GCSE

Rewarding Learning

Chief Examiner's Report

Mathematics

Summer Series 2022

Foreword

This booklet outlines the performance of candidates in all aspects of this specification for the Summer 2022 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

Contents

GCSE Mathematics

Chief Examiner's Report

General

With all the disruption experienced over the previous two years, this suite of papers seems to have provided an encouraging introduction to formal GCSE examinations for another cohort of candidates and a second examination for many who sat the November 2021 papers, all of whom appeared well prepared across the full specification, given the constraints imposed on teachers. Clearly the pressure of preparing so much material in the limited timespan impacted on candidates' recall of some topic areas, but it was encouraging to see evidence of candidates performing at expected grade levels across large areas of the specification. The papers proved a good test for many candidates who had little experience of public examinations at this level. In general, most candidates seemed to perform well, with the papers being successful in allowing candidates of differing abilities to respond positively to the questions posed. The vast majority of candidates attempted every question. The papers had a moderate incline of difficulty and the standard of answering was in general good. It was evident that significant work had been done by teachers and candidates alike.

Assessment Unit M1 Foundation Tier

Unit Overview

This paper proved accessible to the majority of candidates sitting it and nearly all candidates attempted all of the questions. There was no evidence to suggest that candidates ran out of time and it was pleasing to see candidates providing detailed working out to their solutions in many cases. As noted in previous series some candidates had no access to the equipment required for the examination, with a minority lacking a calculator, ruler or protractor. The standard of handwriting was very poor on a small minority of scripts and some answers were almost illegible. Candidates still express difficulty providing appropriate written reasons, justifications and explanations in their answers and more abstract concepts, including writing basic algebraic expressions and solving straightforward equations proved too challenging for most at this level. A number of candidates needlessly lost marks carelessly, once again highlighting the importance of checking work, rereading questions carefully and checking the sensibility of answers.

Marks ranged from single figure percentages to over 80%.

Q1 This straightforward question on mobile phone storage was reasonably well answered. In Part (a) of the question, a minority of candidates were unable to correctly identify and find the difference between 1.5 and 3.4 Part (b) was well understood and most candidates used a calculator to sum the given values to 32 GB. It was clear, however, that a number of candidates were careless in their calculations and needlessly lost the available mark. A minority of candidates may well not have had access to a calculator and worked the total out using non calculator methods. The final part of the question was well understood and many candidates correctly doubled their answer to Part (b), showing awareness of the practical use of 50% in context.

Q2 The majority of candidates corrected listed the rivers in order of length, a minority ordering by numerical value rather than river name. A few candidates listed the lengths in reverse order. Part (b) was less successfully answered. The majority of candidates correctly found 135 km as three times the length of the River Derg but many were unable to relate this back appropriately to the question that had been set.

Q3 Part (a), measuring the length of the line AB, was answered within tolerance by a significant majority of the cohort. Mistakes included rounding the measured value to 6 cm or answering in mm rather than cm. It was evident that a small number of candidates did not have access to a ruler. Circle understanding was less well understood in Part (b), with a large proportion of the cohort unable to identify a point on the circumference. Others, who knew what the circumference was, were careless in the placement of their 'X' and lost the mark. Part (c), demonstrating understanding of the term 'parallel', was answered well by most candidates. The final part of the question, testing understanding of the term 'diameter' was poorly answered. This proved to be a good differentiator of ability with better candidates able to describe that a diameter needs to pass through the centre of the circle. Some candidates correctly asserted that line CD was a chord, rather than a diameter and earned the mark. Common incorrect responses including 'CD is the same as AB', CD is a radius' and 'the diameter lies on the outside of the circle' were consistently seen. Poor literacy skills led to some candidates being unable to answer this question, perhaps in the way they wanted, which may have cost them the mark, particularly if their response was ambiguous or unclear.

Q4 Most candidates scored well on this question, though a significant number of candidates were unable to identify the given shape in Part (a) as a trapezium. Those who recognised the shape as a trapezium were mostly unable to spell it accurately. Some candidates were generously awarded the mark for naming the shape as a quadrilateral. A common response was to leave the answer space blank. Part (b), finding the area of the trapezium, was answered correctly by about 40% of the cohort, mostly by counting centimetre squares. Those who attempted to use the formula for the area of a trapezium were in the main successful. Drawing the line of symmetry in the final part of the question was well understood, though a minority of candidates who clearly knew what they were doing, were careless with the positioning of their lines and lost the mark.

Q5 This straightforward question on first quadrant coordinates caused few problems. The majority of candidates correctly identified the given plot as (1, 4). As expected, a significant minority answered (4, 1). In Part (b) most candidates were able to earn the available mark for plotting the point (0, 2), though some candidates were slightly inaccurate with their plot.

Q6 This question proved to be a good differentiator of ability with better candidates earning all 3 of the available marks. It is clear that many candidates are unable to demonstrate understanding of factors, multiple and squares, even at a basic level. Factors of 20 were generally well understood, but multiples of 4 often included the factor 2.

Q7 Most candidates demonstrated good understanding of interpreting a bar chart. The majority of the cohort had no trouble identifying 3 as the number of days with at least 3 staff absences in Part (a). Part (b) was much less successful with a significant minority answering with the highest frequency rather than the modal number of 2. In Part (c) few candidates were unable to access both available marks for summing the seven frequencies to 21, but where 2 marks weren't awarded, 1 mark was often unavailable as method was very rarely shown. One of the most common incorrect responses seen was 28, presumably where candidates counted from the tops of the bars to the top of the chart each day. Part (d) was often carelessly completed, and it was clear that some candidates were confused by what was expected in the frequency column. A lot of responses showed frequencies in the tally column leaving the frequency column blank. Others multiplied their 'tallies' by the upper class intervals producing an incorrect frequency column. A number of candidates left the frequency table completely blank.

Q8 A surprisingly poorly answered question on the whole. In Part (a) roughly half the candidates were able to find the difference between the given temperatures successfully. Common incorrect responses to the difference between 34°and –58° were 24°and – 24°. Both parts of Part (b) proved to be good differentiators of ability with only the very best candidates earning marks. In Part (b)(i) only a handful of candidates could substitute 8 for C into the formula, F = 1.8C + 32, and produce the expected answer of 46.4° Common incorrect responses included 40 and 41.8, from either simply ignoring the 1.8 or adding 1.8 and C. Part (b)(ii) was slightly more successful and probably reflects the fact that candidates have been taught that water freezes at 0°C and had no need to apply the formula.

Q9 Both parts of this question on volume and its practical application proved to be a good differentiator of ability. In Part (a), many candidates multiplied the cuboid's dimensions accurately and produced the required answer of 7560, with a minority gaining a further mark for including appropriate units. The units mark was a standalone mark and was awarded for cm^3 or in some cases ml. A few candidates were able to earn this mark for litres, if they changed 7560 to 7.56. The most common incorrect response was 63, resulting from summing, rather than multiplying the dimensions. In Part (b) candidates were expected to divide their volume by 120 to produce 63, the number of tubs of gravy that could be filled. A minority of candidates provided correct responses, though a follow through from Part (a) often led to candidates who had produced an incorrect volume being awarded marks. Some candidates, working with a value other than 7560, failed to consider the need to give a whole number answer and lost a mark.

Q10 It was disappointing to see so many poor responses to the first two parts of this question. A significant number of candidates were unable to round £11.158 to the nearest penny in Part (a). An even poorer response was seen in Part (b) where candidates had to round 131.9p to £1.32. In Part (a) common incorrect responses included 11.160, 11.60, 11.58 and 12.58. In Part (b) some candidates who knew to round 131.9 to 132 lost the mark for answering £132, rather than £1.32 Money notation on a minority of scripts was poor, with answers such as £11.16p seen occasionally. Parts (c) and (d) of the question proved to be good discriminators of ability with better candidates picking up the 4 available marks. Finding $\frac{5}{7}$ of 11760, in Part (c), was answered well by only a minority of the cohort. A considerable number of blank responses were seen and it was evident that some candidates did not have access to a calculator, with quite a few attempting to manually divide 11760 by 7 and multiply the result by 5, mostly unsuccessfully. In Part (d), again, only better candidates were able to access the available marks for calculating 70% of £260. For candidates who knew how to calculate percentages, the final mark was sometimes lost due to misinterpreting the question and answering £78, which is the amount Priya pays, rather than the amount her employer pays. Once again, it was clear that some candidates either did not have a calculator or chose not to use it.

Q11 This straightforward question testing application of angle measurement was often misinterpreted by candidates across the ability range. Many candidates measured the angle with a protractor accurately but then were unable to decide if the ladder was safe. Others were inaccurate in their measurement or did not have access to a protractor.

Q12 Better candidates were largely successful in gaining the marks available in Part (a) for identifying Jane's plumbing bill as correct due to her use of BODMAS. A significant minority of candidates were awarded 1 mark for answering Jane without an appropriate reason, in many cases simply stating 'she worked it out correctly'. Other candidates believed Tom's bill was correct and missed the fact that the callout fee is

only charged once. It was pleasing to see many correct responses to Part (b), with candidates across the ability range showing understanding of finding 10% of £12.50 Some, however, found the sale price of the taps as £11.25, rather than the saving of £1.25, highlighting again the importance of reading questions carefully and checking work.

Q13 This question on averages was well answered by candidates in general, with most picking up some of the available 5 marks. Only better candidates were completely successful in all three parts. Many correct responses to Part (a) were given and it is evident that many candidates at this level are now able to accurately calculate the mean. Some careless calculator inputs led to inaccuracy and loss of marks. The most common incorrect answer was 556.8, where the rowers' weights were totalled, but not divided by 6. Part (b), finding the range, was correctly answered by about half of the cohort. The final part of the question was difficult for most candidates. Although many did give a partial solution to the problem, only 1 mark was available and as a result this was rarely awarded. Candidates needed to demonstrate a sense of finding the mean of the 2 values in the middle. Some candidates were awarded the mark for identifying the median correctly as 92.95 kg. A significant number of candidates stated that an even number of values either had no median or two medians.

Q14 Another good differentiator of ability, this four-mark question on fractions saw about 45% of candidates gain some of the available marks. Various approaches were seen, including working with percentages initially, which often led to an award of at least 3 marks for producing 35%. A significant number of candidates were awarded the first 2 marks for finding 30 as a quarter of 120 and 48 as 40% of the animals, but many were unable to progress further. A sizable proportion of the cohort failed to provide a fractional answer. Common mistakes included converting one quarter to 15%, assuming one quarter of the animals was 25 rather than 30 and working with 40% of 30 birds rather than 120 animals. A number of arithmetical errors were seen, despite this being a calculator paper.

Q15 This question tested angles on a straight line and angle properties of an isosceles triangle. Many candidates gained at least one mark for finding the 72° angle on the straight line, but only a minority were able to produce 36° for angle y. A number of candidates who found 36° lost sight of what they were doing and answered 72° Despite being told that the diagram had not been drawn accurately several candidates measured the angle as 41°

Q16 This question tested understanding of cube numbers in Parts (a) and (b)(i) and significant figures in Part (b)(ii). The first two parts proved accessible to candidates across the ability range with most picking up 2 marks for identifying $5^3 = 125$ as correct and calculating 8.5^3 as 614.125 A minority of candidates thought $2^3 = 6$ was true and others lost a mark needlessly in Part (b))(i) for rounding or truncating their answer to 614 or 614.1 etc. Part (b)(ii) was very poorly answered with few candidates able to demonstrate understanding of significant figures.

