and the product of primes (Question 20). The response to algebra was somewhat weaker than previous M3 papers would have produced as evidenced in Questions 3, 8, 15 and 21. There was a positive response to multistep Number problems as displayed in the level of response to Questions 1, 9 and 13. Students at this level still struggle with questions that require greater forms of literacy, reasoning or communication. This was exemplified in Questions 10, 16 and 25 (b).

Numeracy skills were tested directly and indirectly (through data, geometry or algebra) in Questions 1, 2, 4, 5, 6, 7, 8, 9, 13, 15, 17, 18, 19, 20, 21 and 25. Questions with a functional element were sometimes well answered but candidates are still lacking initiative in approaching a question set in an unfamiliar context as evidenced in Question 6 (b), Question 14 and Question 24. The application of real-life skills in terms of time in Question 5 (a), speed in Part 5 (b), linear relationships in Question 14 and the extension to shape calculations are an area for greater focus. Literacy and communication were a feature of Question 2 on the questionnaire and Question 10 on the triangle with smaller requirements in Parts 12 (b), 14(b), 17 (b) and 25 (b). It was very apparent that whilst candidates often attempt to answer these literary responses, very few actually exhibit clear understanding of what their calculations actually mean as exemplified in the previous questions listed 12,14,17 and 25. There was evidence that candidates were able to complete the paper in the allocated time and any blank responses towards the end of the paper were due to lack of knowledge as opposed to a lack of time.

- Q1** The opening question on money proved accessible to all and enabled almost all candidates to secure full or partial marks. The errors incurred were in the calculation of the total hours but method marks were still awarded for candidates carrying out the correct process.
- Q2** The reasoning question on the survey produced a mixed response. There were very many who approached in a logical manner and found comparative percentages and then were able to justify the statement being incorrect. Some of the most able only focused on text and face to face and were quickly able to decipher that the given statement was incorrect. Some weaker candidates simply tried to divide the surveys issued by the number of responses rather than the inverted calculation and then did not know how to interpret their results. Lesser able candidates struggled to apply a suitable method and either subtracted the given values or found an overall fraction or percentage of the total responses versus the number of surveys issued.

- Q3** Whilst there was clear understanding of the term perimeter, formation of the algebraic expression proved problematic for some. Many who were able to list the sum of the three sides struggled to simplify their expression correctly. In Part (b) finding the value of 'a' was often done by a numerical rather than an algebraic approach, but this was acceptable and allowed even weaker candidates to secure the three marks.
- Q4** In Part (a) the majority were able to interpret the given information and apply an appropriate method to decide on the number of pupils choosing "other". The preferred approach was to calculate the number of pupils choosing each rather than working in equivalent percentages or fractions. Some struggled with the $\frac{3}{10}$ for milk. There was a positive response to the pie chart which has been a notable trend in more recent exam series. Many secured the full marks. Some lost a mark through an inaccurate sector or by not labelling but in general this was well attempted.
- Q5** In general there was limited understanding of calculations involving time. Too many approached time calculations in numerical terms of tens rather than use of 60ths. As a result less than half the candidature scored full marks on the timetable question. In Part (a) many were able to establish that the arrival time at Edinburgh was 13:50 but then struggled to establish the next available train time. In Part (b) again miscalculation of time lead many to arrive at 85 rather than 45 minutes. Of the candidates who got the correct time only the very best were able to convert it correctly into hours to arrive at the correct average speed in miles/hr. Too many simply divided 54 by 45.
- Q6** Calculating the volume of the cuboid which was presented as a net in Part (a) was well responded to with a large majority having no difficulty reaching the correct solution. In Part (b) there were only a very small number who understood the demands of the question and were able to complete to secure the three marks. Few recognized that the longest straight line would be across the diagonal of the base and so Pythagoras Theorem needed to be applied. Most simply recorded 45cm as this was the longest side of the base. There were some who despite acknowledging the requirement for Pythagoras struggled to identify the base of the net and so applied it using the wrong dimensions.
- Q7** There was a most disappointing response to the standard percentage loss question, with just over a half securing full marks. A large proportion of the candidates simply found one number as a percentage of the other and hence arrived at 30%, giving no attention to what was asked. For some who did calculate the loss to be £126 many then failed to find that value as a % of the cost price.
- Q8** Solving the linear equation with brackets was well answered. The vast majority presented three accurate steps to reach the correct solution. There were the usual simple errors which incurred a penalty such as forgetting to multiply the second term in the brackets by the leading term or by rearranging the numerical terms incorrectly but part marks were still achieved. Weaker candidates tried to avoid the algebra and often reached a wrong numerical value of five.

Q9 The problem-solving money question proved a really good discriminator question and allowed candidates of varying ability to secure a range of marks. Nearly all were able to gain the two marks in Part (a). In Part (b) very many gained at least the first mark by calculating the Special Deal income. However, only the best acknowledged the complexity of the question by knowing to subtract the 115 items already sold from each of the available products to establish what was left to be sold individually. Where this was recognized, most secured at least the next two marks and often the final marks as well.

On occasion a candidate may have just found the total income rather than profit, by forgetting to subtract their cost from Part (a). Overall, this was a good question in distinguishing between candidates of varying ability, whilst allowing all candidates to make a reasonable attempt.

Q10 The question on angles between parallel lines and within triangles produced a most disappointing response despite being a lower grade question on this paper. Candidates really struggled with the requirement to give reasons for their angles and despite this being highlighted in bold on the paper, very many simply found the three angles and concluded correctly that it was isosceles but were unable to secure full marks. BEF was generally well explained either in words or by an appropriate calculation which acknowledged angles on a straight line added up to 180° . Only a limited few candidates across all scripts clearly identified BFE as an alternate angle. Whilst there were indeed other correct approaches which could have led to three correct angles, it was clear that candidates struggled to communicate their mathematical thinking.

Q11 The Venn diagram question was almost always an all or nothing response. For anyone who realized the 22 taking salt included the 6 in the intersection of the circles then establishing 16 for salt only generally led to the correct final answer of 8 for full marks. Too many did not appear to understand the concept of the Venn diagram and simply placed the 22 in the left-hand side of the salt circle leading to an incorrect answer of 2. There was clear lack of understanding among many candidates on this topic.

Q12 There was a very good response to the stem and leaf diagram with many securing all the available marks in Part (a). Occasionally a mark was lost due to a value out of place numerically, an omitted value (for some reason 58 was often missed) or by no key or a meaningless key. Understanding that the new worker would decrease the median was recognized by some, with several actually identifying the median before and after.

Q13 The financial question on the two savings accounts again proved a very good discriminator question. A pleasing number of candidates had no problems with any aspects of this question and secured the full five marks. On occasion a single mark was lost in the final answer line by inadvertently recording B rather than A or by dropping the 1p from the final difference. Too many approached both options from a Simple Interest approach losing a significant number of marks.

- Q14** This was the first question where there was a definite change in the level of answering and some candidates started to struggle with the content. The application of the linear graph in a real-life context seemed alien to very many candidates and answers just appeared to be from guesses. It was pleasing therefore to see a good candidate have no issues with this question and be able to answer all three parts correctly but this was a limited few. Finding the delivery charge in Part (a) was accessible to many, understanding that this was the cost before any number of days were factored in. Calculation of the gradient in Part (b) was generally approached by simply counting squares and applying $\frac{\text{change in } y}{\text{change in } x}$ without any acknowledgement of scales on axes and so many simply arrived at $\frac{3}{2}$ or 1.5. Many simply divided $\frac{575}{7}$ showing lack of understanding. Some good candidates who knew the importance of the scales chose difficult points and incurred an accuracy error.
- Q15** Expansion and simplification of the brackets produced a disappointing response for a fairly routine algebraic process. Only a quarter of the candidates arrived at the correct final solution. Errors included not arriving at a quadratic when multiplying $2y$ by $3y$ or by not multiplying the second term in the bracket by the $2y$ term. Some who got the expansion correct failed to gather the terms correctly.
- Q16** The reasoning question involving calculations of a circle and a semicircle allowed nearly all candidates to achieve some marks, dependent on their level of understanding of what the question demanded. For some candidates no marks were achieved when they embarked on calculations using the wrong formula. Since the correct formulae were provided in the Additional Support Materials, this could have been avoided. Very many successfully calculated the area of the shaded circle. Many were able to continue by calculating the area of the semicircle. Only the best brought the question to completion by identifying the unshaded area as the difference between the semicircular area and the shaded circle, hence concluding that the shaded and unshaded areas were exactly the same.
- Q17** Estimating the mean from the grouped frequency table in Part (a) was generally well approached and allowed for a range of marks to be secured. Most knew to identify the midpoints, albeit some struggled to identify them correctly. Finding the product fx values was recorded by many in the table. Those who were confident in this topic had no problems dividing the sum by the correct total of 20 to arrive at the mean. There were the usual few who unnecessarily rounded their final answer to a whole number. Unfortunately, some who set up the fx column correctly, then embarked on a completely alternative and incorrect approach using other values accumulated from the table. In Part (b) the majority understood that the mean was only an estimate as there were no exact values or that the data was presented in groups or intervals.
- Q18** Despite reverse percentages being a standard M3 question, there were very limited correct answers to this question. Most candidates simply calculated 18.2% of the given £10225 and subtracted it. For those who were able to set up the initial step of $£10225 = 81.8\%$, most successfully secured the three available marks.
- Q19** The response to the fractional equation question produced a mixed response but there were only about 10% who secured the full four marks. Those who approached by trying to eliminate the fractions at the outset by either multiplying through by 12 or by using a common denominator of 12 were generally successful in reaching the correct solution. Occasionally there was an error in converting the fraction in front of the second bracket but follow through marking still allowed them to be awarded for their efforts. Too many approached using decimals and in many cases inaccurate rounded or truncated decimals led to further errors. Unless recurring decimals were applied and carried throughout, this approach often incurred at least one and often two penalties.

