GCSE

Rewarding Learning

Chief Examiner's Report

Mathematics

January Series 2020

Foreword

This booklet outlines the performance of candidates in all aspects of this specification for the January 2020 series.

CCEA hopes that the Chief Examiner's and/or Principal Moderator's report(s) 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 section on our website at www.ccea.org.uk.

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GCSE MATHEMATICS

Chief Examiner's Report

Subject Overview

This was the first time that this new specification was examined as a Spring series in its entirety and therefore the first Spring award based upon it. Although the modules M1, M2, M3 and M4 had been examined three times previously, the completion papers for M5, M6, M7 and M8 were taken for just the second time.

The performance of candidates in general suggests both that candidates had been well prepared for this specification and that the set of papers had been set at an appropriate level to allow candidates to demonstrate their knowledge, skills and understanding at the level for which they had been entered.

On the whole, familiarity with the style of the module papers for M1 to M4 meant that most candidates seemed ready to tackle questions on the full range of specification content, including topics subsumed from papers aimed at a set of lower grades. On average overall performance on these four papers showed a similar standard to the summer suites of M1 to M4 in 2019.

As might be expected on the second sitting of the new suite M5, M6, M7 and M8 (each comprising non-calculator and calculator papers), with the influx of topics previously examined in the modular rather than the terminal papers and other topics entirely new to the specification, the papers proved slightly more challenging than the now familiar M1, M2, M3 and M4. Nonetheless it was encouraging to see candidates attempt all the questions posed and the quality of response from many was of an extremely high standard. Overall the standard seemed comparable to that of the summer series.

More detailed comment on each of the module papers is provided below.

Assessment Unit M1 Foundation Tier

Unit Overview

This was quite an accessible paper for most candidates and marks as high as 87 were awarded, with the mean mark around 45%. Questions became progressively more challenging throughout the paper with the first few questions addressing grade G material through to grade D material at the end of the paper. The majority of candidates attempted most questions and picked up marks for showing understanding across a range of topics, either for correct answers or appropriate method being shown and used. Weaker candidates struggled with the more abstract parts of the paper, such as drawing a linear graph, working backwards from a given volume to find a depth, finding the area of a circle and using this in a functional way, comparing perimeters of simple shapes using algebra and working with averages from a frequency table in a real world context. Questions which were successfully answered by the majority of the cohort included substituting values into a worded formula to find the hire cost of a bouncy castle, finding the number of hours a visitor centre was open, calculating the difference between numbers in the hundred thousands, identifying a hexagonal prism, identifying camera models from a table, calculating ticket prices from a table and savings if a family ticket is purchased, finding change as a number of coins, changing fractions into percentages for comparison of examination results, working backwards from a total to find the cost of a burger and interpreting dual bar charts. It was pleasing to see so many correctly drawn and labelled pie charts and most candidates were awarded at least 2 of the 6 marks available for finding the profit from selling candles on

a market stall, despite this being Question 25 of 27. There was evidence, as in previous examination series, that some candidates did not have access to the required equipment, namely calculator, ruler and protractor.

Comments on individual questions follow.

Q1 A minority of candidates were awarded the full 5 marks for completing the given statements with the correct number. Common incorrect responses included packets of crisps weighing 6 g, Tom walking at anything other than 6 km/h and cans of cola having a capacity of 25 ml. The best answered part of the question was (e) where candidates mostly responded with the cruise ship weighing 40,000 tonnes.

Q2 Although many candidates gained the full 2 marks in Part (a) for finding the cost of 2.5 kg of potatoes it was disappointing to see a sizable number who were unable to use a calculator to find 2.5 × 1.5 A common incorrect response was £3.50 which came from 2 × 1.5 + 0.5 Part (b) was well answered by most who either divided £10 by £1.20 and correctly answered 8 tins of tuna or added £1.20 repeatedly as far as £9.60 to reach the same conclusion. Others lost 1 of the available marks if they were careless in their totalling of their £1.20s or wrote 9.60 on the answer line. The most common incorrect method seen was 10 × 1.20 = 12 tins.

Q3 Both parts of this question on the cost of hiring a bouncy castle were well answered with most candidates having no problem substituting 7 days and the £20 delivery charge into the given formula in words in Part (a). Some candidates did however fail to appreciate the order of precedence and added 20 and 55 before multiplying by 7, resulting in an answer of £525 which gained no credit. Finding the delivery charge in Part (b) was more challenging but successfully answered by many candidates. A common incorrect method seen was 200 + 165 = £365 rather than 200 – 165 = £35.

Q4 This was a successful question and many candidates correctly answered all 3 parts. In Part (a) the correct answer of 10 for the number of hours between 9 am and 7 pm was seen in the majority of scripts. The most common incorrect response was 11 hours where presumably candidates counted 9 am as the first hour rather than 10 am. Part (b) was correct in most cases although many candidates chose to set 666,000 – 589,000 out as a sum and subtract using a non-calculator method. The stone column in Part (c) was mostly identified correctly as a hexagonal prism. The most common incorrect response was cylinder and a few candidates answered pentagonal prism.

Q5 This was another very accessible question and few candidates had problems identifying the cameras in the table from the given criteria. Marks were lost however when candidates were careless and simply wrote, for example, Nika rather than Nika N500. As there were two models for each camera brand, candidates needed to be specific in their answers.

Q6 This mileage chart question was straightforward, but many candidates still struggle to understand how to read the information correctly. The most common incorrect response in Part (a) for the distance between Coleraine and Ballymena was 8 miles, presumably coming from 26 – 18, the values recorded beside Ballymena and Coleraine in the first column next to the town names. Candidates who were competent in their understanding of using mileage charts in this form had no problem in Part (b) though some candidates answered Larne and Stranraer, rather than Larne and Strabane for obvious reasons.