Q17 Many correct responses to calculating the rectangular site's perimeter were given in Part (a). A minority of candidates rounded their answer needlessly from 110.4 to 110m and a common incorrect answer was 55.2m, where candidates simply summed the two measurements shown on the diagram. Part (b) was a good differentiator of ability and stronger candidates knew to divide their answer to Part (a) by 1.8 and round their answer up to the nearest whole number. Some candidates failed to change 180cm into 1.8m and made no progress if they divided 110.4 by 180. Others who changed 110.4m into 11040cm and divided by 180 generally gained at least one of the two marks. A significant number of candidates, however, left their answer as 61.33, missing the point of the question, which required the number of sections needed to go around the perimeter.

Q18 This question tested pupil knowledge of pie charts and proved a good differentiator of ability. About one third of candidates were able to access some of the four available marks, with a small proportion gaining full marks. It was pleasing to see consistent understanding across the cohort of generating the required sector angles. Loss of marks occurred due to poor or careless protractor technique, or in some cases because candidates had no access to a protractor. Many candidates, disappointingly, scored no marks, often calculating the angles incorrectly and ending up with five sectors on their pie chart rather than the required four.

Q19 Only a minority of candidates were able to successfully calculate Debbie and Robbie's wages correctly, with most unable to deal with the overtime, particularly Robbie's time and a half rate. While few candidates were awarded all three marks, generous follow through marking allowed some candidates to access two marks for working with one correct wage.

Q20 The completion of this two-way table proved accessible to candidates across the ability range. Many fully correct responses were seen and it was pleasing to note that the majority of candidates scored at least some of the 3 marks available. The most common mistake was double-counting for the total and completing this box with 78, rather than 39. A significant minority of candidates recorded the values in their table with tallies rather than numerals and this is a practice classroom teachers should dissuade students from using.

Q21 This question which dealt with buying a number of buns costing 55 pence each and a single gift box costing 80 pence was well answered by many candidates, across the ability range. Most candidates tackled the problem by taking the change and the cost of a gift box away from £10 to leave £6.60, which they then divided by 0.55 to produce the required answer of 12 buns. Candidates who misinterpreted the information given often ended up adding multiple gift boxes, which restricted the marks available. Some candidates were penalised for arithmetical errors, especially those not using a calculator who employed a method of either repeated addition or subtraction to solve the problem.

Q22 This was one of the least successful questions on the paper with even better candidates rarely awarded any of the marks available. Candidates at this level struggle with even basic algebraic principles. In Part (a), a very small number of candidates were able to produce the required expression, and even then notation was often poor. Fewer candidates were able to produce the required expression in Part (b) and it was extremely rare that anyone in the cohort was awarded a mark for Part (c).

Q23 Whilst pleasing to see that many candidates were familiar with stem and leaf diagrams the award of all 3 marks was infrequent. Candidates dropped marks when they failed to order their leaves or provide an appropriate key. Others were careless with their entries and omitted one or two values. Some candidates were unsure of how to deal with the single-digit values while a small minority failed to attempt the question at all.

Q24 This question on percentages allowed for differentiation by ability. Only the very strongest candidates were able to identify $\frac{6}{28}$ as the required fraction and change it to a percentage rounded to 2 decimal places correctly. A common incorrect approach saw many candidates work with two separate percentages, 3 out of 10 as 30% and 3 out of 18 as 16.67%, which they then summed to 46.67%, showing a lack of understanding of the problem and the method required.

Q25 It is clear that the majority of candidates at this level have been poorly prepared to answer questions competently on surveys and questionnaires. The expected answers to Part (a), which related to the lack of a time-frame and gaps in the response section, were mostly not provided and very rarely were both reasons given together. Candidates often showed no understanding of the question set and gave answers which were irrelevant or inappropriate. A minority of candidates failed to answer Part (a). Part (b) proved to be more accessible and about 30% of candidates realised that a sample size of 10 was too small and gained the available mark.

Q26 This question which tested fractions proved to be a very good differentiator of ability. A variety of approaches were shown by better candidates, from the expected method of finding one third of 150 minutes, followed by half of 50 minutes, leading to an answer of $\frac{25}{150} = \frac{1}{6}$, to the more succinct $\frac{1}{3} \# \frac{1}{2} = \frac{1}{6}$. Some candidates benefitted from the fact that the $2\frac{1}{2}$ hour time frame was irrelevant and that the correct answer could be produced if a different time period was chosen. However, the majority of candidates were awarded no marks, with many unclear how to start solving the problem.

Q27 Another question which tested student understanding of algebra proved to be too abstract for the vast majority of the cohort, with no marks awarded being the norm. Candidates who were successful either multiplied out the bracket to produce $5p - 15 = 20$, leading to $p = 7$, or thought in terms of $5 \times$ '?' $= 20$ and then resolved $p - 3 = 4$. A common incorrect approach saw candidates equate $5(p - 3) = 20$ to $5p = 23$

Q28 A challenging question in Part (a) which required using the circumference of a circle formula was answered well by only a couple of candidates. Most respondents answered 1500 by summing 250m six times and gained no marks. Generous marking in Part (b) allowed candidates to access 2 marks for correctly dividing 2000m by 14.5m/s to produce 137.93, though little understanding of what this actually meant was shown. Only a small minority of candidates were able to convert 137.93 seconds to 2 minutes and 18 seconds.

Assessment Unit M2 Foundation Tier

Unit Overview

In general candidates were able to attempt the vast majority of the questions, with no indication that they had insufficient time. The rounding of answers left a lot to be desired, with many candidates rounding unnecessarily or incorrectly in a number of questions. As is always the case, a number of candidates should clearly have been entered for a different unit. Some scored almost full marks, so should have been entered for M3, while others scored few or no marks, so should have been entered for M1.

Lack of equipment was evident for some candidates, mainly the lack of a protractor which prevented them from answering two questions on the paper.

The quality of written work was generally good, with clear methods shown in many cases. It would be helpful if centres could remind candidates to show their working in the spaces provided and write their final answer clearly on the answer line, rather than in the spaces below the questions and answer lines.

Q1 This question was meant to give candidates a straightforward start to the paper, but proved more difficult than expected. In Part (b), many did not seem to realise that 1.8C meant they had to multiply the 8 by 1.8 Some added, while some divided. The general lack of understanding of how to use the formula meant that few were able to obtain the correct answer in Part (c) either.

Q2 Many candidates were able to calculate the volume, although some lost a mark because they did not include units with their answer. Most who obtained an answer in Part (a) went on to divide by 120 in Part (b).

Q3 This was poorly answered and highlighted the general lack of understanding of rounding which was evident throughout the paper. In Part (a), the most common wrong answer was £11.160, while in Part (b), there was a consistent failure to change from pence to pounds. Parts (c) and (d) were much better with most making some attempt. One area of concern in Part (c) was the number of candidates who converted the fraction to a decimal and then rounded unnecessarily, meaning they couldn't get an accurate answer.

Q4 It seemed that many candidates failed to realise they needed to measure the angle. Many made a correct statement which seemed to be based on an estimate of the angle, rather than a specific measurement.

Q5 For questions such as Part (a), candidates should be taught that simply restating information given in the question cannot be used as an explanation. There were a number of alternative clear reasons given which were perfectly valid.

Q6 Parts (a) and (b) were generally well done, with only a small number mixing up the mean and range in this series. Part (c) was generally well attempted, although many didn't specify that the values had to be ordered, while some calculated the median incorrectly because they used the unordered values.

Q7 Most candidates were able to obtain the first one or two marks, but some appeared confused as to whether they were working with raw numbers or percentages, resulting in their final fractions having the wrong denominator. In some cases, candidates failed to give their answer as a fraction.

Q8 This was the more challenging version of this type of question, given that candidates had to start from the angle outside the triangle. Most started by taking the 108 from 180 to get 72, but often marked this 72 in the wrong place in the diagram. The right answer was obtainable by 'fluke' if candidates simply divided the 72 by 2, but this received no credit.

Q9 As with other questions on this paper, the rounding in Part (b)(ii) caused issues, with many candidates rounding to 1 decimal place rather than 1 significant figure. The answer 600.000 was also seen relatively often.

Q10 While Part (a) was reasonably well done, the fact that units needed to be changed caused issues in Part (b). For those who successfully converted the units and divided, some lost the final mark by rounding down rather than up.

Q11 Many candidates were able to correctly work out the angles and complete the table. Those who attempted to draw the pie chart generally did so accurately with few errors. There was evidence of a significant number of candidates attempting the question without a protractor.

Q12 In general, most candidates made a good attempt at this question, although many did not understand the concepts of double time and time and a half. There was some misinterpretation of the question, with a few candidates reading it that both people worked 6 hours on Saturday, 2 of which were at the overtime rate.

Q13 While many candidates were able to complete this successfully, some failed to record the given information correctly, meaning they were unable to calculate the missing values.

Q14 Most candidates set out their method clearly in this question, with many obtaining the correct answer. Some subtracted either the change or the cost of the gift box, but not both. It was disappointing that a significant number of candidates obtained a decimal answer and failed to realise this couldn't possibly be correct. The 'add on' method was seen a number of times, but should be discouraged as it takes a lot of time and effort for candidates.

Q15 This question was very poorly done, with few correct answers seen. Part (a) highlighted that many candidates are unfamiliar with correct algebraic notation, with answers such as $p2 + c3$ and $p \times 2 + c \times 3$ common. The correct answer for Part (c) was rarely seen.

Q16 Candidates should be encouraged to complete a 'rough' version first, which they then put into order, as this reduces the number of errors made by trying to order it as they go along. The most common loss of a mark was failure to include a key.

Q17 The starting point for this question was to realise that the fraction was $\frac{6}{28}$ and failure to do so meant no further marks were available. Many candidates rounded to 1 decimal place rather than 2, while some left their answer as a decimal rather than a percentage.

Q18 It was pleasing to see a number of other valid reasons coming from candidates, many of whom had a clear understanding of this topic. On the other hand, many referred to generic answers such as 'too personal' or 'none of her business', which had nothing to do with the question.

Q19 A significant obstacle for candidates in this question was inability to correctly convert the time to 150 minutes. Of those who got to the correct answer of 25 minutes, some forgot to write this as a fraction of the original time, resulting in a loss of the final mark.

Q20 There was little evidence of a correct method for this question, with many candidates appearing to solve it by trial and error, substituting in values for p until they found one that worked. In this case it didn't prevent them from getting the correct whole number answer, but would present problems if the answer was a decimal.

Q21 Part (a) was very poorly done, with the majority of candidates failing to recognise they needed to find the circumference. The formula for area appeared a few times. A number of candidates simply multiplied the 250 m by 4, ignoring the ends.

In Part (b) a pleasing number of candidates knew to divide the 2000 by 14.5 to obtain the decimal answer, but many were unable to convert this to minutes and seconds. 137 minutes and 93 seconds was a common answer, which candidates should know could not possibly be correct.

Q22 Many candidates used a simple interest method for this question rather than the correct compound method, resulting in an answer of £1840. The most common loss of a mark for those who used the correct method was giving £1852.2, rather than £1852.20, as their final answer.

Q23 A significant number of candidates either multiplied the 2, 3 and 5 to get 30, or expressed the 24 as a product of prime factors. These alternative approaches were both worth only the first mark. Those who used the simpler method of finding multiples of 30 and 24 generally got the right answer more often than those trying to use the prime factor decomposition followed by a Venn diagram.

Q24 This is one of the new topics for M2 which wasn't on the old T2 specification. It presented some challenges to candidates, particularly in Parts (b)(ii) and (b)(iii). Only a very small number of candidates were able to use the graph to calculate the cost per minute and a valid formula was rarely seen. A mark was available for starting the formula off with 'T = 20', but few candidates even got to that stage.