- Q20** Recording 4725 as a product of primes was accessible to nearly all. Occasionally a mark was lost due to no index notation, + signs rather than x signs or by including x 1 at the end of their recorded answer. It is apparent that very many candidates are now approaching this using the straightforward calculator function.
- Q21** At this point in the paper there was a real change in the level of response and it became apparent that only the top-level candidates at this level of entry were approaching these latter questions with familiarity and ease. Factorising the quadratic in Part (a) was either totally right or totally wrong with the occasional error in signs used in brackets. However, very, very few saw the link between Parts (a) and (b) and seeing the two correct solutions recorded in Part (b) was rare. Most candidates simply presented $x = 5$ as the only solution, obviously just approaching by a trial and error approach.
- Q22** Finding the equation of the line joining the two given points was a good differentiating question. The strongest candidates were able to identify both the gradient and the crossing point and position them correctly in the linear equation. Some were able to calculate the gradient of three but struggled to link it with the crossing point. A large proportion of candidates simply presented the midpoint of the line passing through the two given points.
- Q23** The requirement for trigonometry was recognised by many but the necessity to include the height of the boy was often overlooked or not converted to metres before being added to the calculated value for the kite. Some inaccurate solutions were reached by early rounding. Candidates should be encouraged in a multistep question to withhold rounding until the end of all their intermediate calculations.
- Q24** The novel problem assessing the curved surface area of the cylinder produced very few fully correct solutions but it was pleasing to see some top candidates producing correct solutions by a variety of approaches. Some found the circumference of the rim, added the 1cm overlap for the label and then proceeded to multiply by the height of 12 whilst others found the curved surface area of the label and then accounted for the overlap as a separate rectangle with dimensions 1cm x 12cm. The vast majority of candidates approached this with a volume formula of $\pi \times 3.42 \times 12$.
- Q25** Using the information given in Part (a) to produce a box plot allowed for a range of marks. The strongest candidates correctly manipulated the given information to identify the minimum as 3 and the upper quartile as 20 and generally proceeded to present a totally accurate box plot. Many candidates were able to identify the minimum as three but struggled to get the upper quartile and so their box plot did not reflect the readings appropriately but part marks could be awarded. Weaker candidates simply tried to present the five given values on the scaled grid with no real understanding of the type of diagram required. Communicating the reason in Part (b) was generally well answered with many linking to the fact that the median was 14 and so 50% were below that and hence the majority were aged below 16. However, in some cases it was hard to decipher if candidates were really able to interpret this correctly or whether they achieved the mark by default with a generic statement.

Assessment Unit M4 Higher Tier

Unit Overview

The performance of candidates in this paper ranged from excellent to poor. In the papers I marked the marks ranged from 4 to 99, with many candidates achieving 50 and above. A small percentage of candidates scored below 20.

The general feeling from all examiners is that the paper was successful in allowing candidates of differing abilities to respond positively and most questions were attempted. Questions that stretched the more able candidates were Questions 13, 16, 17 Part (b), 19, 20, 21 Part (b) and 23.

Questions/topics which seemed to cause most problems in general were:

- Question 13 (calculating the curved surface area of a cylinder with an overlap).
- Question 15 (using bounds to find a max average speed – time in hours and mins caused problems).
- Question 16 (finding the equation of a perpendicular line).
- Question 17 Part (b) (a reasoning question on Circle Theorems).
- Question 19 (factorising a quadratic using the difference of two squares and fractions; factorising a quadratic with three variables).
- Question 20 (setting up and solving a quadratic equation using the area of a trapezium).
- Question 21 Part (b) (calculating an estimate for the median using a histogram).
- Question 23 (calculating the apex angle of a sector given a cone).

Candidates should be reminded that if they leave multiple solutions to one question without writing an answer in the answer line then the worst solution is marked. Candidates must make it clear which solution they are using for each question.

There were some candidates who either ran out of time or could not attempt the last four or five questions as these questions were left these blank by more candidates than usual.

Several markers commented that it was evident there were a lot of candidates entered for M4 who would have been better suited sitting M3.

Q1 This question on comparing two options for compound interest was answered well by the majority of candidates. There were a variety of methods used with the most efficient one being:

$$\text{Option A: } 4500 \times 1.035^2 = 4820.51$$

$$\text{Option B: } 4500 \times 1.05 \times 1.02 = 4819.50$$

Calculations for Option A were usually correct, however, the final answer was sometimes rounded incorrectly to £4820.50 and this incurred a penalty of one mark. For Option B the most common error was using £4500 for both calculations and then adding these together. A small number of candidates used depreciation. Answers not rounded to two decimal places for money notation were penalised in this question.

- Q2 (a) (i)** In general, most candidates were able to identify £50 as the delivery charge by reading the answer from the y-axis on the straight-line graph used in real-life context.
- (ii)** This question on finding the gradient of a straight line was not answered well. The most common incorrect answer was 1.5, found by just counting squares and using $\frac{\text{rise}}{\text{run}}$, rather than using the scale of the real-life graph.
- (b)** This question on interpreting the gradient of a real-life graph was answered quite well in general. The main words required were 'cost per day'. Some candidates used language associated with scatter graphs.
- Q3** This question on expanding a bracket and simplifying the expansion was answered quite well with most candidates obtaining at least two marks. The expansion of the bracket was answered well but it was the simplifying that caused the most problems. Candidates did not need to factorise their final expression and those who attempted this usually made a mistake. Others divided their final expansion by two and therefore lost a mark.
- Q4** This question on finding areas of a circle and semi-circle was answered quite well. The vast majority of candidates obtained the first two marks for correctly finding the area of the shaded circle. Those who struggled to finish the question usually tried to make the areas equal by dividing the area of the semi-circle by two rather than subtracting the shaded area.
- Q5 (a)** This standard question on estimating the mean from a grouped frequency was answered very well in general. Most candidates were able to find the correct mid-points and multiply these by the frequency. Only a minority of candidates tried to use upper bounds rather than mid-points. Some candidates lost the final mark for rounding their answer or writing down the group the mean was in.
- (b)** This question on explaining why the answer to Part (a) was only an estimate was answered very well. The most common correct reasons were 'we don't know the exact times' and 'we used mid-points'.
- Q6** In this reasoning question about a right-angled triangle the majority of pupils recognised the need to use Pythagoras' Theorem and answered the question correctly. A small number of pupils tried to use Trigonometry but most of those who did this did not have enough working to obtain full marks.
- Q7** This standard question on reverse percentages continues to cause problems for too many candidates. They misinterpret the question and start by calculating 18.2% of £10225 and then adding or subtracting their answer, obtaining zero marks. Candidates must start this question by letting 81.8% equal to £10225 and then finding what 100% is. The mean mark for this question was two marks.
- Q8** This standard question on solving an equation with fractions and brackets was answered well by most candidates. The most efficient methods used were to either multiply everything in order to eliminate the fractions, or to find a common denominator first and then equate numerators. Candidates who chose to use decimals usually lost marks for rounding within the question.
- Q9** This question on writing a number as a product of prime factors was the best answered question on the paper. Pupils used a variety of methods and more candidates are now using the Shift FACT function on their calculator and this obtains full marks. A small number of candidates did not write their answer in index notation and therefore lost a mark.