Q7 A well answered question on ticket prices across all three parts. In Part (a) the majority of responses gave the correct answer of £23. In Part (b) there were a small number of candidates awarded 1 mark for working with either 2 adults and 2 children or 1 adult and 3 children, highlighting the importance of reading questions and information carefully. Some arithmetical errors were seen, mostly when candidates chose not to use a calculator to total their ticket costs and take away the price of a family ticket. Part (c) was very well answered and the majority of the cohort were awarded the available mark. Candidates should be reminded to include correct units with their answers, in this case 20p, 10p and 5p.

Q8 This pie chart question showing the proportion of UK households owning dogs proved to be a good differentiator of ability with better candidates gaining all 4 marks while less able candidates generally picked up at least 1 mark. The correct answer of 25% in Part (a) was seen in the majority of scripts though a small number of candidates answered 90, presumably from the number of degrees in a right angle. Part (b) was well answered by many and the expected answer of $\frac{1}{3}$ was seen often. A range of answers was acceptable and where the mark was not awarded candidates generally gave answers as percentages or in some cases decimals. A small number of candidates gave inappropriate answers such as $\frac{0.4}{1.3}$ or $\frac{1\frac{1}{2}}{4}$ and should be reminded that fractions should have whole number numerators and denominators. Part (c) was less successful with many candidates unable to find $\frac{3}{8}$ of 800,000. Most candidates realised in Part (d) that Rebecca's statement that England has most households owning dogs, as it has far more households, was correct, showing good understanding of the information and the way in which it was presented.

Q9 This question proved to be a good differentiator of ability. In Part (a) most candidates were able to change $\frac{13}{20}$ into 65% but only better candidates were able to access all 3 of the available marks in Part (b) for ordering the examination results correctly. Those who were most successful changed the scores in each subject into percentages or decimals for comparison. The most common error for those working with percentages was to convert $\frac{7}{10}$ incorrectly as 7%. A small number of candidates attempted to change the scores into fractions for comparison but were unable to find a common denominator. Weaker candidates simply found how many marks were lost in each subject and ranked according to this criterion.

Q10 A minority of candidates were able to identify the value of the digit 4 in 3.04 correctly in Part (a) showing lack of understanding of the place value of a decimal number. Many appeared to simply ignore the decimal point and treat the number as 304. Part (b) was poorly answered by candidates sitting this paper. 3.1 was frequently given as the smallest number and others who identified 3.024 as the smallest often placed the remaining numbers in an incorrect order. Candidates who placed the decimals under each other with the decimal points lined up were usually correct in their answer.

Q11 This question proved very accessible to candidates at this level with full marks being the norm. Some arithmetical errors were seen and led to the loss of at least 1 of the 2 available marks. A common answer was £3.5, which is the calculator output when dividing 14 by 4. Candidates should be encouraged to consider their answers in context and use correct money notation.

Q12 Many candidates were able to accurately measure the length of the line as 8.5 cm and provide the required answer in millimetres in Part (a). It was evident that some candidates had no ruler and simply guessed the length of the line. Others were

unable to convert their measure from centimetres into millimetres and multiplied by 100 or 1,000 or divided by 10, 100 or 1,000. Candidates were allowed 1 mark for correctly multiplying their incorrect length by 10 which benefited those who measured the wrong line. In Part (b), many candidates either had no protractor or were unable to use it proficiently. Incorrect answers were often a few degrees outside of tolerance and with greater care the mark may have been awarded. Some candidates misinterpreted which angle CDA referred to and lost the mark for measuring the angles at C or A.

Q13 This question on inequality signs and metric units rewarded those with a good knowledge of metric conversion and many candidates scored at least 3 of the 4 available marks. Others appeared to randomly insert inequalities and in a minority of cases it was clear that candidates mixed up the greater than and less than signs after showing which measure was larger in their method. A misinterpretation of what was being asked led to a small number of candidates assuming that they only had to insert one of each symbol and as a result left one of the answer boxes blank.

Q14 This was another successful question with many candidates awarded the full 3 marks for demonstrating their understanding of dual bar charts. It was pleasing to see a large number of well written and valid explanations given on the answer line as entrants at this level generally find providing reasons difficult. The most common errors were arithmetical but follow through marks were allowed for appropriate method and correct reasons following from work. Candidates who calculated weekly totals for the number of apples and oranges sold were mainly more successful than those who worked with daily sales differences.

Q15 Candidates who knew how to calculate percentages of an amount had little problem finding 40% of 8,500. However, many simply divided 8,500 by 40 showing no understanding of the problem while others misinterpreted what was required and having found the correct answer then subtracted it from the total tickets sold and answered 5,100. An inappropriate approach, possibly used by those without a calculator, saw candidates find 50% of 8,500 as 4,250 and then 10% of 4,250 as 425. This led to an answer of 3,825 on a small number of scripts. This question proved to be a good discriminator of ability.

Q16 This question on calculating the amount of silverside beef purchased given the total cost of fillet and silverside was another good discriminator of ability. Better candidates were awarded all 4 marks for the correct response of 6.9 kg. The majority of candidates, however, were unable to produce the correct final answer but most gained the first two marks for calculating the amount spent on silverside as £33.81 A common error included not knowing how to calculate 4.5 × 13 and weaker candidates either ignored the 'point five' and used 4 × 13 = 52 or simply added 50p onto £52. Some arithmetical errors were seen when subtracting the amount spent on fillet steak from the total cost of £92.31 The final step in solving the problem was to divide £33.81 by £4.90, the price per kg of silverside. A minority of candidates attempted to use repeated addition of 4.90 up to an amount close to 33.81 but none were successful in finding the required answer. A number of candidates who having found the correct answer of 6.9 kg in their method rounded it to 7 kg on the answer line and lost a mark.