Q25 All relevant formulae for this question were either on the formula sheet or in the additional support materials, but nonetheless resulted in few correct answers. Some candidates thought the 34.2 was either the radius or the diameter of the circular face of the cylinder, showing no understanding of the units given. Many were able to calculate the volume, but then did not know what to do with it to find the mass.

Q26 Candidates have become increasingly confident with this type of question, with clear method and working clearly shown. The main issue was the rounding of the final answer. Candidates should be taught not to round to the nearest whole number in questions like this. Perhaps they are making the incorrect assumption that the word 'estimate' means they shouldn't leave their answer as a decimal.

Q27 This appeared to be a straightforward Pythagoras question, but was not done particularly well this series. In some cases, the furthest candidates got was to double the values given. Some candidates correctly used the theorem with the original values, so were still able to access 3 marks.

Assessment Unit M3 Higher Tier

Unit Overview

The performance by candidates on this paper was fairly average with most scores bunched in the middle band of 45% – 65%. Few candidates secured very high scores but likewise there were few very low scores; occasionally there was evidence that a candidate had been entered at a level beyond their ability. It was apparent that due to Covid effects, some centres had clearly chosen to omit some content; in particular there were Algebra and Data Handling topics that seemed completely alien to some candidates. At the outset of the paper there were enough straightforward questions to get candidates settled. From Question 6–14 there were more varied attempts and responses and from Question 15 onwards there was a greater challenge but still some very strong responses. Question 27 on the cumulative frequency and boxplot had the most disappointing outcome. 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 5) and in the questionnaire (Question 10) and in the estimate of the mean from the grouped frequency table (Question 21).

The responses to the multistep problem-solving questions showed greater success and it was clear that candidates are better prepared for approaching these. This was apparent in Question 1, Question 4, Question 8 and Question 21 where there were a variety of approaches used and varying levels of success but none of these questions were ever left unattempted, which is a promising development in the third Assessment Objective. Examiners felt that there was perhaps a decline in the amount of working being shown by candidates and with a wrong answer submitted, it was often difficult to award part marks.

There was a positive response to most Number questions and also Geometry and Measure was well approached. Algebra topics were not as well answered as in the past with marks being lost in algebraic processes being assessed in Question 9 – basic algebraic notation,

Question 14 – factorising, Question 20 – real-life contextual linear graph. Question 27 on Data Handling presented the most challenge to candidates on this paper.

Numeracy skills were tested directly and indirectly (through data, geometry or algebra) in Questions 1, 2, 3, 5, 6, 7, 8, 11, 13, 17, 18, 23 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. This was evident in Question 16, 18, 20, 22 and 24. Literacy and communication were a feature of Question 10 on the questionnaire and Question 24 on bounds. Whilst most were successful in their responses to Question 10, only the best were able to articulate their reasons clearly in Question 24.

There was evidence that candidates were able to complete the paper in the allocated time and any blank responses to Question 27 were a lack of understanding and knowledge as opposed to a lack of time.

Q1 The opening question allowed candidates the flexibility to approach using basic numerical calculations, fractions or percentages and was generally well answered. Occasionally the last mark of recording the answer as a fraction was overlooked. There were some who having calculated 30 birds, then misinterpreted the questions as 40% of the rest were mammals, rather than 40% of the original 120 animals.

Q2 Calculation of the angle at the apex of the isosceles triangle was accessible to most with many securing the full 3 marks. Sometimes having found the adjacent angle of 72°, recognition of where the two equal angles were within the triangle led to an incorrect conclusion of y = 54°

Q3 **(a)** No issues with the majority identifying the correct cube number

(b) **(i)** The correct answer given in most cases.

(ii) Only the very best were able to round correctly to 1 significant figure. Many candidates recorded to 1 decimal place or to the nearest whole number. For some who knew that there should only have been the initial 6, they then erred by recording as 600.000 rather than 600.

Q4 **(a)** Calculation of the perimeter was well answered, with a limited number calculating the area.

(b) The necessity to change units, either both to cm or to m and then to round up to a complete number of sections produced a mixed response. Many recognised one or other of the required steps but only the best carried out the two steps accurately to lead to 62 sections.

Q5 There was a really positive and improved response to the construction of the pie chart, with a large proportion of candidates securing all the available marks. There was evidence that some who were able to calculate the correct angles in the table had not come equipped with a protractor to measure and draw the angles. Only on a few scripts were the labels on the sectors missing.

Q6 This was the first question to challenge most students and produced a varied response. Many were able to deal with the concept but others struggled with the calculations for double time and in particular time and a half. Some candidates also misinterpreted the 6 hours normal time and 2 hours overtime as only 4 of the 6 hours at normal time. The requirements of the question meant most candidates accessed some marks but it differentiated well across different levels of ability.

Q7 Completing the two-way table was successful for nearly all with only a limited few not being able to place the values correctly. Some candidates omitted the final of 39 in the total row and column or in fact calculated two totals recording 78 in the position.

Q8 The problem-solving finance question was well answered with very many securing full marks. Some misinterpreted that each bun had an associated cost of a box but since this led to a non-integer number of buns they should have been alerted to their error.

Q9 In all Parts (a), (b) and (c) the recording of the algebraic expressions was not very well done. Some were successful in Part (a), only a limited number in Part (b) and a correct answer in Part (c) was very rare. Despite Part (c) asking for the answer in its simplest form, many simply wrote p – 3 + c + 4 and so lost the only available mark. For a generally standard algebraic notation question this was a disappointing response.

Q10 The responses to the survey question were perhaps better than usual, where candidates really did focus in on the context of the questionnaire. Most were able to give at least one correct reason as to why the question posed might have been confusing. In Part (b) the idea that the sample size was too small was acknowledged by most.

Q11 This problem-solving question involving fractions was a very good question for discriminating between candidates of varying abilities. If candidates approached it numerically, many got 2 marks for reaching 50 minutes and 25 minutes but failed to record their final answer as a fraction of the original 2½ hours. Some approached using fractions and again secured 2 marks for reaching the fractional values of $\frac{5}{6}$hr and $\frac{5}{12}$hr but could not relate these back to the fraction of the original time. Others who approached using decimals were awarded 1 mark for their efforts. It is still apparent that candidates with access to a calculator for "time" calculations often err in interpreting 2½ hours as 2 hours 30 minutes and input 2.3 into the calculator. The very best candidates saw the higher level approach of ignoring the original time and simply calculating $\frac{1}{2}$ of $\frac{1}{3}$ to give $\frac{1}{6}$ securing the full 3 marks.

Q12 Solving the equation with brackets was well answered. The usual errors of not expanding the 2nd term in the bracket or rearranging the numerical terms correctly often incurred a single mark penalty. Generally candidates accessed full or partial marks here.

Q13 In Part (a) only about half the candidates were able to deal with the two semicircular ends correctly; either as $\frac{\pi d}{2}$ and then doubled or understanding that combined there would be a full circumference using πd. There were many incorrect solutions of simply 6 × 250 = 1500m. In Part (b) there were a limited number of fully accurate solutions. Whilst the knowledge to calculate time was approached correctly using distance/speed, the technique for converting their answer into minutes and seconds was only mastered by the very best with few being able to deal with the decimal part of the calculation, interpreting it as a part of 100 rather than a part of 60.

Q14 Factorisation was either well known or not at all. In Part (a), some did not extract the highest factor of 4 whilst in Part (b) some struggled with how to deal with the first term of 1 in the bracket once the p had been extracted.

Q15 Finding the midpoint in Part (a) was generally well answered; however some tried to read from the graph and were inaccurate and did not seem to be familiar with the algebraic approach. Finding the equation of the straight line in Part (b) was only answered fully by the most able candidates. Some part marks were awarded for correct calculation of the gradient. There were very many blank responses to this question.

Q16 The fact that the formula for density had been provided in the additional resource booklet should have made this question more accessible. However, many struggled to deal with the volume calculation and seemed to have limited knowledge of treating the cylinder as a prism with the cross-sectional area already calculated for them. For those who did recognise this, full marks were secured easily. The greatest misinterpretation was thinking they needed to carry out an inverse calculation to find the radius, leading to a volume calculation for the cylinder but in doing so many went wrong.

Q17 The repeated proportional change question was well answered by most, but the requirement to record the money notation with the zero in the second decimal place was often overlooked. A significant number of candidates approached via a Simple Interest approach and depending on how they presented their work, occasionally a single mark for the first year calculation could be awarded but often no marks were achieved.

Q18 The novel way of assessing LCM gave a varied response. Many approached by breaking down the 24 into its prime factors but often then candidates calculated the HCF of the 2 numbers. Similarly, by an alternative approach, many identified 30 as the second value but again proceeded to calculate HCF. Many were successful when they listed the multiples of 24 and 30 and arrived at the correct solution of 120.

Q19 Expanding the double brackets was either well known or not at all. There were occasional errors in computing the last term with many adding –3 and + 5 to lead to a third term of 2 instead of multiplying to give –15.

Q20 The real-life context of the linear graph seemed unfamiliar to very many candidates. A complete and accurate solution to all 4 parts was rarely seen. Most candidates were able to access the marks in Part (a) and in Part (b)(i). Finding the charge per minute proved challenging with many ignoring the fixed charge and hence readings were just taken directly from the graph with no cognisance of the gradient being required. Unfortunately, some who did make valid comparisons then calculated them incorrectly, for example £10 for 400 minutes giving 40p rather than 2.5p. Only the very best were able to relate all parts to provide a valid formula in Part (b)(iii).

Q21 The grouped frequency table requesting the mean, modal class and median class produced a varied response. In Part (a), as a result of the two blank working columns, many embarked on the correct method of frequency x midpoint; however having completed this, many then deviated to incorrect calculations such as total frequency divided by 6 which did not even use their original tabulated calculations. Overall, the response to the mean from the grouped table was probably better answered than in previous years, possibly due to the advanced knowledge in the additional support materials. Identification of the modal class in Part (b) was well answered but identification of the class interval containing the median in Part (c) was not so well answered.

Q22 Despite the fact that this should have been a fairly routine Pythagoras question with the diagram already provided, many candidates simply worked with the speed and time concepts embedded in the question, producing figures of 44 km and 52 km and then not know what to do with them, many simply adding or subtracting these distances. For those who did then recognise the application of Pythagoras, full marks were often secured. There were others who omitted the speed and time aspect and simply worked Pythagoras with the given speeds, not giving consideration to the 2 hours, but this still allowed marks to be awarded.

Q23 The problem-solving question with reverse percentages integrated within was not well answered but did act as a very good discriminator question between candidates of varying abilities. At the outset, too many embarked on finding 36% of 45360 as these were the only numerical figures listed in the question. Then, there were those who were able to equate 64% = 45360 but then did not know how to proceed. For those who did execute the reverse percentage application correctly, the total of 25515 was generally reached. The final requirement to use ratio or fractions to determine the number of pearl bulbs was only answered by the very best.

Q24 Understanding of bounds to communicate a clear and articulate response to this question was limited to only the very best. Too many seemed to have ignored the first sentence outlining the accuracy to which the length and width had been measured, which was pivotal to the success of this question. There were a lot of random calculations trying to prove whose area was correct rather than focusing on whose was wrong. The best responses were those who went straight for the maximum and minimum possible areas using the limitations given and immediately recognised that Steve's answer lay outside of these. Others of a higher skill identified straight away in isolation that Steve had used 75 × 25 and hence had rounded the 30m to the nearest 10m rather than the nearest m.

Q25 The solution of the algebraic fractional equation was probably better answered than in some previous series. This was possibly due to the fact that many candidates worked with quarters and halves in decimal format and so there was greater success than if they had fractional values that were not easily converted to decimals. Most who approached in this manner arrived at a full and accurate solution. Where candidates approached by trying to eliminate the denominators by multiplying through by 4 or a greater multiple, too many forgot to apply that multiplier to the numerical –2. Then, there were candidates who totally ignored the –2 and so ignored the complexity of the question set.