- Q10 (a)** This question on factorising a quadratic expression was answered to a very high standard. A small number of pupils mixed up the + and – signs in their answer.
- (b)** This question on solving a quadratic equation linked to Part (a) was very poorly answered. Most candidates did not link the question to Part (a) and a lot of candidates who did link it only wrote the positive x value as their final answer, choosing to ignore the negative answer.
- Q11** In this question on finding the equation of a straight line given two points the vast majority of candidates were able to get the first two marks by correctly calculating the gradient. Some candidates did not recognise they were given the y-intercept value and went on to use $y = mx+c$ and substitution to try and find the value of c. In these cases, mistakes were usually made.
- Q12** In this trigonometry question most candidates knew to use ‘sin’ in order to calculate the unknown side, with the majority of candidates getting the first three marks for correctly calculating the missing side. The main errors made were in calculating the height using the extra 85cm with a common wrong answer of 89.02 as these candidates added 85 instead of 0.85
- Q13** This was a question on finding the curved surface area of a cylinder with an overlap involved. Only a small number of candidates obtained full marks in this question and the main issue was dealing with the 1cm overlap. The most common incorrect solution was to find the curved surface area using $2 \times \pi \times 3.4 \times 12 = 256.35$ and then adding on the overlap of 1cm to get 257.35. This was awarded 2 marks using the alternative solution in the mark scheme. Other common mistakes were adding the 1cm to the radius or diameter at the start or adding on the area of the two circles i.e. the top and bottom of the cylinder.
- Q14 (a)** Most candidates were able to gain some marks in this question on drawing a box plot. Many candidates were able to find the minimum value of three but there were more issues in finding the upper quartile of 20. There were some candidates who did not use a ruler when drawing their box plot.
- (b)** This reasoning question on interpreting the box plot was answered very well in general. The most common answer was ‘yes because the median is 14’.
- Q15** There were only a minority of candidates who obtained full marks in this question on using bounds with distance, speed and time. The biggest issue was finding the boundary for time due to the time being given in hours and minutes. The most common mistakes were using minutes (70.5) or using 1.105 for 1 hour 10.5 minutes. Pupils are advised to write the full answer on their calculator for this question.
- Q16** In this question on finding the equation of a perpendicular line only the more able candidates were able to start it correctly and usually went on to gain full marks. The main issue for the candidates who did not perform well was not knowing to use the method of substitution to find the gradient. There were no follow through marks if candidates did not start with a gradient of $\frac{3}{4}$. The most common mistake was using the two sets of coordinates in the question to obtain an initial gradient of $\frac{6}{7}$.

- Q17 (a)** This question on finding two missing angles using circle theorems was answered very well. Most candidates obtained full marks or at least one mark on a follow through from their first answer.
- (b)** Candidates continue to struggle with open reasoning questions using circle theorems. There were only a small number of candidates who obtained full marks in this question. The majority of candidates obtained zero in this question, and it was often left blank or there was an attempt to find the missing angles but without any reasons provided. Some candidates were able to gain one mark for starting with angle $\text{RPQ} = 65^\circ$.
- Q18** This question on stratified sampling was answered very well with a lot of candidates obtaining full marks. The candidates who did not get full marks usually left it blank or had everything wrong. Some candidates had wrong answers for the 18-40 age group but got the other two values correct.
- Q19 (a)** This question on using the difference of two squares to factorise a quadratic was not answered well in general with the majority of candidates obtaining zero marks. The main issue was not being able to deal with the fractional coefficient of x^2 .
- (b)** Again, very few candidates obtained full marks in this harder factorising question. Most candidates recognized the starting point of taking the 'a' outside the bracket, but then stopped or could not deal with the 'x' and 'y' terms. Some candidates were able to obtain two marks by factorising partially i.e. leaving the 'a' term in one of their final two brackets with everything else correct.
- Q20** In this challenging question on setting up and solving a quadratic equation using the area of a trapezium only the strongest candidates obtained full marks. The majority of candidates obtained zero marks in this question as they could not start it correctly. The mean mark for this question was one mark. A lot of candidates did not recognise the shape as a trapezium and started with the area of a rectangle. Others tried to split the trapezium into a triangle and rectangle but struggled to calculate the correct expressions required for the height. The candidates who were able to start this question correctly usually had no problem going on to solve the quadratic, choose the positive x value and substitute it into the expressions for height and length.
- Q21 (a)** This question on completing a frequency table and histogram was answered very well in general with the majority of candidates obtaining full marks.
- (b)** Candidates continue to struggle with finding the median from a histogram. Most candidates were able to obtain one mark by correctly identifying the group the median lies in but did not understand how to find the estimate for the median within the group.
- Q22** In this standard question on solving a fractional equation leading to a quadratic only the more able candidates obtained full marks. The majority of candidates started by gathering the fractional parts to the left-hand side and letting them equal to five. However, other candidates started by finding a common denominator on the right-hand side and then cross multiplied to get their quadratic. The less able candidates could not start this question correctly or left it blank. Common mistakes made within the question when expanding brackets; collecting like terms; ignoring the negative answer; not rounding to two decimal places.

Q23 This question on finding the angle at the apex of a sector which folds to form a cone proved to be a good, challenging question, in which only the top candidates were able to obtain full marks in. However, the breakdown of the marks allowed most candidates to gain partial marks. The majority of candidates obtained the first two marks for correctly finding the height of the cone using the formula for the volume of a cone. Some candidates were also able to gain the next two marks by using Pythagoras' Theorem to find the slanted side. A selection of students were then able to go a bit further and either work out the curved surface area or circumference of the circle but it seemed rare for them to then go on make the correct link between the sector and whatever they had worked out.

Assessment Unit M51 Foundation Tier Non-Calculator

Unit Overview

This non-calculator paper ranged in marks out of 50 from single figures to scores in the mid-40s. The questions provided opportunity for candidates of all abilities to pick up marks throughout the paper, with part marks often awarded for appropriate method. Some questions proved to be good differentiators of ability and allowed stronger candidates the opportunity to demonstrate their understanding of topics presented in a non-standard way. There was no evidence to suggest candidates had insufficient time to complete the paper, though quite a few questions were not attempted, presumably due to lack of knowledge rather than time pressure. The standard of answering was variable in general. The quality of written communication and answer structure was poor overall. There was often little evidence that work had been checked or answers had been tested for sensibleness. As reported in previous examination series a minority of candidates did not have access to the required equipment, in particular a ruler and protractor, which limited available marks in Question 14 (b), drawing the parallelogram accurately. The level of language used in this paper was appropriate throughout for the candidates sitting it.

- Q1** This question, calculating 6.5 hours pay at £7 per hour, saw the majority of candidates awarded at least one of the three available marks, mostly for finding $7 \times 6 = £42$. Better candidates were able to deal with the half hour's pay and find £3.50, which they then added to 42. Candidates should be reminded to check that their money notation is correct as answers such as £45.5 or £45.50p were commonly seen.
- Q2** Part (a) of this question, finding the total number of counters in the next pattern, was generally well answered by candidates. Part (b), however, finding the number of white counters in Pattern eight, was much less successful with only better candidates able to gain either of the two available marks. Many candidates attempted to draw patterns five, six, seven and eight, but were careless with their attempts and received zero marks. Others lost sight of what they were doing during their working out and 32 was a common incorrect response, which is the total number of counters in Pattern eight, rather than the number of white counters.
- Q3** Roughly half of the cohort were able to calculate 25% of 84p accurately, though it was clear that many didn't recognise that 25% is equivalent to $\frac{1}{4}$. Some candidates found 50% of 84p as 42p, then found 50% of 42p as 21p. Others attempted to multiply 84p by 0.25, or by 25, and then divide by 100, but were largely unsuccessful.
- Q4** Most candidates had no problems with the first two parts of this question testing understanding of gauges. The airspeed gauge in Part (c) was more problematic and candidates often misinterpreted the scale. However, better candidates did generally provide the correct answer of 165. Part (d) was the most challenging part of the question and proved to be a good differentiator of ability. A minority of candidates correctly interpreted the scale correctly and provided the expected answer of £625. A common incorrect response was £620, presumably from miscounting the intervals between the major markings as five rather than four.
- Q5** It was disappointing to see such a straightforward question on probability so poorly answered. Candidates were asked to match letters on the given probability scale to flavours of crisps but few candidates answered all three parts appropriately. A significant proportion of the cohort answered with words describing likelihood, rather than provide the letters as instructed. Others provided probabilities expressed as fractions which generous marking allowed if they were equivalent to the answers expected.