Q17 The majority of candidates were quite successful in Part (a) with 12.5 a common response while a method mark for $0.4^2 = 0.16$ was often awarded to those unable to produce 12.5 At this level it is expected that candidates should be able to use a scientific calculator to solve problems such as $\frac{2}{0.4^2}$. A response of $\frac{25}{2}$ was given by a number of candidates who clearly had their calculator output mode set to display fractions. This needlessly cost them a mark and candidates should be taught how to

set their calculators to display decimals. Some blank responses may suggest that not all candidates had access to a calculator or that this type of problem has not been prepared for in the classroom. On a minority of scripts 0.4^2 was evaluated as 0.8 showing poor understanding of squaring numbers. An incorrect answer of 25 was seen on a number of scripts where candidates divided 2 by 0.4 and then squared their answer of 5. Finding the cube of 6 as 216, in Part (b), was consistently seen. Some candidates did however misinterpret 'cube' and found the cube root of 6 or its square. Others showed lack of understanding when cubing and displayed method such as $6 \times 6 = 36$, $36 \times 36 = 1296$. Both parts of Part (c) were poorly answered by a significant majority of candidates. In some cases it was clear that candidates did understand what square and prime numbers were, but they failed to gain the available marks when they either inserted extra incorrect numbers or omitted correct ones. Commonly, 1 was listed as a prime number in Part (i), as was 39. In Part (ii), 1 was often omitted as a square number, possibly because it had been used in Part (i) and 10 was frequently given as well.

Q18 Candidates struggled with this question. Many were unable to complete the table in Part (a) for the given linear equation accurately. Responses were often blank or answered incorrectly which led to no marks being awarded in Part (b) either. Candidates who were successful in Part (a) usually gained both marks in Part (b) for plotting their points and joining them with a straight line. In some cases (1, 1) was misplotted at (1, 0) and a mark was lost when the resulting graph was not straight.

Q19 It was evident that most candidates did not understand how to find a missing dimension when the volume of a cuboid was given. A minority of candidates found the correct value of 2.65 m for the liquid's depth and were awarded full marks. Others gained 1 mark for calculating the area of the base as 4.2 m^2. A common incorrect approach saw candidates adding the length and width of the base, then subtracting from the given volume leading to 6.73 m. Another approach frequently seen in candidates' method included finding the area of the base and then using trial and improvement to select values to multiply 4.2 by to get 11.13 Candidates attempting this method rarely made further progress and at this level they should recognise that division of the volume by the area gives the missing dimension. The question was a good discriminator of ability.

Q20 This straightforward question on angles in a polygon saw many candidates awarded at least 2 of the 3 available marks. It was clear that a majority of the cohort recognised the angle sum of a quadrilateral as 360° and knew to add the 3 given angles and subtract their total from 360°. This led to an angle of 82° and was worth 2 marks. The final mark was for finding the other angle on the straight line as 98°. Although a sizable number of fully correct responses were seen, many gave the missing angle of the quadrilateral as their answer, rather than finding the angle marked at x. Several candidates used 380° as the angle sum of a quadrilateral and there were a number of arithmetical errors seen in their method, mostly due to candidates not using a calculator.

Q21 This pie chart question allowed candidates of varying abilities to access marks for demonstrating their understanding. Many candidates were able to apply the correct process in obtaining the sector angles and were awarded 2 marks for finding all 5. However, loss of marks occurred with poor protractor use in drawing sectors that were outside of tolerance in some cases. It was pleasing to see that most candidates are now labelling their sectors appropriately. Those who did not calculate the angles correctly generally scored no marks if they went on to complete the pie chart.

Q22 This question on two-way tables was very well answered by many candidates with many scoring 2 or 3 of the 3 available marks. Occasional arithmetical errors were seen but the most common mistake was, despite completing the table correctly, to give a final answer of 50 for the number of rooms in the hotel. Candidates providing this answer totalled the row and column sums and in effect were double counting, showing that they had either lost sight of what they were doing or failed to understand what the values in the table represented.

Q23 It was evident from the responses given that most candidates at this level have little knowledge of how to express one quantity as a percentage of another and this question proved to be a good discriminator of ability. Better candidates who were able to apply the correct method either gained full marks or lost the final mark when they failed to give their answer correct to 1 decimal place. A common incorrect approach, where candidates multiplied the 2 values and divided by 100, led to an answer of 50.57 Other incorrect methods frequently seen included subtracting 59 from 86 and answering 27, or dividing 86 by 59, rather than 59 by 86 and answering 1.45, 1.46, 145 or 146. Candidates, in some cases, who knew to divide 59 by 86 lost marks for early rounding in their work.

Q24 Candidates struggled with this question which involved finding the area of a circle in Part (a), finding the maximum number of circles that could be cut from a rectangular sheet in Part (b) and calculating the area left over after the circles had been cut out in Part (c). While a few candidates were able to find the area of the given circle correctly in Part (a), most had no concept of finding a circle's area. Occasionally the formula to find the circumference of a circle was used or the diameter of 10 cm was applied to the area formula. On the majority of scripts, however, π was not seen anywhere in the methods shown. Part (b) proved to be the most accessible part of this question and a minority of candidates did provide the correct answer of 50 when they realised 10 rows of 5 circles fitted onto the sheet. No marks were awarded to the majority of candidates in the final part of the question though a small number of the cohort did achieve 1 mark for finding the area of the rectangle as 5,000 cm^2.