Q26 Calculation of the volume of the cone was generally well done and very many got the two available marks. Familiarity with the formulae supplied at the front of the paper should have made this question accessible to all but clearly there were candidates who tried to remember the volume of a cone with no acknowledgement that it was provided. Some candidates misread the question and tried to deal with the cylinder too, despite the fact that the complete dimensions of the cylinder were not given.

Q27 Without a doubt, this question caused the most difficulty for candidates and in a large number of scripts there were multiple blanks to all parts of this question. There seemed to be a very small proportion of the candidature confident in what was needed to even set up the cumulative frequency column and where this was missed, most just abandoned the rest of the question, thus forfeiting 10% of the paper. The two blank columns in Part (a) seemed to lead many into thinking this was another calculation of the mean from a grouped table. Where there was success in Part (a) the cumulative frequencies in Part (b) were often plotted at the midpoint rather than at the upper bound. Whilst this incurred a penalty, these candidates were then able to attempt a response to the median and interquartile range in Part (c). However, success here was often limited with few managing to interpret the horizontal scale correctly or those who read the halfway and quarter way values from the horizontal up to the curve and then across. In Part (d), candidates who had made a decent attempt to this point often secured some marks for their comparisons with the boxplot. Others who had no success with cumulative frequency tried to relate the box plot values to the original data set and may have successfully gained a mark or two. In general, this part was not answered if earlier parts had not been accessed. It should also be noted that just quoting values is not a successful response and clear comparative statements with supporting statistical measures should be presented.

Assessment Unit M4 Higher Tier

Unit Overview

The performance of candidates in this paper ranged from excellent to poor. In the papers which the Principal Examiner marked, the marks ranged from 3 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 – it was unusual to see blank answer spaces. The questions that stretched the more able candidates were Questions 7, 12, 19, 20 and 21. There were also some reasoning questions on this paper and a lot of candidates struggled to use the correct terminology to explain their reasoning.

Several markers commented on the standard of handwriting for the reasoning questions with some answers being almost impossible to read. Issues with reading questions carefully were also evident throughout – for example Q1 gave the circular cross-sectional area as 34.2 cm^2 but several candidates used the radius/diameter as 34.2 cm.

Questions/topics which seemed to cause most problems in general were Question 4 (interpreting real life graphs), Question 7 (simplifying an algebraic expression containing a fraction), Question 9 (drawing and interpreting a cumulative frequency graph), Question 12 (finding an expression by expanding and subtracting quadratics), Question 17(a) (factorising using the difference of two squares with a decimal involved), Question 19 (finding the radius when given the volume of a frustum), Question 20 (trigonometry with algebra), Question 21 (solving an equation with algebraic numerators and denominators).

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 no issues with completing this paper on time or leaving too many questions blank or not attempted.

Q1 This question on finding the mass of a cylinder was answered very well in general. The majority of candidates knew to find the volume of the cylinder by multiplying the area of the cross section by the height and then finding the mass by multiplying density by volume. Follow through marks were awarded when a candidate misread the question and said the radius or diameter was 34.2cm. For follow through marks to be awarded candidates must have tried to find the volume using the values given for the height and area of the cross section.

Q2 In general, this question on increasing shares by a percentage was answered extremely well. Most candidates used the shortened compound interest version to correctly find the value after three years. There was a penalty in this question for incorrect money notation i.e. leaving the final answer as £1852.2 lost one mark. Some candidates used simple interest and they could only obtain a maximum of one mark if they showed the first year as £1680.

Q3 **(a)** The majority of candidates obtained full marks in this standard question on estimating the mean from a grouped frequency table. A small number of candidates used upper/lower boundaries instead of mid-points and were allowed follow through marks. Some candidates tried to use cumulative frequency and obtained 0 marks. Candidates should be encouraged to round their final answer to at least 2 decimal places in future. Rounding to the nearest whole number or writing the class interval after finding '44.57' obtained full marks but may not do so in future papers. Incorrect rounding was not penalised here but again it will be in future.

(b) Most candidates were able to correctly identify the modal class interval.

(c) Most candidates were able to identify the median class interval.

Q4 This question on interpreting a real life graph was not answered very well in general and this is probably a topic teachers did not spend a lot of time on due to Covid issues when getting courses completed.

(a) The vast majority of candidates were able to read off the answer from the y-axis for Tariff A. Some candidates read off where the two lines met i.e. £30

(b) This question on interpreting the gradient was not answered well in general. A lot of candidates tried to compare coordinates from the line such as 200 minutes = £25 Some candidates who did compare correctly and ended up with 0.025 did not convert to pence or rounded to 3p and both of these lost one mark.

(c) Only a few candidates were able to write a formula for the total cost T in terms of m correctly. Follow through marks were awarded based on their answer to (b).

Q5 This question on expanding a pair of linear brackets was answered very well by the vast majority of candidates. A follow through mark was awarded for a basic error in expanding their brackets incorrectly.

Q6 In this Pythagoras' Theorem question, the majority of candidates were able to obtain at least three marks. Candidates who used 22 & 26 in Pythagoras' Theorem correctly obtained 3 out of 4 marks. This was also the case for the small number of candidates who halved the given speeds or multiplied them by 120. Some pupils only obtained one mark for getting 44 km and 52 km but then added or subtracted these and did not attempt to use Pythagoras' Theorem. As in other series' no follow through marks were awarded when a candidate subtracted using Pythagoras' Theorem.

Q7 This question on simplifying an algebraic expression with a fraction was not answered well by most candidates with only a small number getting full marks. Candidates who changed the expression to a single fraction or split the fraction usually did not deal with the minus sign for the last term. Follow through marks were awarded for candidates who went on to simplify this correctly.

Q8 In this reverse percentages and ratio question, most indicated that 45360 was 64% and knew to try and find what value 100% was. Most candidates got the first 3 marks, but struggled with knowing what fraction of this they needed. Some candidates got zero marks due to thinking 45360 was the original total. There were three common approaches to this question. In the first approach, candidates answered it fully correctly, in the second case candidates got as far as finding 36% = 25515 then just divided by 4 to get an incorrect answer. In the final case candidates showed a lack of understanding by just finding 36% of 45360 thus gaining no marks for this question.

Q9 This question on plotting, interpreting and comparing a cumulative frequency graph with a box plot was answered quite well but not as well as in previous years.

(a) The time column given in the paper seems to have confused some candidates. Candidates who were unable to find the correct cumulative frequencies were unable to get any marks for Parts (b) and (c), but marks were given in Part (d) as they could have used the initial table to compare the results.

(b) The majority of candidates who got Part (a) correct went on to plot the points with the upper bounds. Some candidates plotted the cumulative frequencies with the mid points and were awarded 2/3 marks. Candidates should be encouraged to join points with a smooth curve or by using a ruler and ensure their curve/lines go through each point.

(c) The majority of candidates who had drawn a cumulative frequency graph correctly were able to read off the median from 90 and the quartiles from 45 and 135. Candidates are encouraged to draw in the lines to show their readings clearly. Full follow through marks were awarded for those candidates who used mid points in Part (b).

(d) The majority of candidates were able to compare medians and one measure of spread for 2 marks; however, only a minority of candidates were able to gain the third mark for comparing the maximum/minimum times for staff and students. Candidates who simply stated what each measure was did not receive marks – comparisons must be made in this reasoning question.

Q10 This question on solving a linear equation containing fractions was not answered well in general. Although this is a standard question, the initial line was laid out slightly different to normal and this meant only the stronger candidates obtained full marks. There were a variety of methods used to start this question. The most successful attempts were by candidates who started by multiplying through by 4 to eliminate fractions; however, this was only attempted by a minority of candidates.

The majority of candidates started by expanding the brackets and leaving either fractions or decimals and most candidates were able to obtain the first mark in doing this correctly. Common errors in this question were: forgetting to multiply the ' – 2'; multiplying the numbers inside the bracket as well as the fraction outside; errors with signs when collecting y values and numbers on each side of the equals sign.

Q11 **(a)** This question on finding the equation of a line was answered well by the majority of candidates. Candidates who drew the line on the graph provided and used rise over run to find the gradient also realised the y-intercept could be read off as +1 and gained full marks. Other candidates used the formula for finding the gradient and again the majority of candidates were able to do this correctly; however, some candidates were unable to deal with the negative signs correctly. The same candidates usually used substitution and the $y = mx + c$ formula to find c without realising it was obvious from the graph.

(b) The majority of candidates were able to find the perpendicular gradient and follow through marks were awarded from (a) and most candidates recognised that $c = -1$ from the given coordinate. Some candidates used substitution here again. A common error was omitting the 'x' when writing out the equation of the line.

Q12 The majority of candidates were able to start this algebraic question by squaring out the two quadratics correctly; however, only the more able candidates subtracted the expansions correctly. The majority of candidates who were able to do this ended up with either 2 or 3 marks as they never fully factorised the final expression using the difference of two squares. Some candidates tried to find the perimeter initially.

Q13 In this trigonometry question using an angle of depression, the majority of candidates used the incorrect angle as their starting point. The most common answer here was 48.96° which resulted in 3 out of 4 marks. Only the more able candidates obtained full marks in this question by using the correct angle. Some candidates used the sine rule as an alternative correct method. Some candidates tried to find the hypotenuse even though the question asked for the horizontal distance.

Q14 The vast majority of candidates were able to attempt this quadratic equation question and receive some marks; however, only a minority obtained the two correct solutions. The majority of candidates attempted this question using the alternative solution in the markscheme. Nonetheless many candidates never got their quadratic equal to zero and therefore could not solve it. Mistakes were made within the quadratic formula with $b = -4$ either at the start of the formula and not having two negatives making a positive or forgetting to use brackets on their calculator when squaring – 4.

Q15 **(a)** In this circle theorems question, the vast majority of candidates obtained the correct size of angle POQ and most of these candidates were able to give the fully correct reason. However, a lot of candidates are still not being explicit enough in their reasoning. Candidates should be aware that only the fully correct reasoning here will be awarded the mark and answers such as 'it is double PRQ' will not get this mark.

(b) In this more open reasoning question, only the more able candidates obtained full marks for correct reasoning and correct angles. Some candidates were able to calculate angle OQR as 28° but could not give reasons correctly.

Q16 **(a)** This standard question on drawing a histogram was answered well by the majority of candidates. Some candidates found the correct frequency densities but were unable to draw the histogram correctly. Only a small number of candidates plotted the frequency against the number of hours.

(b) This reasoning question on explaining why a stratified sample was the best method to use for the given data was not answered well in general. Answers such as 'it is more accurate' or 'it is a fair method' were very common wrong answers.

(c) This stratified sample question was good for differentiating the most able candidates as only a minority of candidates obtained full marks. The majority of candidates did not start by attempting to find the number of employees who worked more than 36 hours. A small number of candidates correctly found how many employees worked less than 36 hours and were awarded 2 marks for a misread.

Q17 (a) This question on factorising a quadratic using the difference of two squares was not answered well in general. The vast majority of candidates struggled to get the square root of 0.01 and therefore were unable to factorise correctly.

(b) In this factorising (using grouping) question, only the most able candidates obtained full marks. The majority of candidates missed the fact they needed to rearrange the order of the given terms before attempting to factorise. Some candidates were able to obtain the first mark on the mark scheme but did not factorise fully for the second mark.

Q18 The vast majority of candidates were able to obtain some marks in this percentages question. Most candidates could find the hourly rate of £6.50 and the 10% increase as £7.15 but a lot of candidates could not progress from here. A variety of correct methods were used in this question with full marks being obtained by a range of abilities.