- Q6** This probability question proved to be a good discriminator by ability. In Part (a) better candidates correctly totalled the bars in the graph to 50 and gave the probability of choosing a Romance film as $\frac{10}{50}$ or an equivalent fraction. However, in common with previous exam series, many candidates are still answering using words such as 'unlikely' rather than providing numerical answers. A common approach saw candidates using a denominator of 16, presumably since the vertical axis was labelled to 16, and answers of $\frac{10}{16}$ were frequently given. Part (b), finding the probability that an Action film is not chosen was well answered by only a small proportion of the cohort. Some candidates were allowed a follow through mark for consistently working with their incorrect denominator from Part (a). Again, many candidates answered with words and received no credit.
- Q7** In Part (a) candidates were asked to estimate $588 \div 18$. For candidates who knew to round both numbers to one significant figure they were mostly successful in finding the expected response of 30 and were awarded two marks. A significant proportion of the cohort failed to attempt an estimation and proceeded to try to divide 588 by 18 and received no marks for their incorrect method. Several candidates were awarded marks for rounding to 590 and dividing by 20 to get 29.5. Part (b) was very poorly attempted by most candidates with few gaining any of the three available marks for using a similar method to that shown to calculate $972 \div 36$. Candidates may have been confused, or they may not have read the question carefully, and carried on estimating in Part (b). A significant number worked with $1000 \div 40$ and received no marks. Some candidates tried to divide 972 by 36 using long division but only a small minority produced 27 from this method. Better candidates, who were successful often divided by six twice or by nine then four or vice versa. Only a few used three divisors. A common incorrect approach saw candidates divide 972 by 3, then divide this 6 and leave 54 as their answer, presumably following the method shown to divide by 18. Candidates were often inaccurate in their calculations but method marks were awarded for appropriate approaches.
- Q8** Candidates answered this question on sequences well with many receiving 2 marks for correctly adding the next 2 multiples of 4 on to find 25 and 41. A common incorrect response was 21 and 29 where candidates carried on adding 8, rather than 12 and 16.
- Q9** This proved to be another challenging question for candidates at this level with only a small minority able to complete the table correctly in Part (a) by dealing appropriately with the fractions and percentage manipulation of 30. A lot of candidates either left the table part-answered or failed to attempt it all. A follow through from a complete table did allow the award of one mark for an appropriate fraction in Part (b) if the candidate was unable to provide the expected response of $\frac{23}{30}$.
- Q10** Many candidates were able to earn the first two marks for finding $\frac{1}{6}$ of 54 beats per minute and adding it to give 63. Some candidates gained another mark for showing this gave a pulse of 63 beats per minute. Very few were then able to gain the final mark for a valid conclusion showing that each beat lasted less than one second.
- Q11** In Part (a) many candidates gained both marks for multiplying the numbers on Spinner A by the numbers on Spinner B correctly and filling in the table of outcomes. Some careless entries cost a minority of candidates a mark, again highlighting the importance of checking work. In Parts (b) and (c) candidates used their table reasonably well to answer probability questions. Again, some candidates used words of likelihood to answer these questions and failed to gain the marks available. In Part (c) there was confusion around the meaning of 'less than 40' with a minority of candidates treating this as 'less than or equal to 40'.

- Q12** Better candidates coped well with Part (a), using $23 \times 146 = 3358$ to write down the answer to 2.3×1.46 . The majority of the cohort, however, did not know how to use the information given to produce the expected answer of 3.358. In Part (b) many candidates scored some of the three available marks for showing appropriate method, particularly $200 \times 30 = 6000$. Few candidates were able to divide 6000 by 0.5 and 3000 was a common incorrect answer. Quite a few candidates rounded the three amounts correctly to produce $\frac{(200 \times 30)}{0.5}$, but often 200×30 was evaluated as 600. Some candidates rounded 0.48 inappropriately to zero or to one. A minority of candidates failed to attempt to estimate and tried multiplying 202 by 49, then attempted to divide their answer by 0.48, but gained no marks for following a wrong method.
- Q13** This question testing percentages was a good discriminator of ability and only a small minority of candidates produced the expected answer of 54% to earn 3 marks. Pleasingly, though on the penultimate question, candidates were still attempting questions and quite a few managed to earn 1 mark for working out that 23 people passed or 27 people failed, and some were awarded 2 marks for finding 46%, the percentage of people taking the test who passed. Common incorrect responses included 90% and 10%, 90% coming from summing the 50% of males who passed and the 40% of females who passed, 10% coming from candidates believing if 90% passed then 10% failed. Unfortunately no marks could be awarded for these incorrect methods.
- Q14** The transformation in Part (a) was only referenced with the word 'translation' a couple of times throughout the whole cohort. Fortunately a mark was available for stating the shape moved three right and nine up, which a minority of candidates benefitted from. Common mistakes included miscounting the number of units the shape moved to the right and describing the move from B to A, rather than from A to B, as three left and nine down. Some candidates lost the mark for stating three across and nine up, rather than three right and nine up. Pleasingly Part (b) proved more accessible to candidates, many of whom scored at least three of the four available marks for drawing an accurate diagram of the sketched parallelogram. Some candidates were hampered by not having access to a ruler or protractor, while others were slightly out of tolerance with their line lengths and angles on occasion.

Assessment Unit M52 Foundation Tier Calculator

Unit Overview

This calculator paper was accessible to stronger candidates, but proved challenging for much of the cohort. Marks ranged from single figures to scores in the 40s out of 50 marks available overall. The standard of answering was reasonable in general. It was surprising though that some core aspects of the M5 course were misunderstood or not well answered. Probability and basic points of a compass were problematic. Written communication, answer structure and drawings were frequently poor, inaccurate and somewhat untidy. The range of questions was varied and tested all abilities. Candidates mostly persevered with the paper and worked their way through it picking up marks consistently and there was no evidence to suggest candidates ran out of time. It is clear that many candidates are not checking their work and it was evident that some candidates failed to read instructions given carefully enough and answered different questions. Whilst pleasing that the majority of candidates had a calculator and the mathematical equipment required a minority were disadvantaged by not having everything they needed. The level of language used in this paper was appropriate throughout for the candidates sitting it.

- Q1** A map of Northern Ireland was shown with some towns and cities marked. In Part (a) it was surprising that some candidates were unable to locate Newry as the place that is furthest west. Portaferry, the place which is furthest east, was often answered. Similarly in Part (b) there was some confusion when finding the place to the south and east of Killyleagh, with some candidates answering Banbridge, which is south and west. A minority of candidates answered with Downpatrick and Portaferry, clearly misinterpreting the question as asking for a place south of Killyleagh and another place east of Killyleagh. Many candidates were awarded the available mark in Part (c) for indicating on the map a place that was both north of Banbridge and southwest of Lisburn. A generous tolerance was allowed, but a minority of candidates were confused by the direction southwest and placed their 'X' inappropriately.
- Q2** A straightforward question on likelihood which was well answered by most of the cohort. Part (a) was answered correctly with 'odd' by a majority of candidates. A small number thought 'even' was more likely, which at this level is disappointing. A few others misunderstood what was being asked and answered 'yes' or 'no'. There were no issues with Part (b), writing down 'five' as the number most likely to be chosen. In Part (c) most candidates answered correctly that 'seven' and 'two' have the same chance of being chosen as the 'nine'. A common error was to write just one of the expected answers rather than the two required.
- Q3** Two of the three parts of this question testing vocabulary of likelihood were answered well by many candidates across the cohort's ability levels. In Part (a), however, the concept of 'fair' was not well understood by many and a 'fair' coin was often referred to as an 'evens' coin. Parts (b) and (c) were better answered and good understanding was shown by candidates of likelihood and how to express it in words.

- Q4** Part (a) of this question testing sequences was accessible to most candidates and many scored at least two of the four available marks, with better candidates gaining all four marks. In Part (i) few candidates were unable to spot that the sequence was halving each time and most of the cohort gave the correct answer of four. In Part (ii) most candidates understood that the terms were increasing by seven each time and produced the correct response of 32. Part (iii), a sequence of square numbers, saw some candidates adding 9 to 25 to give 34, rather than answering with 36, the next square number. The final part of (a) required the next triangular number after 15, which most of the stronger candidates found correctly.
- Part (b) allowed for discrimination by ability as only the most capable candidates were successful in finding 18, which is half of 36, one of the terms in sequence Part (iv) as it is continued. Clearly some candidates were confused by what was being asked as answers such as Parts (ii) and (iv) were common and there were also some blank responses.
- Q5** This question on tiling a wall proved challenging for all but the strongest candidates. Most candidates found the area of the wall as $200 \times 80 = 16000 \text{ cm}^2$, then divided by 20, rather than by 202, the area of each tile. Few candidates attempted to solve the problem in the expected way but some did earn a mark for producing ten and four, the number of tiles needed to cover the 200 cm and 80 cm lengths of wall. Better candidates then multiplied to produce 40, gaining the second mark. A minority of candidates who found 10 and 4 correctly then added to give an answer of 14.
- Q6** This was a very well answered question in general with most candidates understanding they had to convert from cm to inches or vice versa to test if the suitcase would be allowed on board the plane. The majority of the cohort converted the dimensions of Toran's bag from inches to cm and most were correct in their conversions and found that the bag would be permitted on board. A small minority of candidates incorrectly applied the given conversion, one inch = 2.54 cm, and gained no marks. Some candidates, who converted correctly, went on, needlessly, to find the volume, showing a lack of understanding of what they were trying to show. Candidates should be reminded that it is not appropriate to truncate their calculated values and to take care with their rounding.
- Q7** Better candidates were able to measure both cars accurately and use the fact that the small car is 12 feet long to find the length of the stretch limo in feet. Some poor measurements, outside the 2 mm tolerance, led to candidates who knew what they were doing, losing marks needlessly. Those who attempted to use the method expected, often produced the answer of 42 feet and gained 3 marks. Common incorrect responses included $4 \times 12 = 48$ feet or $12 \times 3 = 36$ feet, both of which gained no marks for using incorrect methods. Some candidates managed to produce an answer within tolerance by estimating, without measuring lengths, how many small cars fitted into the length of the limo. A minority of candidates indicated three lots of 3 cm lengths and a 1.5 cm length on the limo, which is equivalent to the required 10.5 cm length. Unfortunately some of these candidates were often unable to produce 42 feet from their method, instead answering with $36 + 1.5 = 37.5$ feet or 36 feet by ignoring the 1.5 cm length.
- Q8** Listing the nine meal deal combinations was on the whole very well answered and most candidates were awarded the full two marks. Where candidates erred it was by repeating combinations or by including invalid combinations, such as two mains rather than a main and a snack. Checking of answers would have allowed candidates to spot their listing of repeated answers.