Q25 It was pleasing to see so many candidates attempting questions and scoring marks towards the end of the paper and this functional mathematics question on profit proved accessible to most. Many completely correct answers were seen which were awarded 6 marks while the majority of entrants were able to access at least the first 2 marks for finding the cost of the 42 boxes of candles and the selling price of 34 of them. A significant number of candidates were able to produce £46.20 for the candles sold at 35p each which was worth 3 marks. Some arithmetical errors were seen and careless use of correct values through poor transcription was noted, for example, 100.80 later used as 100.08 Incorrect money notation on the answer was penalised 1 mark in a small number of cases where candidates answered £67.8 rather than £67.80

Q26 Candidates struggled with this question on identifying the shape with the greatest perimeter with side lengths given in terms of x. A minority of better candidates did provide fully correct solutions and were awarded 4 marks. However, scripts were often blank, or a token answer was given without method, which gained no marks. For candidates who did attempt the question with working, many were unclear of what was required to solve the problem and algebraic approaches were often hampered by a poor understanding of collecting like terms and simplifying expressions. Few candidates were able to compare like with like as the $12x$ part of each perimeter was often not found. Many simply summed only the sides with lengths recorded on the shapes and ended up with perimeters of $4x + 1$, $6x + 2$ and $12x + 2$. In this case $12x + 2$ gained 1 mark although many following this approach ended up with $11x + 2$, presumably because they ignored the side labelled with a

length of x. For candidates who attempted to sum all sides of each shape many ended up incorrectly resolving expressions such as $12x + 3$ to $15x$. An alternative approach which was acceptable was to substitute values of x into the expressions found, with 1 being the most successful value candidates used. Unfortunately some candidates were inconsistent with their values of x, for example, choosing to substitute $x = 3$ into Shape A, which was a triangle, and $x = 4$ into Shapes B and C which were quadrilaterals. Others attempted to work with 180 and 360, presumably from the angle sums of the shapes.

Q27 This question on averages based on a frequency table was mostly inaccessible to candidates at this level with few of the cohort awarded any marks. A small minority were awarded 1 mark for correctly identifying the mode as £5 though some candidates gave the mode as 34, as this was the number of £5 vouchers sold. Few candidates identified the median correctly with most using incorrect methods and £20 was commonly given as the median. The mean was also poorly attempted by those who tried to find it. The most common responses saw candidates dividing their total by 5 rather than 80. It was clear that most candidates had not been adequately prepared for this type of question.

Assessment Unit M2 Foundation Tier

Unit Overview

It was pleasing to note, once again, that the majority of candidates were able to make a good attempt at all questions on the paper, with little evidence of them not having sufficient time to complete it.

There was evidence that many candidates could benefit from a greater focus on their algebra skills, with many unable to form expressions or solve equations correctly.

The relatively new topic of Venn diagrams appears to have not been widely taught, with very few candidates having a clear understanding of how to complete the diagram.

Widespread success in the questions requiring measurement of angles and lines suggests that most were well equipped for the exam. There is evidence of candidates seeming to think they need to do manual calculations in questions where it asks them to 'show their working', rather than use their calculator.

It was, once again, pleasing to note that the vast majority of candidates show clear working in almost all questions, allowing them to secure many method marks, even in questions where they fail to obtain the correct final answer.

Candidates securing very high marks should clearly have been entered for M3, particularly considering that there is a 75% overlap between the papers. They would, in all likelihood, have secured a Grade B had they attempted it.

Q1 This straightforward opening was successfully answered by the vast majority of candidates, although some failed to be specific enough with the name of the camera, failing to include '10' and/or 'OM' in their answers.

Q2 There were a variety of methods for answering Part (b), with some candidates measuring the angle and then cancelling a fraction out of 360. Some left decimals within their fraction, so were unable to secure the mark. In Part (c) many candidates simply divided 3 by 8. It was pleasing to note that the majority understood Part (d) and selected the correct answer.

Q3 This question allowed candidates to show their ability to convert fractions to decimals or percentages for the purposes of comparison. The most common error was to state that $\frac{7}{10}$ was equivalent to 7% or 0.07, rather than 70% or 0.7

Q4 Given the straightforward nature of the question, it was disappointing to note the large number of candidates failing to secure the marks. There seems to be limited understanding of place value among many candidates.

Q5 It was pleasing to note that most candidates not only got the correct answer, but also wrote the answer in correct money notation, with cases of £3.5 being few and far between.

Q6 Candidates should be taught that, where 2 marks are awarded for a question, there should be an 'intermediate step' before the answer. In Part (a), many could have secured the first mark by writing down the length of the line in cm, then converting to mm. This would have avoided the cases where their initial measurement was out of tolerance and, despite them seeming to know how to convert it to mm, they did not get any marks as their initial (incorrect) measurement was not written down.

A disappointing number of candidates gave an acute angle as their answer for Part (b), despite it clearly being obtuse in the diagram.

Q7 This relatively simple question was poorly answered. It is unclear whether candidates didn't know the meaning of the symbols, or whether they had limited knowledge of conversions between common metric units in everyday use.

Q8 It was pleasing that a majority of candidates showed clear evidence of working out the totals in order to justify their answer.

Q9 The most common error in this question was for candidates to obtain the correct answer, then subtract it from the original amount. Many don't seem to know the difference between '40% of' and '40% off'.

Q10 Most candidates were able to correctly multiply 4.5 by £13 to get the total cost of the fillet steak, although some seem to think they just need to multiply by 4 and then add on 0.5 The second step was also mostly correct, giving candidates the correct value of the silverside purchased.

It is disappointing that so many candidates adopted a 'count up' or 'count on' method to find how much silverside was bought. This is a poor method and will only work in very simple questions where the answer is a whole number. They should be encouraged to use division for questions of this nature.

Q11 In Part (a) the common partially correct answer of $\frac{25}{2}$ came from a leading brand of calculator being used in 'Math' mode and not converted back to a decimal.

The number '1' caused huge difficulties in Part (c), with many candidates believing that it is prime and is not square.

Q12 This was reasonably well answered, although candidates should always be encouraged to extend their line across the grid, rather than restrict it only to the values given in the table.

Q13 While most were able to get the 4.2, many did not know what to do after that, once again highlighting the lack of understanding of division amongst candidates. Some began by adding the measurements, meaning they were unable to make any progress with the question.

Q14 Having correctly obtained the 82, it was disappointing that so many candidates failed to realise they simply needed to subtract it from 180 to find the required angle.

Q15 This question was well answered, with most candidates knowing what to do and how to do it. In general candidates who were able to calculate the angles proceeded to draw them accurately.