Q19 This frustum question was the one that caused the most problems for the vast majority of candidates. Very few candidates were able to start this question using the two volumes of cones correctly. Only a very small minority of candidates obtained full marks in this question. The main error in starting this question was not squaring the '2' when attempting to write down the formula for the volume of the large cone. However, the main problem with this question was being able to tidy up the r^2 terms after correct or incorrect first lines. A lot of candidates just used one cone and let its volume equal to 16625.

Q20 (a) In this A* question involving trigonometry and algebra a lot of the more able candidates attempted to write sin p and sin r in algebraic terms but did not know what to do after that. But there were still some very good correct solutions given that this was a slightly different question than has been seen in the past. Most candidates did not understand what the question was asking and just tried to solve the quadratic.

(b) Most candidates who obtained full marks in Part (a) also obtained full marks here. Candidates were awarded marks for solving the quadratic correctly even if they did so in Part (a). Follow through marks were awarded for simple mistakes in solving the quadratic.

Q21 The vast majority of candidates started this question on solving an algebraic fractions equation by subbing in x = 3 initially and trying to obtain a single fraction using a common denominator. Only the most able candidates obtained full marks in this question. Common mistakes were made in expanding brackets in the numerator or when tidying up like terms mainly due to negative numbers being involved. Follow through marks were awarded for a simple error; however, when there was a major error such as not expanding the denominator (difference of two squares) correctly then no follow through marks were awarded.

Assessment Unit M5 Foundation Tier Non-Calculator

Unit Overview

This paper proved accessible to most candidates sitting it and nearly all candidates attempted all of the questions. There was no evidence to suggest that candidates ran out of time and it was pleasing to see detailed working out to solutions in many cases. As noted in previous series some candidates had no access to the equipment required for the examination, with a minority lacking a ruler and protractor. The standard of handwriting was poor on a number of scripts and some answers were almost illegible. Candidates still express difficulty providing appropriate written reasons, justifications and explanations in their answers and the questions testing percentage and probability at the end of the paper proved too challenging for most at this level. A number of candidates needlessly lost marks carelessly, once again highlighting the importance of checking work, rereading questions carefully and checking the sensibility of the answer.

Marks ranged from single figures scores out of 50 to marks in the high 40s.

Q1 This straightforward question on reading temperature scales was reasonably well answered. In Part (a) of the question, a significant majority of the candidates were able to correctly identify 25 as the temperature on the thermometer. Part (b) was also well answered with most candidates providing the correct answer of 35 for the temperature shown on the gauge. Part (c) was the poorest answered part of this question with about one third of candidates unable to provide the required reading of 76 from the gauge. Common incorrect responses included 68, 73 and 78.

Q2 It is pleasing to note that the majority of candidates attempted to estimate their answers in Parts (a) and (c) with only a tiny minority showing a lack of understanding of the methods required. Part (a) was generally well answered with many completely correct answers of 800 supported by appropriate method gaining both of the available marks. Some careless arithmetic led to answers of $20 \times 40 = 80$ which lost the accuracy mark. Alternative approaches, which were infrequently seen, included $20 \times 38 = 760$ and $19 \times 40 = 760$, both of which gained full marks. Only a small minority of responses saw candidates calculate 19×38 and thus lose both marks. An incorrect response seen several times was $20 + 40 = 60$. Part (b) proved to be a good early discriminator of ability with candidates required to realise that by rounding both values up in Part (a) their estimate would be an overestimate. Literacy skills at this level are in many cases weak and the quality of written response often reflected this. Part (c) was more challenging and fewer correct responses were seen to this estimation problem which required rounding and division. Better candidates were able to produce and solve $3200 \div 400$ (or $3000 \div 400$), though some confused their notation and wrote the divisions the wrong way around ($400 \div 3200$).

Q3 This question on likelihood was well answered by candidates across the ability range. Part (a) was correctly answered by the vast majority of respondents who identified Spinner A as providing the best opportunity of landing on grey. Part (b) also proved accessible to most candidates with many giving Spinner C as the spinner where the chance of landing on white was evens. Finally, Part (c) was also successfully answered by a majority of candidates with most correctly putting the spinners in order of their likelihood of landing on the white section.

Q4 Whilst the majority of candidates were unable to find the correct answer for the cheaper shop and by how much, most candidates did score at least some of the 5 available marks. Only better candidates were able to complete all steps accurately and the question proved to be a good differentiator of ability. For Vision NI many candidates were awarded 2 marks for correctly adding $12 \times 50 = 600$ and 120, to

produce £720. However, a number of candidates were unable to multiply 50 by 12 accurately and some were unable to add 120 to their '600' correctly. Sales 'r' Us proved to be more difficult for candidates sitting this paper to resolve and many were unable to find one quarter of 900 as 225. Those who did find 225 often were unable to accurately subtract it from 900 to produce £675. Only a small minority of candidates failed to show any understanding of the term 'deposit', with instances of 120 added to 50 and attempts to multiply 170 by 12 seen infrequently.

Q5 This was quite a well answered question by most, with the majority of candidates gaining at least one of the two available marks. The enlargement using a scale factor 3 was spotted by many but it was disappointing to see candidates unable to spell 'enlarged', with many instances of 'inlarged' seen. Others, failing to give the correct term, often answered incorrectly with 'increased'. A common incorrect scale factor given was 2 rather than 3.

Q6 Many fully correct answers were given to this question testing probability events from a dice roll. Some misinterpretation of what was expected was observed as a minority of candidates wrote numbers corresponding to the dice roll in the boxes rather than the letters referencing the three events, A, B and C. Others attempted to answer using fractions but were generally unsuccessful.

Q7 This question testing fractions and percentages in the context of earnings proved to be a good discriminator of ability. In Part (a) only better candidates earned all three marks for finding $\frac{2}{5}$ of 9 × 25 as £90. Many candidates gained 1 mark for calculating 9 × 25 = £225, though many more were unable to accurately multiply 25 by 9. If 225 was found, often candidates were unable to find 2/5 of it, with a commonly seen approach being to divide by 5 and provide an answer of £45, forgetting to multiply by 2. Others, who knew to divide by 5 and multiply by 2 were careless in their arithmetic and lost the available accuracy mark. Few candidates attempted to solve the problem by first finding $\frac{2}{5}$ of 25 hours as 10 hours and then multiplying this by £9 to produce the required answer. Part (b), similarly, was well answered only by better candidates. Some candidates misinterpreted the question and attempted to find 15% of Jon's weekly wage of £225 rather than 15% of £9, his hourly rate. Candidates producing the correct answer of £1.35 added this on to £9 and answered with £10.35 in some cases, losing one of the marks available. Others, who had a sense that they needed to multiply 15 by 0.09 were often unsuccessful in their attempts, and a common incorrect answer given was £135. Some success was seen by candidates finding 10% of £9 as 90p and then 5% as 45p and summing to £1.35

Q8 This straightforward scale drawing of a triangular field question was well answered by candidates with many gaining at least 2 of the available 3 marks. A few candidates, however, were disadvantaged by not having a ruler and protractor. A small minority of blank responses were seen and quite a few poorly attempted hand-drawn triangles were offered. Some candidates had difficulty using a protractor to construct the required 70°angle but most were successful in drawing 5 cm and 9 cm lines within tolerance.

Q9 A well answered combinations question with candidates across the ability range accessing both of the available marks in many cases. Some candidates listed all 12 possible starter and main course combinations while others knew to multiply the 3 starters by the 4 main courses to produce 12. Some candidates misunderstood the information presented and listed combinations that were not valid, such as listing 2 starters or 2 main courses instead of 1 starter and 1 main course. Some double counting was seen on a minority of scripts, once again highlighting the need for careful checking of work.

Q10 This question testing understanding of translation was a good discriminator of ability. Better candidates were able to translate the given triangle 7 right and 4 down and access the 2 available marks in Part (a). Some translations were poorly drawn freehand and the translated triangle's vertices were just within tolerance in a number of cases, although outside of tolerance in others. A small minority of candidates had 2 vertices correct and were awarded a mark, though checking of their answer would have shown that the translated triangle was not congruent to the given triangle. A generous mark was allowed for a triangle which was correctly translated either 7 right or 4 down. Part (b), describing the translation mapping B back to A, was very poorly answered with few correct responses seen. A few candidates lost the available mark for answering 7 across and 4 up, rather than 7 left and 4 up, but unfortunately as only 1 mark was available the knowledge demonstrated was insufficient for this award. Incorrect responses included 'negative', 'reflection' and 'transformation', while a significant minority of candidates left the answer space blank.

Q11 This estimation question proved to be more challenging than the earlier estimation questions and was a good differentiator of ability. The majority of candidates who demonstrated understanding of what was expected correctly rounded the values to 400, 10 and 50 and most then went on to correctly calculate $\frac{400}{50} \times 10$ as 80 A minority of candidates who rounded the values correctly answered with 800 or 8 and lost the accuracy mark. Those candidates who gained no marks often rounded inappropriately, including rounding 395 to 390 or 300, or rounding 53 to 100. Others attempted to answer the question using non-estimation approaches and were awarded no marks.

Q12 Part (a) of this distance-time graph question was reasonably well answered by candidates and the available 3 marks were fully awarded to 28% of the cohort. For those not providing completely accurate graphs 1 or 2 marks were often awarded for producing 1 or 2 correct stages. The quality of graphs drawn varied from neat and accurately ruled graphs to carelessly inaccurate hand–drawn graphs, often outside of tolerance. A minority of candidates were unprepared for this type of question and clearly had no understanding of the topic. Part b(i), calculating average speed, was only answered correctly by the strongest candidates with many others gaining a generous mark for identifying 5 and 20, mostly without km or minutes indicated. Common incorrect responses included 20 ÷ 5 = 4 km/hr (or 5 ÷ 20 = 4 km/hr) and 70 ÷ 10 = 7 km/hr, where candidates attempted to calculate the average speed for the complete journey. Part b(ii) was poorly answered, which is consistent with other questions at this level when mathematical reasoning is required. Candidates were generally unable to justify why Andrew's return home was the fastest part of his journey. Few candidates referenced the line steepness or attempted to compare average speeds. Those who were successful often compared times for the outward and return journey. A common incorrect response included 'he was faster on the way home as it was all downhill'.

Q13 Part (a) was a challenging non-calculator question on percentages at which few candidates at this level made much progress. Candidates demonstrated a variety of approaches to working out 45% of 1200 though few got as far as 12 × 45. A common, incorrect, approach adopted by many was to find 50% of 1200 as 600, 10% of 600 = 60, 5% of 600 = 30, 600 – 30 = 570. An incorrect answer of 550 was frequently seen. Part (b), expressing 240 as a percentage of 1200, was slightly better answered, with the correct response of 20% given by stronger candidates. Some candidates who realised 240 divided in to 1200 5 times were then unable to produce 20% as their answer.

Q14 The final question on this paper was another good differentiator of ability with stronger candidates gaining full marks in both parts. Generous application of the mark scheme allowed many candidates to pick up 1 or 2 marks for identifying correctly either the numerator or denominator of the correct probabilities. In Part (a) it was obvious that a minority of candidates were unable to either understand what was being asked or were unprepared for this type of probability question. Many incorrect answers were given that used probability terms such as 'likely', 'unlikely' or 'evens'. Part (b) was similarly poorly answered with a sizable proportion of candidates unable to figure out what was expected, with many providing answers giving likelihoods in words.