- Q9** Most candidates attempted the conversion appropriately and divided €22.99 by 1.10, which led to an answer of 20.9 on their calculator. Some candidates failed to transcribe their calculator answer into correct money format and lost a mark for their answer of £20.9. A minority of candidates simply subtracted €1.10 from €22.99 to get 21.89, gaining no marks for using an incorrect method. Others multiplied 22.99 by 1.10 to get 25.289, also gaining no marks.
- Q10** Better candidates were able to calculate the price of the longer gold chain by either finding the cost of 1 inch of chain as $264 \div 18$, then multiplying by 21 or realising that the length increased by one sixth so the cost would be $264 \div 6 + 264$. Correct answers of £308 were frequently seen, but marks were often lost by poor or early rounding or truncation. The price of one inch of chain was £14.66 which was variously rounded or truncated to £14.66, £14.67, £15, £14, £14.60 or £14.70. Generally, most candidates multiplied their 'inch' price by 21, however, a minority of candidates multiplied their 'inch' price by 3 and added this to the price of the 18 inch chain.
- Q11** Clearly not all candidates are aware of the method of calculating polygon angle sums by splitting a polygon into the smallest number of triangles and multiplying the number of triangles by 180° . In Part (a) candidates familiar with the method split the hexagon into four triangles, but many candidates drew more than four triangles and a minority drew a mix of triangles and quadrilaterals. In Part (b) some candidates who hadn't managed to answer Part (a) correctly still produced the correct answer of 720° for the hexagon's angle sum, often by taking two away from the number of sides of a hexagon and multiplying by 180° . Only better candidates were able to calculate the decagon's angle sum in Part (c) but few used the fact that the decagon had been split into four quadrilaterals to help them.
- Q12** A disappointingly high number of candidates were unable to accurately reflect the given triangle in the x-axis in Part (a). The placement of a correctly reflected triangle was sometimes inaccurate and frequently candidates translated, rather than reflected, the triangle. A minority of candidates gave a non-congruent triangle as their answer. As there was only one mark available many candidates did not receive anything for their attempt. In Part (b) better candidates were able to apply the enlargement scale factor of four to the length and width of the given rectangle dimensions. A minority of candidates added the scale factor on to the dimensions rather than multiplying by it.
- Q13** Part (a) of this question tested ratio, which is a very difficult concept for candidates at this level. Consequently few candidates were awarded either of the two marks available for producing the ratio of 2:3:4 for the three sizes, 500 g, 750 g and 1 kg, of cereal packs. Many candidates ignored ratio altogether, while better candidates who tried to answer the question appropriately often had difficulty with the mixed units, sometimes failing to change the 1 kg pack to 1000 g or changing it to 100 g. For candidates producing 500:750:1000 answers were often simplified incorrectly or only partially. At least in Part (b) less able candidates could gain two of the four available marks for increasing the 500 g pack by 20% to get 600 g and for taking 20p off the price of the new pack to get £1.36. However, the final two marks were rarely awarded as candidates often could not follow an appropriate method to consider which pack offered better value. Few candidates compared prices per 100 g (or similar) or the number of grams for each pound spent (or similar). In some cases those who produced correct figures for comparison came to the wrong conclusion.

Q14 Part (a) of this question testing probability required candidates to sum the probabilities given in a table, take the total away from one and divide this by two to find the two equal missing probabilities. Better candidates were able to sum the given probabilities to 0.74 and work out that the remaining probability of 0.26 meant that Mussenden temple and Derry City Walls each had a probability of 0.13. Candidates whose method started off well sometimes were unable to sum the four probabilities in the table correctly, despite having a calculator. A commonly seen incorrect total was 20 or 0.2 ($0.3 + 0.1 + 0.14 + 0.2$ being added as $3 + 1 + 14 + 2$), which led to 0.8 and answers of 0.4 for each of the missing values.

Part (b) required adding the probabilities for Ulster Museum and Titanic Belfast and many correct responses were given, showing that candidates at this level can deal with 'OR' in probability. Part (c), a question on relative frequency was less well understood with many candidates dividing 1800 by 3 rather than multiplying 1800 by 0.3. This part of the question proved to be a good discriminator of ability and a small minority of the stronger candidates gained both of the available marks for correctly answering 540.

Q15 This question on a distance-time graph proved difficult for the majority of the cohort. Part (a), identifying which part of the journey to the theme park was the fastest stage, was the most successful part with many candidates identifying Stage 1. Some candidates ignored the information given in the question and answered Stage 5, which was the journey back to school. This, once again, highlights the importance of careful reading of information given in questions. Part (b) was poorly answered and the majority of candidates were unable to find the amount of time the students spent at the theme park. Only a small minority were able to take readings of 11 o'clock and half three from the graph and work out that students spent 4.5 hours at the theme park. Some candidates answered 4.3 or 4.30 hours but were not awarded the available mark. The final part of the question, Part (c), was beyond the capability of the vast majority of the cohort. A small number of candidates were allowed one mark for indicating 20 miles and 30 minutes (or equivalent), but few could calculate the average speed as 40 mph. For those who worked with $\frac{20}{0.5}$ most were unable to resolve this to 40. Some candidates attempted to calculate the average speed using $\frac{20}{0.3}$ while others used $\frac{20}{30}$.

Assessment Unit M61 Foundation Tier Non-Calculator

Unit Overview

It was felt that this paper tested a wide range of mathematical skills and was well differentiated, giving both weaker candidates the opportunity to successfully demonstrate their abilities, while providing sufficient challenge for those more able. The better candidates responded positively with well-structured answers but those weaker had errors in method or accuracy, used inappropriate rounding and on occasions lacked the ability to communicate effectively.

As always, allowances were made for basic errors and follow through marking used when early errors produced unexpected answers. I felt that some candidates were very well prepared and were able to access all questions but a number did appear to have not covered all topics tested and a few highlighted this fact by adding comments on their papers, which is obviously not to be encouraged.

There were no obvious time issues but weaker candidates definitely struggled with the more difficult and higher graded questions towards the end of the paper, often either leaving them blank or writing random answers.

Topics that were best answered on this non-calculator paper included the next terms in the sequence and the table of outcomes, while those that proved difficult were the transformation, bearing, relative frequency and graphical simultaneous equations questions, all notably at the end of the paper.

- Q1** This probability question provided a good start for the majority. A common error was the misinterpretation of the scaling of the probability number line with weaker candidates counting in tens and giving E as the answer to Part (a) and C to Part (b). Almost all were successful in giving A to Part (c). Although not asked for, generous marks were given for correct numerical answers but none for 'wordy' responses.
- Q2** This was another question generally well answered, with common errors including miscalculating the total number of films or taking the 'total' to be 16 and giving $\frac{10}{16}$ as the answer to Part (a). A correct follow through for using a wrong denominator in Part (b) did obtain marks. Also in Part (b), despite the word 'not' being highlighted in bold, the wrong answer of $\frac{12}{50}$ was common.
- Q3** (a) Those who understood the process of 'estimation' scored well here; weaker candidates attempted the division and did not receive marks.
- (b) A number of candidates incorrectly carried on an estimation process into this part. Even those who chose correct paired factors for the division were often let down by their inability to carry it out. Another common error was to just divide by the 3 and the 6 giving 54 as their answer rather than complete another division by 2, to attain the correct answer of 27.
- Q4** Those who either did not read the intro or didn't know what it meant by 'the next multiple of four' got this question wrong. A mark was given for just the 25 or for a correct addition of 16 to the first term being incorrect.
- Q5** This question was reasonably well answered. In Part (a) if the correct values were obtained for the girls and boys, then the table was usually completed properly. Weaker candidates had difficulty in working with the fractions, with the very weakest just guessing. A generous follow through was given in Part (b) for their 'total pupils present' figure written as a fraction of 30.