Q16 Most candidates chose to complete the whole two-way table, with only the best realising that, in fact, only 3 missing values needed to be inserted before the total could be found.

Q17 This question proves difficult every year, and this year was no exception. Many candidates fail to get a fraction as their starting point, instead trying to find a percentage of some amount. Of those who made some progress, many failed to round correctly and some went on to subtract their correct answer from 100, losing the final mark.

Q18 In Part (a) a disappointing number of candidates used the formula for circumference rather than area, or used the diameter instead of the radius.

Part (b) was commonly done by dividing the total area by the area of the circle, with no thought given as to how the circles could actually be cut.

As a result, many candidates correctly obtained the '50' in Part (b) rather than in Part (c), where it should have been the first step.

Q19 This was the most pleasing question on the paper from the point of view that the vast majority of candidates showed clear working and secured some of the method marks.

The most common mark for an incorrect final answer was 5, either because it was not in correct money notation, or because the candidate made an error in the very last step of finding the profit.

Q20 There were a huge variety of methods used for this question. Unfortunately, the least common was the simple use of basic algebraic expressions!

Many candidates chose, in some cases seemingly unintentionally, to substitute in $x = 1$, meaning they ended up with a numerical value for each of the perimeters.

Of those who did attempt the correct algebraic method, the most common error came from the negative number in Shape B, which was added on instead of being subtracted.

Q21 This was very poorly answered indeed, with some candidates unable to identify any of the averages, and a large number able to identify only the mode.

Of those who had 2 or 3 of the averages correct, allowing follow through for the final answer, many stated that the reason was the mean because it was 'closest' to £15, despite this not being mentioned in the statement they were asked to comment on.

Q22 Most candidates had little idea what to do in this question. Many ignored the fact that the 1.83 needed to be squared and that the final answer was obtained from a multiplication rather than a division.

There was little evidence of candidates rewriting the formula with the given values inserted, even though this may have helped them see what to do next.

Q23 Nearly half the candidates secured the first mark for correctly multiplying out the bracket, but many were unable to make further progress.

Few candidates proceeded with just a single error. Most incorrectly obtained $22x$ and 6 or – 6 as the terms on the next line of their solution.

Q24 A surprisingly high number of candidates attempted Part (a) using a 'product of prime factors' method, rather than just simply listing the factors of each number. This led to 2^3 appearing as a common incorrect answer.

Few correct answers were seen in Part (b), with little understanding of LCM evident.

Q25 The most commonly secured mark in Part (a) was for '5' in the Art only section. It was to note that few candidates were able to work out that the missing value in the central overlap was 3 rather than 5. Only a small number of candidates realised that they needed to insert a figure outside the circles for those who did not study any of the subjects.

Given the lack of understanding of what the sections of the diagram actually mean, as evidenced in Part (a), it was no surprise that very few candidates were able to obtain a correct answer in Part (b).

Q26 Candidates either knew how to do this, or didn't. As a result, they either secured full marks or none at all. Some attempted (unsuccessfully in most cases) to find the answer by drawing a diagram.

Q27 It was frustrating to see how many candidates simply worked out 12 × 15 in this question, failing to realise it had anything to do with a circle.

As is often the case in questions of this nature, many used the formula for circumference rather than area of the circle.

Only a few fully correct answers were seen.

Q28 Despite being the last question on the paper, many candidates were able to secure at least some marks. This was most commonly by correctly attempting to work out the circumference of the full circle, or by realising that Pythagoras' Theorem was needed to find the hypotenuse of the right-angled triangle.

Assessment Unit M3 Higher Tier

Unit Overview

The performance by candidates on this paper was very good at the outset of the paper but performance really dropped off after Question 20. There was clear evidence that some new M3 topics which had not been answered well in previous papers had now been given greater attention – this was most notable in the success of drawing the pie chart (Question 6) for which nearly all came equipped with a protractor. However, there is still work to be done in preparing candidates for Venn Diagrams (Question 18) and simplifying algebraic fractions (Question 22).

There were many straightforward questions in the first third of the paper enabling all candidates to experience success across a range of topics. From Question 10 onwards through the next third of the paper, there were more demanding questions but the questions were well attempted, with many part marks awarded even where a final correct solution was not reached. After Question 20 there were definitely gaps in knowledge of many candidates who had entered for this module and there were many zero scores in these questions for weaker candidates. However, these more challenging questions were able to stretch and distinguish the better candidates. The responses to the multistep problem-solving questions showed great success and it was clear that candidates are better prepared for approaching these. This was apparent in Question 1, Question 6 and Question 15 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. There continues to be improvement in the methodology and presentation of candidate work and this enhances candidate scores throughout.

There was a positive response to most Number questions, in particular those assessing financial aspects which included the butcher's bill in Question 1, the candles in Question 10 but the reverse percentage in Question 21 was not recognised by many. The basic Number facts in Question 2(c) and Question 16 also cost candidates marks. Algebra topics were not

as well answered as in the past with marks being lost in routine algebraic processes being assessed in Question 13 using a formula, Question 14 solving a linear equation and Question 17 expanding quadratic brackets. In general, shape questions were well approached particularly Question 4, Question 5, Question 15 and Question 20 with trigonometry in Question 24 being less successful. There was a mixed performance on Data questions interspersed throughout the paper.

Numeracy skills were tested directly and indirectly (through data, geometry or algebra) in Questions 1, 2, 3, 5, 7, 8, 10, 13, 14, 16, 17, 18, 19 and 26. Questions with a functional element were very well answered and candidates are now confident in approaching a question set in an unfamiliar context. This was evident in Question 1, Question 9, Question 10 and Question 15. Literacy and communication were a feature of Question 12 on averages and Question 25 on the advantage of the statistical diagrams. Many candidates did appear to struggle with presenting their thinking clearly in these responses.

Q1 The opening question on the butcher's bill was accessible to all candidates with the majority securing full marks. Occasionally there was a calculation error or a misread in the cut of meat used but overall a successful start for most.