Assessment Unit M5 Foundation Tier Calculator

Unit Overview

This paper proved accessible to most candidates sitting it and nearly all candidates attempted all of the questions. There was no evidence to suggest that candidates ran out of time and it was pleasing to see detailed working out to solutions in many cases, though occasionally it was poorly structured and drawings were somewhat inaccurate and untidy. As noted in previous series some candidates had no access to the equipment required for the examination, with a minority lacking a calculator, ruler and protractor. The standard of handwriting was poor on a number of scripts and some answers were almost illegible. Candidates still express difficulty providing appropriate written reasons, justifications and coherent explanations in their answers. Many struggled with probability and especially recognising the fact some answers required calculated answers involving fractions. It was also noted that many candidates did not recognise square and cube number sequences. A lack of focus and attention to detail hindered some candidates.

The range of set questions was varied and tested all abilities and marks ranged from single figures scores out of 50 to marks in the high 40s.

Q1 Parts (a) and (c) of this question matching probability words to events were well answered by many candidates, who knew it is certain that the day before Friday is Thursday and that it is likely a doctor will see at least one child patient on any work day. Part (b), however, revealed a lack of calendar awareness by many. Answers of likely were frequently given for the chance of a birthday falling on 30 February.

Q2 Inaccuracy using a protractor led to many candidates losing marks in this question on compass directions. Only a small minority of candidates gained both of the available marks for correctly identifying Glasgow's position on the map. Others, who either had no protractor, or failed to recognise the need for its use, were hampered by an inability to deal with the directions North East and North West.

Q3 Part (a), writing down the square numbers between 20 and 70, allowed many candidates to pick up 2 marks for showing understanding of the square number sequence. Others earned one mark for providing 2 or 3 correct squares but just over half the candidates were unable to demonstrate any understanding of the knowledge being tested. Better candidates coped well with Part (b) and were awarded 2 marks for showing that $8 \times 15 + 1 = 121$, which is 11^2. A large proportion of the cohort failed to fully complete their answers, stopping when they found 121. This could be due to careless reading of the question or losing sight of what they were doing but rereading the question and checking work would have led to fewer candidates losing marks needlessly. A minority of candidates chose their own value, rather than '15', to work with, but unfortunately no marks were available for this approach.

Q4 In Part (a) most candidates scored either 1 or both of the available marks for reflecting the given shape in the mirror line. Many responses were hand-drawn and just within tolerance. In questions such as this, the expectation is that candidates should be using a ruler to draw straight lines. Part (b) proved much more challenging to candidates sitting this paper and was a good differentiator of ability. Most were unable to make any progress completing the shape so that it had rotational symmetry of order 4. Tracing paper would have assisted candidates but it seemed that a significant portion of the cohort had been inadequately prepared for this type of question.

Q5 The first part of this question on probability was very well answered, with most respondents identifying A on the scale as the best match for the probability of Benny taking a prawn sandwich. A minority of candidates answered '0', rather than A, but were allowed the mark. Part (b), however, was very poorly answered in general with the majority of the cohort unable to identify C as the best match for the probability of selecting a cheese sandwich. Even candidates who correctly showed in their workspace the probability as $\frac{4}{10}$, or its equivalent, often chose the incorrect letter on the probability scale, showing an inability to relate fractions to the given probability scale. A minority of candidates answered using words such as 'likely' or 'unlikely', once again highlighting the necessity to read questions carefully.

Q6 Parts (a) and (b) allowed candidates to show their understanding of the concept of best value and reasoning and was a good discriminator of ability. In Part (a) successful approaches compared like with like, for example comparing price per litre for each size of tin (or litres per £), scaling both sizes up to 60 litres or scaling the price for a 5 litre tin up to 12 litres. Better candidates gained all three available marks and it was pleasing to see the many candidates able to access at least 1 of the marks. A minority of candidates failed to compare like with like and made no progress, while others showed no understanding of the question and multiplied 12 by 29 and 5 by 12.25 Part (b) was well answered by candidates gaining full marks in Part (a), who mostly reasoned that a customer may not need 12 litres of paint and gained the available mark. However, many candidates were confused in their reasoning, and had either not read the question carefully enough or not understood what was being asked. A significant minority of candidates provided answers that contradicted their findings in Part (a). The final part of the question, Part (c), was well answered by many who were able to find how much a painter would earn for 9 hours' work if he or she earned £84 for 6 hours work. Some arithmetical errors were seen which unfortunately meant that no marks could be awarded for appropriate method as only 1 mark was available for a fully correct response.

Q7 This proved to be quite a challenging question for candidates sitting this paper. Many candidates failed to show understanding of the term 'inclusive', but generous application of the mark scheme allowed the award of 1 mark to a significant proportion of the cohort for identifying either the correct numerator or denominator. Again, a large number of candidates answered using words, rather than with the required fraction.

Q8 Both parts of this question proved to be good differentiators of ability with better candidates gaining all 4 available marks. In Part (a), candidates were provided with the 1 inch = 2.54 cm conversion and asked to covert 9.01 inches of rainfall to the nearest centimetre. Many candidates correctly multiplied 9.01 by 2.54 to produce 22.8854, but were unable to round their answer to 23 cm. Common incorrect answers given included 22.8, 22.9 and 20 cm. Other candidates rounded 9.01 to 9 and 2.54 to 2.5, which is not appropriate in this type of question. However, generous marking did not penalise this approach. A minority of candidates showed

no understanding of this unit conversion problem and calculated 9.01 ÷ 2.54 as 3.547 … which they then rounded to 4 cm. No marks could be awarded for this approach. In Part (b), candidates were asked to convert 5 kg into pounds and many better candidates had little problem producing the correct answer of 11. Others who knew the correct conversion in some cases lost a mark for inaccurate arithmetic, despite this being a calculator paper. One candidate wrote 2.2, 4.4, 6.6, 8.8, 10.10 and answered 10.10 pounds. It was disappointing to note that despite the conversion being given in the insert provided with the paper that many candidates either didn't look at the insert or missed it.

Q9 In Part (a), few candidates had issue completing the table of outcomes accurately and the award of 2 marks was common. Marks were lost carelessly on a small number of scripts that could easily have been regained through checking. A very small minority of candidates left incomplete tables, suggesting that they may not have been fully prepared for this type of question. In Part (b) many candidates identified the probability of getting a 5 as $\frac{2}{12}$, although as usual a sizable number of candidates answered using words such as 'unlikely'. Part (c) was well answered by a minority of candidates who earned the mark for identifying $\frac{3}{12}$ as the probability of Kendra getting a 'Tail' and an odd number. Again, a number of candidates answered using words.

Q10 Part (a) was a straightforward question on sequences for which most candidates were able to gain the available mark. Those who failed to answer with 'subtract 5 each time' or its equivalent either continued the sequence by inserting the next few values or noted that the pattern would continue to end in '6' or '1', neither of which were awarded a mark. Part (b) was much less successful and proved to be a good discriminator of ability. A minority of candidates were able to identify the next two cube numbers as 125 and 216. Most candidates seemed not to recognise the sequence and were unable to access either of the 2 available marks.

Q11 A challenging question at this level as many candidates sitting this paper either struggle with or are unfamiliar with ratio. However, the question proved to be a very good discriminator of ability. In Part (a), only a minority of better candidates were able to deal sensibly with the information given in the question and correct answers of 72 kg were few and far between. A common incorrect response was 12, where candidates simply divided the 36 kg of gravel by the 3 parts of gravel in the concrete mixture, not realising that there were a total of 6 parts and that they needed to multiply 12 by 6. Part (b) was slightly better answered with a minority of candidates gaining both of the available marks for dividing 198 kg of concrete by 6 to get 33, then multiplying 33 by the 2 parts sand to get 66 kg. Better candidates realised that as sand made up 2 parts out of the 6 in the concrete mixture all they needed to do was divide 198 by 3. It was pleasing to see a number of candidates also being awarded 1 mark for getting as far as 33 kg.

Q12 This currency conversion question was another good differentiator of ability with better candidates gaining all 3 of the available marks and about 40% of the cohort gaining at least 1 mark for demonstrating the appropriate method. Most candidates attempted to solve the problem by converting Phil and Gerry's euros into pounds sterling and then finding the difference between the amounts. A sizable proportion of candidates were unable to convert their currencies correctly and multiplied the euro amounts by 1.09 rather than dividing by it. A minority of candidates found the difference in the given euro amounts as 230 – 168 = 62 and converted this to £ by dividing by 1.09, often gaining full marks. Generous application of the mark scheme meant that many candidates were not penalised for early rounding, inconsistent rounding or truncation of their values.

Q13 Some correct responses to this 90° anticlockwise rotation about the origin problem were seen, but infrequently. Some of the hand-drawn triangles were just within tolerance and candidates should be encouraged to take more care over their drawings. Candidates who were unable to draw the correct rotation often gained 2 marks for a correct rotation about the wrong centre or 1 mark for the corresponding clockwise rotation about the origin. It was obvious that many candidates were attempting to answer this question without the aid of tracing paper.

Q14 This recipe scaling question was a good discriminator of ability with a minority of candidates awarded all 3 of the available marks for fully correct responses. Many candidates, however, were unable to get the problem started as they couldn't express 150 g of bacon as $\frac{3}{4}$ of 200 g of bacon. For those candidates whose method involved dividing the other ingredients by $\frac{4}{3}$, generous follow through marking was allowed for dividing by 1.3.

Q15 The final question on this paper was another good discriminator of ability. Candidates were given 4 of the interior angles of a pentagon and were asked to find the supplementary angle to the missing fifth angle. Many candidates gained a mark for summing the given angles to 479° but progressed no further as they were unable to produce 540°, the angle sum of a pentagon. Candidates commonly took 500° or 560° as the angle sum of a pentagon. For those going on to correctly find the final angle of the pentagon as 61°, most then subtracted this from 180° leading to the required answer of 119°. An alternative approach saw candidates summing the 4 exterior angles they could find to 241° and then subtracting this from 360° to produce the required answer. A minority of candidates split the pentagon into a quadrilateral and a triangle and attempted to solve the problem from this starting point, but were mostly unsuccessful in their attempts.

Assessment Unit M6 Foundation Tier Non-Calculator

Unit Overview

This paper tested a wide range of mathematical skills allowing weaker candidates to successfully demonstrate their abilities, while providing sufficient challenge for those more able. The better candidates responded positively with well-structured answers; the weaker candidates had errors in methods or inaccurate answers. Allowances were made for basic errors and follow through used when early errors produced unexpected answers. Most were able to communicate their thoughts and reasoning and the Principal Examiner felt that in general candidates who were well prepared were able to access all questions. The language used was accessible, though better reading of the question could have produced better marks. A lack of time was not really a consideration with almost all working through to the end of the paper and only weaker candidates not attempting the last few questions. Topics that were well answered included simple probability, number of combinations and the translation while those that proved most difficult were the reverse translation, binary decimal difference, loci, and the quadratic graph solutions.

Q1 This question provided a good start for almost all candidates and was well answered. Many had more difficulty with using the word 'enlarged' than identifying the correct scale factor of 3, with unacceptable answers here including reduced, expanded, multiplied, and made bigger.

Q2 Most candidates successfully calculated the correct probability and placed the correct letters in the boxes. A few wrote down the probabilities instead of the letters but were given the marks if they were the correct probabilities. A very small number used the same letter twice giving BAB or CAC as their responses.

Q3 This proved to be a challenging question and clearly identified those candidates with poor understanding of percentages and poor mental maths. There were issues in finding 9 x 25 correctly and then finding 2/5 of their answer. Those who tried to work through a percentage method encountered problems calculating 10% of the £9. They then struggled to work the 15%. A number also erred in trying to calculate

$225 \div (2 \times 5)$

Many struggled with this part, with some trying to find 15% of 225 or working incorrectly with the £9 as 9 x15 or 0.9 x15; those who had correctly written 9 x 0.15 or 0.09 x 15 often had problems multiplying the decimals.