- Q6** Many candidates gained the first mark for 9 and could add this successfully to give a second mark for 63. The next two marks were awarded for a clear explanation on why a beat now lasted less than a second, requiring the idea that the 63 represented 63 bpm or beats per minute, that there are 60 seconds in a minute and hence if there are now 63 beats in 60 seconds, each beat must last less than a second. These last two marks were only achieved by the better candidates.
- Q7** The completion of this table of outcomes was generally a guaranteed two marks for most, although a lack of concentration may have led to a silly error and hence a loss of a mark for some. A few didn't read the intro properly and gave paired outcomes rather than a 'score'. Parts (b) and (c) were very well answered by those with a correctly completed table.
- Q8** (a) A number of candidates tried to do the given multiplication, often unsuccessfully, thus ignoring the 'write down' instruction. Quite often a wrong answer of 33.58 was given or some abbreviated answer using some of the correct digits.
- (b) Many picked up a mark for getting 6000, some got as far as $\frac{6000}{0.5}$ for 2 marks but only the best were able to successfully carry out the division, with 3000 being the most common wrong answer to this part.
- Q9** This proved to be a good differentiator with only the best getting three marks. Quite a few got the 15 and 8 but didn't add them together. Some who did, then changed the 23 into 46% and gave that as their answer or calculated 27 and then did not know what to do with that.
- Q10** (a) Naming the 'type' of transformation is always the first thing to give in a full description of the transformation - here the word 'translation' was often left out. A vector answer is not expected at this level but it is necessary to give the direction of movement as in three right and nine up.
- (b) The majority of candidates picked up at least two marks here but it would be interesting to ask some of them to name the shape that they had constructed. In many cases it would be difficult to identify a parallelogram.
- Q11** This 'reflex' bearing proved to be too difficult for the majority and was only answered successfully by the very best candidates.
- Q12** There were a number of variations given here which did not receive marks. Common wrong answers included the next term of 13, +3 as the value of the 'gap', n^3 which is not acceptable or getting the two key terms mixed up and writing $-2n + 3$
- Q13** (a) This was undoubtedly the hardest question on the paper with even the statistics being slightly inflated by those who guessed successfully the missing values in the table. It is set at a high grade and proved to be accessible by only the very best. One mark was gained by adding the given frequencies but often this value of 88 was just subtracted from 100 to give 12 as a missing value in the table. Similarly the 'relative frequencies' were added to give a value of 0.81 which obviously didn't receive a mark but again was used to subtract from 1 and give 0.19 in the table.
- (b) Only the very best picked up this mark with the correct division of 2300 by 0.23 giving 10000.
- Q14** The last question tested solving simultaneous equations by a graphical method. No marks were given for an algebraic solution. A generous mark was given to those who had lines with either the correct intercept or the correct gradient, with usually only the intercept gaining the mark. Those who had the correct line received three marks if they identified the values of -2 and -3 but wrote them in the wrong places in the answer space.

Assessment Unit M62

Foundation Tier Calculator

Unit Overview

As always, opportunity was provided for all candidates to be assessed on the breadth of their syllabus and many made a good attempt at answering most questions. The paper discriminated well between candidates of differing abilities and provided a good mix of procedural type questions together with those more thought provoking thus resulting in the usual range of scores relative to ability.

Throughout, allowances were made in marking, with part marks being awarded for positive working; however it was noticeable that weaker candidates had difficulty with the latter part of the paper, where the higher graded and more thought provoking questions caused problems.

On this calculator paper highest marks were achieved in the questions involving comparison of units, listing combinations, exchange rates and enlarging a rectangle, while those that caused most difficulty were writing a ratio, changing the subject, number of sides in a polygon and locus.

- Q1** This proved to be a more difficult question than expected with the most popular wrong answer being to use an area method incorrectly. Many worked out the 200×80 as 16000 but failed to divide by 400, the correct area of each tile. It was hoped that they would 'fit' the tiles along the edges, find that there were 4 rows of 10 tiles and calculate the number needed as 40 but not so. A mark was given for identifying the ten and four.
- Q2** This 'carry on bag' question was well answered by the majority. Common errors included misuse or rounding of the 2.54 or calculating and comparing volume which didn't receive marks.
- Q3** The intro did say 'scale drawing' but it was disappointing that many did not measure the drawings and use these to calculate the 'real' length of the limo, often guessing that the limo was 'roughly' three or four times the length of the car and writing answers of 36 or 48. A generous range of possible answers received marks for various measures taken from the diagram.
- Q4** This was very well answered by many candidates, often listing the correct combinations systematically. Errors tended to be along the lines of repeating the same combinations and hence omitting a few or presenting the possibilities using lines or a 'tree diagram' rather than giving each meal/snack combo. Some also just matched each of the three mains with the snack opposite in the table giving only three answers.
- Q5** This 'exchange rate' question was also answered very well, though a number lost a mark for poor money notation. There were also the obvious errors in multiplying by 1.10 rather than dividing or changing one Euro into £'s and rounding the conversion.
- Q6** Rounding of either the $\frac{264}{18}$ value or $\frac{264}{6}$ (calculating the cost of 3") often led to a loss of one mark for a huge variety of possible answers. At least this was a mark gained. There was however the possibility of candidates losing this mark for poor money notation if they hadn't already been penalised in the previous question.

- Q7** Either splitting the triangle into four or six triangles (lines drawn from each of the vertices to a centre point) gained the first mark in Part (a). Those who used four quite often calculated the correct value of 720° in Part (b); those who used six quite often forgot to subtract the 'extra' 360° at the centre of the hexagon. Only the better candidates worked out 4×360 for the decagon in Part (c), though a few did use the given formula to calculate the correct answer of 1440° . Weaker candidates found both Parts (b) and (c) difficult.
- Q8** (a) The majority gained the one mark available although some just translated or even rotated the triangle below the x - axis. Allowances were made for a decent free hand drawing and for the vertices 'close' to the correct positions.
- (b) This 'scale factor enlargement' was very well answered by nearly all. Those who didn't understand the concept often added four to the length and width values or made mistakes in their multiplication by four.
- Q9** (a) Better candidates dealt well with the $1\text{kg}=1000\text{g}$ to allow the comparison. Those who used the ratio symbol at this stage gained the first mark; weaker candidates found it difficult to simplify fully to the required answer. A mark was awarded for either $\frac{1}{2} : \frac{3}{4} : 1$ or $0.5 : 0.75 : 1$.
- (b) This part was a good discriminator with the better candidates able to make the comparison and gain the four marks. Those weaker had a good chance of getting at least the first two marks.
- Q10** (a) This part was a fairly standard 'complete the missing probabilities' table with a slight twist in that there were two values missing but of equal size. Good candidates picked up the three marks available. Those weaker often divided the 0.74 by 2 giving 0.37 in each of the missing spaces - not really very sensible given it should have been clear that the new total of the probabilities could not possibly be one.
- (b) Very poor addition in this part often led to the wrong answer of 0.15. Equivalent fractions or percentages to the correct answer of 0.24 were acceptable here.
- (c) Quite a few calculated $\frac{1800}{0.3} = 6000$ as their answer without realising the value had to be less than 1800. Marks awarded tended to be either two or zero.
- Q11** (a) There were a lot of very disappointing answers here with some who gave five as their answer obviously not reading the word 'to' given in bold in the intro. Some who did, quite often gave two as their answer hence showing a major lack of understanding of the graph gradient.
- (b) This question asked 'how long. There were no marks for those who gave from 11 to 3.30. There were also no marks for those who did not include units in their answer. 4.3 hrs was another common mistake while 270 mins was acceptable.
- (c) A generous first mark was given for sight of 20 and 3, 20 and 0.5 or 20 and $\frac{1}{2}$. Sight of 20 and 0.3 were not acceptable however. Again it was disappointing that candidates could not see that if the journey took $\frac{1}{2}$ an hour to go 20 miles, then in an hour they would go 40 miles hence a speed of 40mph.
- Q12** (a) The most common error here was y^4 . When candidates were aware that the index was six some lost the mark by writing y^6 rather than y^6
- (b) As per usual, this inequality question was often poorly done. The $>$ symbol seems to scare candidates and one wonders if this had been given as an equation would they have got it right. I expect so.