Q2 The calculations in (a) and (b) were very good. A few misinterpreted cube to mean cube root in (b). However, only a limited number of candidates retained accuracy within solutions offered in (c)(i) and (c)(ii). Too often the Figure 1 was listed as a prime number or omitted as a square number. The number 39 was also often included as a prime number. Despite this assessing the basic number facts, there were only a minimal number of candidates who gained both these marks.

Q3 Completion of the table and subsequently drawing the straight line graph yielded a very good response.

Q4 Finding the height of liquid in the container, given the volume and dimensions of the base, produced varying levels of success. Whilst most started by calculating the area of the base successfully, some then subtracted this value from the volume rather than dividing it in. Some weaker candidates thought there was a requirement to either cube the dimensions given of the tank or cube root the volume given, presumably due to sight of metres and metres cubed in the question. There were several occasions where candidates transcribed the given volume of $11.13m^3$ as $11.3m^3$ thus incurring a penalty.

Q5 There was an excellent response to finding the exterior angle of the quadrilateral. Occasionally, a candidate may have failed to complete the last step by just finding the interior angle and forgetting to subtract it from 180°.

Q6 There was a much improved response to the pie chart question. It was clear that candidates had better preparation than in previous series and were also equipped with a protractor. The straightforward step of doubling each value to calculate the number of degrees perhaps made the question more accessible. Candidates still need to be encouraged to label the sectors with the heading rather than simply the angle or the value it represents.

Q7 Completion of the two-way table was well answered. However, there were two common errors made in recording the final answer on the answer line of how many rooms were in the hotel. Some read the total for the column 'room only' whilst others totalled both the horizontal and vertical and recorded 50 as their final solution.

Q8 Finding one number as a percentage of another was generally well answered. However, some candidates who truncated the fraction too soon then failed to retain the accuracy to 1 decimal place. Others who recorded the recurrence as indicated by their calculator did not understand the meaning of the recurrence and completed by rounding incorrectly. Some of the weaker candidates offered a solution which was finding 59% of the 86 members.

Q9 This was the first question which clearly started to differentiate between candidates of varying ability. Whilst most were able to calculate the area of the circle in (a), only the very best understood the requirements of (b) and (c). In (b) the vast majority failed to realise that it was complete circles that had to be cut from the rectangular sheet and embarked on a method involving dividing the area of the rectangular sheet by the area of the circle. Even on progression to (c), there seemed to be no recognition that the wrong calculations being presented were simply the reverse of what had just been offered in (b). However, there were some follow through marks awarded. It was pleasing to see that the best candidates were able to interpret the complete question and present full and accurate solutions to all parts.

Q10 There was a positive response to the multistep problem-solving question on candle sales. There were a range of different approaches offered and in many cases the full 6 marks were achieved. Often 4 marks were reached by those who started correctly but confused boxes and candles or sold and unsold variables. Others who tried to embark on the cost per candle at the outset incorporated some rounding error or working with the profit per box at the outset also led to some difficulty and these approaches were less successful for candidates. Unusually, a notable number of candidates who knew the correct method, for some reason subtracted 34 boxes from 42 boxes at the outset and recorded 6 remaining boxes rather than 8. There are still some incurring a penalty by omitting the zero in the money notation recorded on the answer line.

Q11 Many candidates secured full marks in the question on the perimeter of the shapes. However, it was strange to see so much wrong thinking in the approach to this question. A significant number of candidates thought that once they had formed their algebraic expressions, they then had to be equated to 180 or 360 degrees according to the shape given. Clearly there was a misunderstanding in the requirements of the question but due to positive marking many still reached the valid conclusion. Some struggled gathering the terms in B resulting in an expression of $12x - 4$ instead of $12x + 4$. An alternative but perfectly viable solution of substituting an x value into all the algebraic sides and hence calculating the greatest perimeter was often presented too.

Q12 This question on finding the averages from a frequency table was one of the poorest answered questions on the paper. A limited number attained the full 5 marks. Many were able to identify the mode correctly whilst the median proved problematic with many simply recording £20 as it was the middle value in the table. There was a mixed response to the mean with too many simply totalling the vouchers and dividing by 5 to give £16, with no consideration given to the actual value of the vouchers. In many cases the blank column was completed using fx approach but was then not used at all in moving forward with the mean. Even when a candidate was successful in finding all three averages correctly, their final justification was often worded incorrectly. Many said the mean was the 'closest' which was not the correct reasoning; rather the mean was the only average greater than £15 should have been offered.

Q13 Manipulation of the formula was poorly executed by a substantial minority. Candidates either scored full marks or no marks here. Too many simply multiplied 22×1.83 not dealing with the squared term whilst others divided the 22 by 1.83^2

Q14 The response to the linear equation was perhaps not as well answered as usual. Many got 1 mark for correctly expanding the bracket but were unable to proceed. Others got 2 marks by making a single error in rearranging the terms whilst the majority did score the full 3 marks.

Q15 There was a good response to the multistep question on the perimeter of the badge. Even where full marks were not achieved, very many were able to accumulate

reasonable part marks. Very many recognised the need for Pythagoras' Theorem to calculate the straight edge. On progression to the circle, calculating the circumference was generally fine but adapting this to three quarters of the circumference was sometimes overlooked or dealt with as a quarter rather than three quarters. Unfortunately, a number of seemingly good responses in error included the 2 straight lengths of 6cm also in their final solution.

Q16 The novel approach to testing LCM was challenging for many. The majority approached this from a product of primes method and subsequently wrote 2 and 3 on the answer line as these were the resulting factors on the calculator display. Hence, there was no real understanding of the context of the question. Where the focus was on the 48, too many wrote the numbers 6 and 8 not realizing that the resulting LCM for these figures would have been 24. Despite there being a variety of correct answers to this question, the number of accurate solutions seen was limited.