Q4 Most pupils were able to gain at least 2 out of the 3 marks for this scale drawing with common errors being the lines or angle being outside tolerance. Certainly, the difficulty in using a protractor accurately was highlighted as well as the weaker pupils producing diagrams which weren't even triangles.

Q5 This question on working out the number of two course lunch combinations was well handled by the majority of pupils. Most chose to list the various combinations and count how many; a small number did the 3 x 4 calculation.

Q6 **(a)** **(i)** This translation was carried out very well by most with part marks being awarded for either a correct horizontal or vertical movement.

(ii) This part proved more difficult with common errors made including just repeating the translation given from A to B, trying to write the correct answer as a vector or attempting to come up with a completely different transformation.

(b) While a significant number gained the full two marks here for the correct reflection there were many who were given a single mark for a correct reflection in any vertical line to the right of shape A and a few who correctly reflected shape A in the line $y = 1$

Q7 This estimation question was generally well answered by most candidates although some had difficulty in dividing 4000 by 50 often writing 800 instead of 80. Full marks were also given for $\frac{3950}{50} = 79$ but nothing for the weaker attempts made to try all sorts of methods to multiply and divide by the numbers given.

Q8 **(a)** Every opportunity was given in this travel graph for candidates to score at least some marks with follow through on each of the different sections. Common mistakes made were to start at 09:10 rather than 09:15, not have the correct 20 min stopping time and finishing at 10:30 rather than 10:25.

(b) **(i)** The common wrong answer for this part was 4 km/hr from an incorrect calculation with 5 km and 20 min. Only the very best worked out 15 km/hr correctly and again a follow through from candidates' graphs was applied.

(ii) Quite a few picked up this last mark for their explanation even though they could not draw the graph as all the relevant information was given in the introduction.

Q9 **(a)** This question on percentages proved to be a good discriminator. The most common method used was to calculate 10% of 1200, multiply the answer by 4 and then add 5% of 1200. A surprising number who calculated 10% of 1200 to be 120 surprisingly could not calculate the 5% value.

(b) Many gained the first mark for setting up the required calculation of $240/1200 \times 100$ but then not being able to finish it. The best candidates spotted the follow through from Part (a) where they had already found 10% was 120 pupils hence the 240 pupils must be equivalent to 20%.

Q10 **(a)** This was attempted by most, but a considerable number lost at least 1 mark by not having the correct value of 11 sent messages and the correct total number of messages, 28. Both 'seen' picked up a mark but placed correctly in a fraction got the 2 available. It should be noted that candidates continue to write probability in terms of a ratio which is not acceptable.

(b) Similarly, this applied to Part (b); a correct value of 13 who sent 40 – 59 messages was to be selected at random from a correct total of 17 who sent less than 60 thus giving an answer of 13/17. Again, a mark was given for sight of each and both marks for them combined correctly in a fraction.

Q11 **(a)** There appeared to be two extremes in the answers for this question from those who got it all right, to those who had never heard of binary. A variety of acceptable answers were given a mark in this first part with the best highlighting the fact that a binary number only uses 1's and 0's.

(b) It was disappointed to see those who had the correct method unable to add up correctly the values of 32,16, 8, 4, 2 and 1 and then others who felt they needed to place a decimal point between the 6 and 3, thus losing the mark.

(c) There were quite a few who were able to set up the correct method to convert this decimal number but for whatever reason then reversed the line of 1's and 0's to give an incorrect answer.

Q12 **(a)** **(i)** 60% got this part correct with common wrong answers including w^6 or $2w^6$

(ii) 40% got this part correct with the most common wrong answer being y^3

(b) There have been more difficult nth term type questions asked in previous papers but only the better candidates attained the mark here. Many just gave as their answer the next term in the sequence 42.

Q13 This turned out to be the most difficult question on the paper despite not requiring construction lines. Only the very best scored 4 marks although quite a few picked up 3 marks for two 'sections' correct followed by correct shading.

Q14 **(a)** An easy mark was available here for plotting the 7 points in the table. There is no doubt that weaker candidates were thrown by the difficult language and didn't realise what they had to do. The second mark was for drawing a 'smooth curve' through these points but every effort was given to award a mark for a 'reasonable' attempt at this curve but not for one with a flat base.

(b) Candidates were expected to take a reading from their graph, and it was disappointing to see that even though they may have been looking in the right place, they were unable to use the scale correctly.

Assessment Unit M6 Foundation Tier Calculator

Unit Overview

This paper provided opportunity for candidates to be assessed on the breadth of the curriculum and many made a good attempt at answering most questions. It was successful in discriminating well between candidates of differing abilities and provided a good range of scores relative to ability. Many questions were consistent with examples that students would likely have been taught and prepared for during past paper practice. Although allowances were made in marking, in general terms, I felt that candidates performed well despite the disruption to teaching and learning over the last couple of years. It was noticeable however that weaker candidates had difficulty in those questions which required written communication.

The questions towards the end of the paper traditionally prove more difficult for the weaker candidates but with generous marking most candidates gained marks here. The topics producing the lowest scores included rotational symmetry, the cubic sequence, ratio and trial and improvement. Those which proved the most accessible were simple probability, proportional payment, table of outcomes and the sequence rule.

Q1 **(a)** Either excitement or trepidation at the beginning of the paper caused many to miss the opening statement 'Fifteen is a triangular number' and jump straight into what 'Martha says'. They then proceeded to make up their own number and use it rather than fifteen missing the reference to 'this triangular number' in the 'Show that' statement.

No marks could be awarded if this was the case and the lesson to be learned is to do the first question on any Mathematics paper twice, reading all the information in detail before attempting a solution. Having calculated $15 \times 8 + 1 = 121$ for 1 mark, the second mark needed them to state that $121 = 112$ or $\sqrt{121} = 11$ and many failed to address this part.

(b) Finding '45' was difficult for some.

Q2 This proved to be a much more challenging question than anticipated for most candidates. Many carried out reflections in the axes rather than any attempt at a rotation.

Q3 **(a)** This part was very well attempted and was positively marked by allowing the letter or the correct probability value of zero.

(b) Incorrect answers of D or E were common perhaps because of counting '4' letters across. This demonstrated poor understanding of both probability and the line scale. Again, numerical answers were accepted.

Q4 **(a)** This question discriminated well between candidates of differing abilities. Those with a good mathematical understanding were able to interpret how they should compare the 'tins' but the weaker candidates could not compare effectively. Either Tin A or 12L were acceptable answers as asked for in the question.

(b) Some candidates had difficulty in expressing a correct statement here, but again generous marking was applied for a sensible answer.

(c) The payment of £126 for 9 hours was very well answered by nearly all.

Q5 The common misconception was that there were 13 ponies (15 – 2) – perhaps some candidates found difficulty with the word 'inclusive', and 4 ponies with an age 'less than 5' – perhaps including 5 or counting the excluded age of 1.

Q6 **(a)** This calculation was well done by many, but weaker candidates forgot to round to the nearest cm when they had done their working out.

(b) Candidates were given that 1 kg = 2.2 lb and this was certainly some help to the majority who gained full marks.

Q7 **(a)** 94% achieved full marks in this completing the 'possible outcomes' table.

(b) This part was very well answered although there were a number who insist on writing probability as a ratio. This is not acceptable.

(c) Generally, well answered and positively marked to ignore incorrect simplification.

Q8 **(a)** The majority of candidates were able to identify that the sequence was decreasing by 5 though a few answered more generally how to continue a sequence or attempted to find an nth term.

(b) Many candidates struggled to recognise that they were dealing with cube numbers here and therefore could not complete the sequence.

Q9 **(a)** This part certainly allowed for differentiation between strong and weak students. Many just dividing the 36 by 3 to get 12. As this is only part of one acceptable method, no marks could be awarded until an attempt was made to multiply the 12 by 6.

A generous mark was given if weights of 12, 24 and 36 matched with the given ratio.

(b) This part was more accessible although a common mistake here was just to divide 99 by 2

Q10 This question posed a challenge for many with the most common mistake being to either multiply both values by 1.09 or employ a combination of multiply/divide in changing from Euros to Pounds. Candidates also benefited from a more relaxed marking of incorrect rounding or truncation.

Q11 The usual difficulty of not being able to rub out pen drawings caused problems when examiners were presented with two very different answers. I would encourage all candidates to use a pencil for any drawing work to avoid this problem. In this question 42% were successful in gaining full marks, and a generous mark was given for a correct 'clockwise' rotation.

Q12 There was a mixed response to this question with a lack of understanding of proportion leading to the most common mistake of just subtracting 50 from each ingredient.

Some used an alternative method of dividing by $\frac{4}{3}$ but quite a few rounded this to 1.3 giving a decimal solution. Again, these candidates received generous marks despite incorrect rounding or truncation.

Q13 There are many acceptable ways of doing this question with marks awarded at each level for attaining 540 or 479, 61 and 119.

A number of candidates failed to use the angle sum of this pentagon correctly as 540.

Q14 Only 13% managed to get full marks for this question but quite a number did get at least some marks. Many did not use a 'test value' to decide if their answer was 3.5 or 3.6 Some of those who did work with a test value did not give it accurately and could not be awarded this mark; a common error was to record 34 rather than the 34.088 which is needed. Lots of common mistakes included not substituting the values for x correctly into the equation and therefore not getting the correct values out. Weaker candidates left this question blank.

Q15 **(a)** **(i)** Understanding of the words 'relative frequency' caused a problem for some, with a common incorrect answer of 12 or 21 often being given.

(ii) Answers were quite often changed into decimals or percentages which was acceptable but not required. Ratios again were not acceptable.

(b) **(i)** Weaker candidates find difficulty when asked to find a probability in not knowing when to use 'probability words' or numerical – at this level no marks are given for 'wordy' type answers.

(ii) Positive marking allowed for 120 out of 300 or $\frac{120}{300}$ clearly seen as an answer but not simplified. This allowed many weaker candidates to gain a mark in their final question but a fairly rare occurrence.

Assessment Unit M7 Higher Tier Non-Calculator

Unit Overview

This was an accessible paper for most candidates. Questions were well attempted and in many cases clear working out was seen which meant candidates could gain some of the available marks.

Q1 Generally answered well and on the whole accuracy was good. Some errors with the accuracy of the angle.

Q2 Answered very well. Most candidates answered using 3 × 4 leading to 12. Very few wrote out the actual combinations.

Q3 **(a)** **(i)** The translation was done very well.

(ii) Not answered well.

Errors arose when candidates attempted to give the answer as a vector with some writing a fraction and even coordinates.

Writing the translation in words got the mark; candidates did not need to use the vector, though if they did it correctly, they also got the mark.

(b) The most common mistake was doing a reflection in the y axis rather than in the line $x = 1$

A few reflected in the line $y = 1$

Q4 Generally well done.

Most candidates knew to start by rounding.

Some made a mistake at the stage 4000/50 with the answer of 800 given. A significant number rounded to 395 × $\frac{10}{50}$ which was accepted.

A few attempted the question without rounding.

Q5 **(a)** Generally very well answered.

(b) **(i)** Most candidates were able to read off 5 km in 20 mins for 1 mark but then tried to divide these two numbers, leading to answers of 4 or 0.25

Perhaps candidates should not try to use speed = $\frac{\text{distance}}{\text{time}}$ and multiply by 3 instead when the time is 20 minutes.

Not many were able to gain the 2 marks for calculating the correct speed.

(ii) A wide range of answers given here – correct answers often included completing the same distance in a shorter time or the slope of the line being steeper.
Some candidates correctly worked out the first speed as 10 km/hr
Incorrect answers often tried to compare their incorrectly calculated speed in Part (b)(i) to the speed they calculated for the journey to school.

Q6 Both parts were generally answered well.