- Q13** Quite a few got the correct orientation of the shape and picked up a generous mark for this, but only the better candidates had it in the correct position.
- Q14 (a)** Those who had covered binary in class or revision tended to get this correct. Some had the answer correct in their working and then reversed it in the answer space thus losing the mark. Some others added a zero to the right of a correct answer and again lost the mark while many were fortunate to gain the mark for adding extra zeros to the left in front of the correct answer. Those who did not know what a binary number was often wrote 1.9 as their answer.
- (b)** Only the very best picked up the two marks here with many giving nonsensical rearrangements. Changing the subject is never a 'favourite' topic at this level.
- Q15 (a)** In addition to all the 'guessed' answers, the most common wrong answer was $\frac{180}{15} = 12$
- (b)** I thought this question was a great way of asking pupils to think about congruence; I don't think they would agree as one answer seemed to be as common as another with the wrong one often selected.
- Q16** There were a mixed bag of answers here with weaker candidates not appreciating that they were discussing additional information needed on Georgia's rolls rather than another experiment having to be carried out.
- Q17** The last question on a paper often proves difficult and this was no exception. Locus questions very often do not require construction, rather a measurement. Those who chose to find the perpendicular bisector of a line joining AB often had the arcs in the correct place but failed to draw the required horizontal line halfway between A and B.

Assessment Unit M71 Higher Tier Non-Calculator

Unit Overview

Most candidates were able to make a good attempt at the questions at the start of the paper. Some however found the topics of relative frequency, nth terms, locus and the terms independent and mutually exclusive more challenging. Most candidates were unable to fully answer question 12 and work with pi when finding the perimeter of the semicircle.

Working out was usually seen and is always to be encouraged as candidates can access many method marks, even when they fail to obtain the correct final answer.

Candidates are encouraged to read the questions carefully.

- Q1** Part (a) was a good starting question as the table was usually correctly filled in. A few errors however were seen. Candidates should check their work carefully. In Part (b), the fraction $\frac{23}{30}$ was usually correct. A few errors such as $14 + 9 = 25$ were seen.
- Q2** Most candidates were able to get 9 and 63 for the first 2 marks. Candidates then gained the third mark for starting to explain their answer of 63. However, many candidates could not access the 4th mark as they didn't know how to fully interpret the value they found or how to explain it correctly.
- Q3** In Part (a), most candidates were able to correctly complete the table. Some made a few errors in their multiplication. Some candidates did not multiply and wrote the outcomes (1,10) etc. Part (b) was well answered. Ratio should not be used. Candidates do not need to convert their fraction to a decimal. Sometimes a wrong denominator was given. Part (c) was also well answered. Some answers of $\frac{7}{12}$ were seen.
- Q4** A range of wrong answers were given, such as not q, $100 - q$, 50%, $x - q$, $\frac{1}{2}$. Few candidates gave the correct answer of $1 - q$.
- Q5** Part (a) was well answered. Some wrong answers such as 33.58. In Part (b), most candidates knew to round the three numbers which was pleasing. Some candidates rounded 0.48 to 0 or 1. Many candidates got as far as $\frac{6000}{0.5}$ and went on to give the wrong answer of 3000.
- Q6** Many candidates were able to gain all three marks with the correct answer of 54%, some getting two marks for 46% as they did not read the question carefully. Some candidates did not work out 50% of 30 or 40% of 20 but were doing wrong work with $50\% + 40\% = 90\%$, $100\% - 90\% = 10\%$
- Q7** In Part (a) many candidates lost the first mark as they did not use the word translation or translate. Move or slide did not gain the first mark. Some candidates were describing B to A when it should have been A to B. The answer in words gained the marks. Three across did not get the mark as it should have been three to the right. Candidates who used vectors often lost the mark for incorrect notation, for example $(\frac{3}{9})$ or (3,9) In part (b) the drawing was usually done within tolerance. Some candidates lost one or two marks for being out of tolerance, but the question was well attempted.
- Q8** In Part (a) few candidates were awarded four marks for the correct answers of 0.22 and 27. Candidates seemed to be guessing values to put in the table rather than calculating the values. Some candidates only gained 1 mark for 88. In Part (b) again few candidates got the correct answer of 10 000. Many incorrect answers were seen.

- Q9** Some candidates were awarded four marks for the correct line and correct solutions. Some candidates were awarded two marks for the correct line but they did not know to write down the point of intersection.

Some candidates drew a line with y intercept three, in these cases there was no evidence of a table of values being drawn.

- Q10** In Part (a) many candidates were able to get the correct answer of $3n - 2$. Some candidates wrote $3n + 2$ or $3n$. A common wrong answer was $n + 3$. Also 13 was seen as some candidates simply worked out the next term. In part (b) many candidates did not recognise the square numbers and many also did not make the connection between Parts (a) and (b). Many did not realise that their answer should have been a fraction.
- Q11** Many candidates who knew the laws for indices were able to work out the correct values for x and y. A few candidates wrote seven and four instead of four and seven. Many approaches were seen, perhaps the most common was recognising two numbers that add to give 11 and subtract to give three, rather than the use of simultaneous equations.
- Q12** Many candidates were able to use Pythagoras and get to $\sqrt{5}$ for one mark and that is all. A common error with the semicircle was forgetting to add on $2r$ for the perimeter. Some candidates were using the area formula. Some candidates were using 3.14 instead of keeping their answer in π .
- Q13** In all parts it was hard to tell if candidates understood the terms or were guessing, but at least they were attempted.

Assessment Unit M72

Higher Tier Calculator

Unit Overview

Most candidates were able to make a good attempt at the questions at the start of the paper. Some however found the topics of similar shapes, proportion and working out the probability in the last question more challenging.

Working out was usually seen and is always to be encouraged as candidates can access many method marks, even when they fail to obtain the correct final answer. Especially on a paper that allows the use of a calculator candidates are to be reminded to still show their working out.

- Q1** The correct answer was £20.90 however candidates who wrote £20.9 lost one mark for incorrect money notation. This was seen many times.
- Some candidates used the wrong method of 22.99×1.10 and gained no marks.
- Q2** The correct answer of 308 was awarded two marks. Candidates who used rounding such as 14.6 or 14.66 or 14.7 in their calculation were penalised one mark.
- Q3** In Part (a) many candidates were able to show the four triangles however some drew many triangles, six being a common approach. In Parts (b) and (c) candidates who knew the formula were usually able to gain both marks.
- Q4** In Part (a) the reflection was well done by most candidates. In Part (b) the answers of 20 and 32 were usually seen as this was well done by most candidates.
- Q5** Many candidates were able to work out 600g and £1.36 to gain two marks. Some were unable to show clear working in deciding if the new box was a better or worse deal. Some candidates made an error in calculating 20% of 500 and some added 20p to £1.56 rather than subtracting it.
- Q6** In Part (a) the correct answers of 0.13 and 0.13 were usually seen as this was well done by most candidates. Part (b) was also well answered but a few candidates who got 0.1 and 0.14 from the table went on to give the wrong answer of 0.15. Some wrote $\frac{2}{6}$. In Part (c) most candidates were able to select 0.3 but a very common wrong answer was $1800 \div 3 = 600$. Some candidates rounded 1800 to 2000.
- Q7** For Part (a) a common wrong answer was Stage 5 where candidates did not read carefully that it was only the journey to the theme park that they should consider. Part (b) was well answered. In Part (c) many candidates were able to identify 20 miles and 30 minutes for 1 mark. However, $\frac{20}{30}$ was often seen and candidates were unable to work out 40 from this.
- Q8** Part (a) was well answered. For inequalities like Part (b) candidates who use = rather than the inequality sign often forget to replace = with the inequality sign in their answer. Some candidates who had $x > -3$ went on to write -3 only on the answer line and were penalised 1 mark. Some candidates had $10x$ and did not know how to solve the inequality.
- Q9** Often a 90° rotation was completed but the wrong point was used. Candidates should take care to use the given point to gain both marks.
- Q10** In Part (a) binary was well answered though some candidates are still writing their answer backwards. In Part (b) candidates are encouraged to show each step as 1 mark was available for getting $3m = h - y$.

- Q11** In Part (a) some candidates knew the formula to calculate the number of sides. However some who obtained 24 went on to add 2 or subtract 2 or divide by 2. Often a wrong formula was used. In part (b) a variety of answers were given.
- Q12** Some candidates knew to give the answer number of trials or number of times the dice was rolled. A common wrong answer was to roll the dice more times.
- Q13** Some candidates drew arcs and circles but did not indicate the correct horizontal line. Some candidates left the question out.
- Q14** In part (a) common wrong answers were $\frac{x}{3}$ or \sqrt{x} . The correct answer was only seen a few times. Part (b) was well done by candidates who knew to use a scale factor. Some candidates lost one mark for rounding $\frac{4}{3}$ to 1.3. Many candidates were adding or subtracting and gained no marks.
- Q15** Not many candidates were able to access all three marks here. Some candidates used R is proportional to v and omitted the fact that it was v squared. A few used the square root of v. Many candidates did not seem to know this topic.
- Q16** For Part (a) many candidates made a good attempt at the tree diagram. Some however forgot to include the labels of rain and no rain. In Part (b) only a few candidates were able to get to the correct answer. Many candidates did not know to multiply and were adding the probabilities.