Q17 Expanding the brackets to form a quadratic expression produced a mixed response. The more able candidates had no difficulty in reaching the correct answer, some struggled with tidying up the middle terms to reach $-4p$ and many completed with the last term as –4 rather than –12.

Q18 As a new topic on the Revised Specification there was a poor response to this Venn Diagram question. It certainly differentiated between candidates who knew exactly how to deal with all the given information and those who randomly placed the given figures into circles without any consideration of the overlapping regions. Too many read the first bit of information relating to Technology and Engineering and placed the 5 in the gap, without considering that 2 of these 5 were already accounted for in the diagram. Most were able to deal with the total for Art correctly and then, dependent on how the original information had been dealt with, some were able to complete the Engineering circle correctly, whereas an earlier error now impacted further on this part. Unfortunately, some who had all regions of the circles correct forgot to total their figures and record the remaining 7 candidates outside of the circle regions. Calculating the percentage in (b) was not well answered, even by those who had (a) correct. The vast majority of candidates simply isolated the 6 correctly but then calculated as a percentage of the total 35 candidates rather than as a total of the Technology candidates.

Q19 Calculation of the midpoint was reasonably well answered but some did struggle dealing with the negative coordinate. There were very many who approached this question using a sketch as opposed to knowing a suitable formula for calculating the midpoint.

Q20 What should be a routine style of question assessing the volume of a cylinder produced a mixed response. When the correct formula was known, there was no difficulty in gaining all the available marks. However, too many still do not know the formula and many weaker candidates simply calculated $\pi \times 12 \times 15$. Despite the fact the question reminded candidates to include units with their answer, some still overlooked this whilst others recorded squared units rather than cubed units.

Q21 In recent exam series there had been a notable improvement in those recognizing a reverse percentage problem. Unfortunately, there was a poor response to the question here. Very, very few embarked on the correct approach of equating 115% to £98.90 with the vast majority simply calculating 15% and then some also subtracting it from the £98.90 Perhaps candidates were relying on the word 'original' being used to direct their thinking, without understanding the context in which such calculations can be set. Some who did approach the question correctly also recorded the original as their final answer rather than reading the requirement for the service charge only to be recorded.

Q22 There was an extremely limited response to simplifying the algebraic fractions with only a few completely correct solutions across the whole entry. As a new topic on this module, it was clear that preparation was insufficient and candidates struggled to recognize the required approach of factorization. Most simply embarked on cancelling individual terms from numerators and denominators. Some did secure a mark for using common factors on the first numerator but then struggled with the quadratic factorization of the second denominator. A few who were able to master both of these steps failed to cancel the numerical terms of 3 and 6. This question was the poorest answered question on the paper.

Q23 Fully correct responses to the equation of the straight line were in the minority with only the best gaining the full 3 marks in (a) and then not many more securing the mark for the parallel line in (b). Common errors in (a) included a negative gradient, writing the crossing point as the x intercept of – 4 rather than the y intercept and recording the final equation in the format $L = mx + c$ rather than the correct $y = mx + c$.

Q24 Whilst the response to trigonometry has improved over recent exam series this did not follow through here. It appeared that many candidates had perhaps used last summer's submarine question for revision purposes and hence felt this was a similar problem, embarking on multiplying the two figures given, a non-sensical approach. Only the best presented correct trigonometry and were able to arrive at the correct height. Others identified the requirement for the sin ratio but were unable to manipulate it correctly.

Q25 Recording an advantage for the stem and leaf diagram or box plot produced a mixed response. Many were able to articulate their reasoning clearly. In the case of the stem and leaf there was recognition that the data was ordered, all the data was still visible or the mode was easily identified. In the case of the box plot correct reasons included the main statistical values are clear, the range is easy to calculate or the median is displayed. Weaker candidates presented vague ideas for both such as 'It is easier to understand' or 'it is laid out better' or 'the data is clearer'.

Q26 As a standard question at this level, finding the product of primes in (a) was generally well answered but finding the HCF in (b) was not as well answered. Very many in (b) identified the shared factors of 2 and 7 but then chose 7 as it was the highest rather than understanding that it was the product of the two shared factors.

Q27 The problem-solving question on algebraic fractions at the end proved challenging for most. Many did gain the first mark for the algebraic expressions for Graham and Darren. It was unfortunate to see so many taking the next step incorrectly in setting up the equation. Too many recorded the fraction of $\frac{2}{3}$ for Darren rather than the $\frac{1}{3}$ he had remaining and had this step been taken correctly, many more candidates could have proceeded further with the algebraic requirements of the question. In previous series where candidates were presented with a fractional equation to solve, the response had improved so it was unfortunate that the requirements were missed in the context of this question. However, it did prove a really good discriminator question at the end of the paper and there were complete and accurate solutions offered.

Assessment Unit M4 Higher Tier

Unit Overview

The performance of candidates in this paper was generally good. For this paper, the marks ranged from 10 to 100, with many candidates achieving 50 and above.

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 15, 21 and 22.

Presentation of work was satisfactory, however, greater care with writing letters and numbers more clearly and laying out work in an orderly manner can help gain more marks. Candidates' use of brackets was slightly better than the last series but there is still room for improvement. Issues with reading questions carefully were also evident throughout, especially in the questions assessing area, perimeter and volume. Many candidates mixed up formulae, finding $\frac{3}{4}$ of the area of a circle in Question 3, surface area in Question 8 and volume in Question 18.

Questions/topics which seemed to cause most problems in general were Question 6 (Venn Diagram), Question 10 (simplifying the multiplication of two algebraic fractions), Question 15 (setting up and solving a linear equation), Question 16 (using algebra to show a given equation for the area of a compound shape), Question 17 (recognising the difference of two squares), Question 18 (finding the surface area of a compound shape), Question 21 (solving an equation with algebraic denominators), Question 22 (a 'problem solving' gradients question using algebra), as well as any questions involving reasons (Question 13, Question 19(b), and Question 20).