(a) Most used $\frac{45}{100}$ × 1200 leading to 45 × 12

Some calculated 10% and did working out from this to get to 45%. Most who went wrong did so when multiplying.

(b) A few used fractions and cancelled but didn't go on to multiply by 100

Some recognised that 120 was 10% so 240 was 20%.

Q7 **(a)** Well answered.

(b) Was nearly as well answered as Part (a). A common incorrect answer was

Some probability words such as unlikely were given and some use of ratio which candidates should avoid.

Q8 **(a)** Most correct answers mentioned the use of 0 and 1 for Binary.
Most incorrect answers made reference to no decimal points or doubling.
Many candidates were able to work out Parts (b) and (c) but not all.
In Part (c) the correct answer was 1010111. Sometimes the answer 1110101 was given.

Q9 **(a)** The common incorrect answers were Part (i) w^6 Part (ii) y^3 but generally well done.

(b) Common incorrect answers included finding the next term 42 or writing n +7.

A significant number of correct answers were given as $7n$ +/– 0

(c) Candidates seemed to find this part challenging.

(i) A few gave this answer as $1/5^2$ Other common incorrect answers included 25 and 3

(ii) Incorrect answers here included 11 and 7^5

Q10 **(a)** Generally points plotted well for 1 mark.

Some evidence of a few candidates attempting to calculate the points for themselves.

When drawing the curve, there were quite a few with flat bottoms but most did attempt to draw a curve rather than using a ruler.

(b) A lot of candidates only gave 1 solution here – more often the 3.6 reading from their graph.

Quite a few who gave 2 readings forgot to include the negative sign and wrote 0.6 instead of – 0.6.

Not many candidates got the 2 marks.

Q11 Candidates found this question challenging. Few got the correct answer of $\sqrt{30}$

A lot failed to use the formula sheet and didn't know the formula for the volume of the cone.

Quite a few substituted in 3.14 for π.

Of those who did get the first mark the majority were not able to progress further.

Q12 Of those candidates who attempted this question, nearer to DA than DC seemed to be least understood.

The arc of 4cm using the centre A was usually gained.

Very few got all 4 marks.

Q13 Many candidates did not gain any marks but of those who did get 1 mark they had either written out the numbers in ordinary form or left their answer as 0.9 x 1010

Q14 Candidates found this question challenging.

Very few correct answers.

Most who gained any marks were able to get to $p(r - q) = q$

$p \times r - q = q$ was seen too many times with candidates failing to include the brackets.

Assessment Unit M7 Higher Tier Calculator

Unit Overview

This was an accessible paper for most candidates. Questions were well attempted and in many cases clear working out was seen which meant candidates could gain some of the available marks.

Q1 Generally done well.

Some candidates did not round the final answer, and some rounded the numbers to whole numbers before doing the calculation. A small number divided instead of multiplying.

Q2 **(a)** Very well done given that the table was supplied and two were already filled in.

(b) & (c) Well done, Part (b) much better than Part (c).

A very small number of candidates gave the answers out of 10 rather than 12 as they didn't count the 2 that were already in the table.

Some candidates are still using ratio which they should not do.

Q3 Some candidates recognised cube numbers. Many tried to look at differences as they did not recognise that they were the cube numbers.

Q4 Some candidates did not seem to realise that concrete and cement are two different things. Many appeared to misread the question and worked with 36 kg of concrete.

Part (b) was slightly better answered than Part (a). Candidates seem to have a better idea of sharing in a ratio. Some only acquired the first mark.

At times 198 was divided by 5 instead of 6.

Q5 Generally well answered.

Some candidates multiplied by 1.09 instead of dividing.

Most used the second method in the mark scheme, rather than the first.

A few candidates multiplied one of the amounts by 1.09 and divided the other amount by 1.09

Q6 There were many different correct approaches to this question.

Some compared the cost of 1 g or 10 g or 100 g, but there were some using 5 g or 49500 g. Some just simply worked out the difference in grams between the two jars alongside the difference in the price, thus getting no marks.

Some worked out 275 divided by 8.80 to get 31.25 Some correctly knew that this was grams per £1 but some thought this was 31.25 pence.

Q7 Generally done very well but a few candidates were dividing by 1.3 for inaccurate answers.

Q8 Generally done well.

Some candidates seemed not to know how to find the sum of interior angles. Those who clearly understood polygons found this a very easy angles question.

Q9 Quite well attempted but not many getting all 4 marks. Mistakes were generally not testing 3.55 when they got to the answer is between x = 3.5 and x = 3.6 or choosing 3.6 as the answer. Some tried x = 3.55, but then assumed it was the answer as it gave an answer just above 34. A few candidates used the wrong formula or left it blank.

Q10 **(a)** Some misunderstanding of relative frequency, not knowing that it should be given as a fraction. For example 12 was given as the answer.

(b) The relative frequency was very poorly answered but then the reason part was better attempted.

(c) This part was better attempted but some fractions of $\frac{120}{300}$ given in Part (ii) and also some simplified forms of it.

Q11 65π was a popular answer with the base not calculated.

Some worked out the answer of 282.7 and did not leave their answer in terms of π.

Some used the wrong formula and volume was worked out at times.

Q12 The line $y = 5$ was usually seen.

The line $2y - x = 4$ caused the most difficulty.

Some candidates shaded but then did not include R so it was difficult to know what their region was.

Not many candidates got full marks.

There was follow through in Part (b) but again not many candidates were getting the marks.

Q13 Poorly attempted with a range of wrong answers. 2 was popular as a wrong answer as there were 2 ways to get £10.

Q14 **(a)** Very poorly attempted. The first reflection was often not shown.

Candidates could have gained 2 marks if they had shown the first reflection.

(b) Very poorly done, perhaps due to getting Part (a) incorrect.

Some candidates were attempting to answer this with more than one transformation.

Assessment Unit M8 Higher Tier Non-Calculator

Unit Overview

This proved a fair paper which tested a good range of topics across the specification. It contained questions for candidates of differing abilities to answer, performing to the best of their ability. The short questions at the start were a good introduction to the paper and the progressively more challenging questions allowed the stronger candidates to respond positively. Lack of algebraic/numerical skills prevented some candidates from achieving better marks, but overall performance was good and to a solid standard.

Q1 The vast majority made a good start with the correct reflection of the triangle, although a minority used the wrong line for reflection.

Q2 Three quarters of the candidates gave a good description of the difference between binary and decimal number systems, but the remainder struggled to express the difference clearly. A greater number of candidates were able to transform from binary to decimal and vice-versa.

Q3 Nearly all entrants were able to simplify the algebraic indices correctly and eighty percent recognised the sequence as $7n$. Over sixty percent could evaluate 5^{-2} and nearly seventy percent could evaluate $1^5 + 6^0$

Q4 Nearly all candidates plotted the points correctly for the graph, but about a fifth of them lost a mark for either drawing a poor graph or more frequently not including a proper minimum between the two lowest points plotted for the quadratic. About two thirds of the candidates used the graph accurately to find the values of x for which $y = 3$. The others missed a negative sign or the negative value altogether or read the graph with insufficient accuracy.

Q5 Most candidates were able to draw the required arc and also the perpendicular bisector of AB and gain a third mark by shading the correct side of each. Only the strongest responses also included the angle bisector of DA and DC for the final mark.

Q6 It was disappointing that over a third of the entry did not even gain the first mark available for substituting the given values in the formula which itself was included on the formula sheet within the paper. Many gained this mark and the next for some simplification but only the strongest candidates reached the answer in surd form to gain the full three marks.

Q7 This proved quite a discriminator of a question with about a third unable to gain any marks for using standard form, the remainder arriving at partially correct answers such as $\frac{45000000}{0.005}$ or 0.9 × 1010 and nearly thirty percent reaching the final correct answer.

Q8 Similarly for the rearrangement of the formula, just over sixty percent gained the first mark for getting as far as the cross-multiplication to $p(r - q) = q$, while only about a sixth completed the expression of q as the subject. Algebraic manipulation proved a stumbling block for many.

Q9 This proved the most challenging question on the paper with only a few candidates recognizing that x would have the lowest value and only about one sixth realising that x^{-3} would have the biggest.

Q10 Many did not realise what was being asked for in this question. While more than half the candidates attempted to rationalise the denominator or set up an equation, only a sixth manipulated the surds successfully to reach the correct answer.

Q11 The majority of the entry incorrectly used the factor $\frac{1}{10}$ for the volume, but the remainder generally used $\frac{1}{1000}$ and mostly completed the calculation correctly.

Q12 This standard question on recurring decimals split the entry into three groups, those who didn't quite know what to multiply by, those who did but made a numerical error or could not simplify the fraction completely and those gaining full marks.

Q13 Most accessed some marks in deciding which circumferences and which areas were rational for the given radii, whether by guessing or calculating with the given values. It is likely that the marks gained were consistent with the level of understanding of the candidates.

Q14 This testing A* question on the space diagonal proved unsurprisingly too much for many candidates. Only the stronger showed clearly how to use the three sides to find the space diagonal and only the strongest then fully completed the calculations with the surd expressions.

Q15 The final question proved more straightforward with over half the candidates able to calculate the first required probability. Most were able to continue with the second, although some arithmetical errors appeared. The challenging finale was correctly answered by nearly a fifth of the entry, mostly using the trial and improvement method implied by the wording of the question, although some very impressive methods of solving quadratic inequalities were also seen.

Assessment Unit M8 Higher Tier Calculator

Unit Overview

Hopefully candidates will have left with a positive feeling at the end of the examination as most could make a reasonably good attempt at all questions, all being accessible while some more challenging were aimed at the most able. There were only a few cases where the level of entry was clearly not appropriate. A wide range of topics were tested and applicable methods were demonstrated well.

Q1 Very few candidates scored no marks for this standard trial and improvement question. Almost half scored the full four marks. One mark was often lost for incorrect use of checking mid-value at 3.55, either by lack of its use or incorrect deduction from its use.

Q2 This relative frequency question was generally very well answered. The commonest error was confusion about using 100 or 150 in Part (b).

Q3 More than half the candidates gained both marks for this question. Surprisingly many just used the given formula for the curved surface area to gain only one mark.

Q4 This question discriminated well, with most candidates gaining a mark for at least one line with shading and nearly half gaining full marks for three lines and correct shading. The majority of these also gained the two marks for calculation of the maximum value in the region.

Q5 Over sixty percent of the entry answered this combinations question correctly and a small number gained one mark for partial solutions.

Q6 Nearly sixty percent of the candidates gained four marks for the correct combination of transformations, but over thirty percent scored no marks. Two marks would have been available had the first transformation been drawn as part of the answer. Over half of those with the correct answer to Part (a) were then able to describe the reflection in $y = -x$

Q7 Nearly three quarters of the candidates completed the tree diagram correctly and then used it to find the probability of the two coins having the same value as each other. Just over half could also calculate the probability that at least 30p had been taken, but many omitted one of the three possible combinations giving this total.

Q8 The graph was very well drawn by most candidates with occasional careless plotting of points or drawing the curve. The reading from the graph was similarly generally very well executed.

Q9 The first part of this question again differentiated the candidates into three similarly sized groups, those who simplified the cubed expression correctly, those who got two of the three terms correct and those with two or more wrong. Only the better candidates could deal with the simplification involving fractional indices in part (b).

Q10 This A* trigonometry question discriminated as intended. An encouraging ten percent gained the full seven marks. The majority of candidates calculated an angle using tan or a side using Pythagoras, which was often then used with the cosine rule, to gain some marks, but many opted to use the cosine rule before calculating sufficient correct values for the triangle involved and gained no marks.

Q11 More than half the candidates finished the paper well by correctly matching the statements to the type of proportionality and a majority of these also recognised which type matched the given sketch graph.

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