Assessment Unit M81

Higher Tier Non-Calculator

Unit Overview

Overall this paper allowed candidates of differing abilities to respond positively, while providing the differentiation required to set grade boundaries, rewarding candidates who very successfully produced well-constructed solutions showing good understanding of the topics examined. The introductory questions proved slightly more challenging and possibly off-putting than anticipated, but attempts were made by all candidates, with some probably not realizing their misunderstanding of the question asked. All appropriately entered candidates had questions available to match their ability level with A* questions included to stretch the most able. Time did not appear to be a problem with most candidates attempting all questions, recognising the topic being tested and confident enough to tackle the problem. Unfortunately the rise in entry and analysis of results suggests that there was a sizeable minority of candidates who would have been better entered for the papers offering grades EDCB. Encouraging understanding was shown on the topics of graphical solution of linear equations, finding the formula for the n th term of a sequence, standard form and probability. The relationship between scale factors in enlargements and area and volume remains a hurdle for all but the more able, while manipulation of surds and coordinate geometry proved, as expected, a challenge for all but the best. It was surprising how many candidates had difficulty in multiplying fractions and this may well be an indication of the fundamental skill deficit resulting from the Covid impact on classroom teaching.

- Q1** What seemed attractive as a question to examiners, was evidently not so for candidates. While over a quarter scored full marks, this was disappointing for a first question on the paper and many candidates were at a loss with the topic posed this way. Some candidates added the values 17, 23, 23 and 25 but did not use their answer in connection with the relative frequency for 400 pizzas sold. Some calculated 500×0.23 as 115 but again did not know how to use this value. Better understanding was demonstrated in Part (b), with nearly half the candidates getting the correct answer here.
- Q2** Over 60% of the candidates gained full marks on the graphical solution of simultaneous linear equations with a sixth unable to gain any marks for drawing an appropriate line on the graph.
- Q3** Nearly three quarters of the candidates found the correct expression for the n th term of the linear sequence with about 15% unfamiliar with this topic. The better candidates were able to use this answer to recognise the second sequence involving square numbers also.
- Q4** While only a minority of candidates used the method given in the mark scheme, it was encouraging to see good understanding of standard form and the rules for indices exhibited in a variety of methods, with a good majority gaining full marks for the question and quite a few making only a simple error in the final conclusion.
- Q5** Surprisingly, a quarter of the entry could neither find the correct perimeter of a semicircle (omitting the diameter) nor use Pythagoras for the height of a right-angled triangle. Many found one or the other of these for one mark. Some equated perimeters correctly for three marks in total, but only the very strongest candidates could rearrange this equation to find the radius for the fourth mark.

- Q6** Less than half the candidates were familiar enough with the term ‘independent’ to correctly select a pair of independent events from the four listed. A large majority correctly selected a pair of mutually exclusive events. Just over half knew how to calculate the probability of either of two mutually exclusive events occurring.
- Q7** Around 40% of the entry gained full marks for enlarging the shape using a negative scale factor and given centre, while around 40% gained no marks. The remainder usually plotted one vertex correctly or used the wrong centre of enlargement.
- Q8** The scores for responses to this question on calculating the probability of one of two independent events occurring were similar to Question 7. More than 40% gained full marks, 40% gained no marks and the remainder usually made numerical errors in multiplying fractions. Surprisingly many made simple errors such as $\frac{1}{3} \times \frac{2}{5} = \frac{3}{15}$. This suggests a gap in basic skills normally developed in earlier years and possibly missing through the COVID disruption.
- Q9** As usual only the better candidates realized that when the height of one of two similar shapes is twice the height of the other then the volume is eight times the smaller volume. The majority of candidates doubled the volume.
- Q10** This was a challenging A* question on surd manipulation. The very strongest gained full marks while the majority were able to gain some marks for beginning to multiply out the brackets but not make all the necessary deductions to reach the full answer.
- Q11** The majority of candidates were able to show which probabilities should be multiplied in this non-replacement example in Part (a) and over half were able to add two products together to match the given answer. Similar weakness in fraction multiplication appeared as had been demonstrated in Question 8. Over a third used one of the various valid methods to answer Part (b), which was very encouraging.
- Q12** The final question proved as challenging as would be expected for the closing A* question. The best candidates knew how to find the points of intersection between the line and the circle, while many others showed some understanding of the coordinate geometry involved to find one point by trial and error, usually involving a sketch. Slightly more were able to find the equation of the diameter in Part (b) for full marks, while many at least knew what the gradient should be.

Assessment Unit M82

Higher Tier Calculator

Unit Overview

Paper 2 proved more manageable to the candidates overall than Paper 1. The questions allowed all those suitably entered for this tier to demonstrate their levels of ability. With the exception of a minority who might have fared better on GMC71 and 72, the lower grade questions at the start of the paper were handled competently by most, although some markers wondered if some of the topics covered here might have been overlooked in preparation for this examination. There were opportunities as the paper developed for candidates to display knowledge of the higher grade topics. While the most challenging questions were well answered only by the best candidates, they still allowed most to get started with the question and the more proficient to show their mathematical skills. There were few papers with unattempted questions and no evidence of shortage of time for the candidates. Generally as the paper progressed, fewer candidates were gaining full marks for the question and more were gaining no marks. The slight irregularity in this occurred with more zeros than expected for the early questions on the exterior angle of a polygon and on locus and near the end with encouragingly strong answers on a probability tree diagram and on a space diagonal.

- Q1** Nearly all candidates simplified the algebraic indices correctly in Part (a) and while the majority solved the inequality correctly in Part (b), many gave the answer as the solution of an equation.
- Q2** In Part (a) a large majority found the binary equivalent correctly and in Part (b) over 70% rearranged correctly to make h the subject.
- Q3** Nearly three quarters of the entry completed the given rotation correctly. Those who did not generally gained some marks having either used the wrong centre or mixed up clockwise and anticlockwise.
- Q4** In Part (a) roughly 70% were able to calculate the number of sides of the polygon, with the remainder generally dividing 180 by 24 or adding or subtracting 2 to/from the correct answer, confused by the formula involving $(n - 2)$. In Part (b) many seemed to confuse 'congruent' with 'similar' so that just over a third of the candidates gained the mark.
- Q5** Some candidates drew arcs and circles but did not indicate the correct horizontal line, but just over half knew how to draw the perpendicular bisector of AB , mostly accurately.
- Q6** Candidates were prompted to think about the differences between knowing properties of the pie chart and having access to raw data. Many who lost the mark realized that more data gives more reliable results but did not relate this to the situation of the question.
- Q7** Over three quarters of the entry recognised the transformation as a reflection in Part (a), with nearly a half correctly identifying the line of reflection. Part (b) involving scale factor of enlargement or ratios was well answered by a good majority.
- Q8** This question was a strong differentiator, with a large proportion of candidates not being able to start dealing with direct square proportion. But the majority made reasonable efforts, with over a third gaining full marks.
- Q9** This question on probability was very well answered. Over 80% gained full marks for the tree diagram, with most others gaining a mark having made numerical errors or omitted some elements of the diagram. Over 60% interpreted the diagram correctly to find the required probability in Part (b) while many used one or three of the branches for their incorrect answer.

- Q10** This multistep trigonometry problem proved the differentiator it was intended to be. Nearly 40% of the candidates showed good understanding of the topic and applied logical thinking to gain full marks for the question. Over 40% could not determine the correct first step on the way to solving the problem, while the remainder generally made a good start to use some trigonometry sensibly but did not see how to use this to complete the solution, thus gaining some marks for the question.
- Q11** An unfortunate choice of scale for the grid for the curve to be drawn on meant that it was difficult for candidates to draw a smooth curve which differed much from straight lines joining the correct points. Most candidates made a good attempt to draw the curve and, with a generous approach taken by markers, scoring was very acceptable both for drawing the graph in Part (a) and for reading it to answer Part (b)(i). The more stretching requirement to draw a tangent to the curve in Part (b)(ii) to find rate of decay was, as expected, only completed by the best candidates.
- Q12** It was very encouraging for markers to come across so many good answers to the space diagonal calculation so near the end of the paper with approximately two thirds gaining full marks. It was disappointing then in Part (b) that only half the candidates indicated that they knew which angle this space diagonal made with the base, although this is not unique to this year's candidature. About three quarters of those who knew which angle they wanted to calculate were able to use the correct trigonometrical ratio to complete the question.
- Q13** This final A* AO3 question proved as testing as anticipated. Just over a third of the candidates gained some marks for beginning to interpret the question and write down some relevant algebra, but only the very strongest showed the high level of understanding and manipulative algebraic skill to gain full marks.

Contact details

The following information provides contact details for key staff members:

- **Specification Support Officer: Nuala Tierney**
(telephone: (028) 9026 1200, extension: 2292, email: ntierney@ccea.org.uk)
- **Officer with Subject Responsibility: Lisa McFarland**
(telephone: (028) 9026 1200, extension: 2106, email: lmcfarland@ccea.org.uk)



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