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 substituting numbers into a formula was well answered in general. The minority of candidates who lost marks made mistakes such as dividing 22 by 1.83^2 instead of multiplying, not squaring the height, misreading the question and using 1.8 instead of 1.83 which obtained one mark.

Q2 In this linear equation question involving brackets, the vast majority of candidates obtained full marks. Almost all candidates were able to expand the brackets correctly with only a small number of candidates unable to continue or making mistakes such as having $8x = 6$, $x = \frac{8}{6}$ or going from $8x = 14$ to $x = \frac{8}{14}$.

Q3 This question involved finding the perimeter of a badge made from part of a circle. Most candidates were able to gain some marks here, with many being successful in gaining all 6 marks. The majority were able to calculate the length of the hypotenuse and the circumference of the full circle. However, some experienced difficulties in deciding how to combine each element of the question – some used one quarter of the circle added to the hypotenuse of the triangle, some added the hypotenuse to the full circle and some included the two shorter sides of the right-angled triangle. A significant number of candidates calculated the area of the circle, rather than the circumference.

Q4 In this question on finding two numbers with an LCM of 48 there were a lot of correct answers. Any of the following were correct answers: 3 & 16; 12 & 16; 24 & 16; 6 & 16; 48 & any factor of 48 other than 1. Common mistakes were giving two numbers that multiplied to give 48 such as 6 & 8 and these answers received one mark. A common answer that received no marks was 2 & 3.

Q5 This question on expanding and simplifying two brackets was well answered. The vast majority of candidates got two marks here, with only a few losing a mark by trying to factorise again or stating solutions to what they thought was an equation. A few made simple errors in expanding but proceeded to simplify correctly.

Q6 **(a)** This question on Venn Diagrams was poorly answered in general. This is a new topic on the revised specification and candidates need more practice at these types of question. Very few candidates obtained full marks and although a lot of candidates were able to put the correct numbers inside the circles they forgot to put the '7' on the outside. The majority of candidates were able to put the '5' in Art only but struggled with the other numbers. The most common mistake was putting '5' in the overlap between Technology and Engineering. Too many candidates obtained zero marks by just placing the 5, 8 and 14 straight into the circles.

(b) This question on interpreting a Venn Diagram to find a percentage was also poorly attempted. A common incorrect answer was $\frac{6}{35} \times 100 = 17.14\%$. Only a small number of candidates obtained full marks for either 30% if they had (a) correct, or 27.3% on a follow through from (a) if they had '5' in the Technology and Engineering overlap.

Q7 This question on the finding the midpoint of a line provided a very mixed response from candidates. Some had no problems in determining the midpoint but many tried to employ the formula for finding the gradient. Some simply added the coordinates together and didn't divide their answers by 2 whilst others were able to calculate the correct x-coordinate but had difficulties in dealing with the minus when calculating the y-coordinate. Quite a few attempted to sketch the Cartesian frame and plot the points.

Q8 This question on finding the volume of a cylinder was very well answered with most candidates using the correct formula and giving the correct units as either cm^3 or ml or even litres if divided by 1,000. Common mistakes were using an incorrect formula, finding the surface area or using $\pi \times 12^2 \times 15$. In these cases candidates could only obtain the mark for the units. A small number of candidates used cm, cm^2 or did not include any units.

Q9 This slightly different question on reverse percentages was answered reasonably well, with many candidates gaining all three marks. Some thought that their task was to find 100%, stating an answer of £86. The weaker candidates tried to calculate 15% of £98.90 and then subtracted it.

Q10 Candidates found this question on simplifying the multiplication of two algebraic fractions challenging. Very few candidates obtained full marks; however, a lot of them were able to obtain 2/3 marks for factorising the two quadratics correctly but then struggled to simplify their final answer. Candidates should be made aware that they must start this question by factorising first and then cancelling down appropriately. Too many candidates started by multiplying numerators and multiplying denominators and not factorising at all. Another common mistake was to start by cancelling out x^2 on the numerator with x^2 on the denominator or similar with the x on both numerator and denominator.

Q11 **(a)** This question on finding the equation of a line drawn on an axis proved challenging for many candidates. Finding the gradient of the line seemed to be the most difficult element and it seemed to be because the gradient was not an integer value. Many struggled to identify suitable points from which to calculate the gradient and of those who did calculate the value of 1.5, some decided to precede it with a minus sign. Establishing that the y-intercept was 6 should have been read from the graph, however, a number of candidates tried to substitute their value for 'm' into $y = mx + c$, thus coming up with an incorrect value for 'c'. Some also had issues in forming the final equation of the line, with elements of the equation appearing in a variety of incorrect forms.

(b) This question on writing down the equation of a parallel line to (a) was well answered by most candidates and follow through was allowed for any answer to (a) written in the correct form. However, some candidates tried to find the negative reciprocal of their gradient for (a).

Q12 This trigonometry question was well answered in general with most candidates able to identify the correct sides involved in the question and use sin correctly. Those who used cos or tan had usually labelled the diagram incorrectly by having 16 on either the vertical or horizontal sides of their triangle. These answers obtained no marks. A few candidates who were able to identify sin correctly mixed up the angle and side and had 24 sin16, obtaining 1 mark for identifying sin. A small minority of candidates used cos to find the horizontal distance and then used Pythagoras' Theorem correctly to find the height, receiving full marks.

Q13 This reasoning question on advantages of using either a stem and leaf or a box plot was not answered well by a sizeable minority. This question set the candidates at an advantage in that they were provided with examples of both a stem and leaf and a box plot to prompt their answers. In Part (a), many correctly identified that a stem and leaf diagram ensures that individual marks remain visible and that the data is ordered. Many others chose to mention the ability to find the mode and the range from a stem and leaf diagram. However, too many are producing vague answers such as 'it is easy to read/understand' or 'it is more accurate'. The same can be said for Part (b), with many candidates feeling that box plots are 'easy to read' or 'clear'. Many candidates stated that it was easy to find an average from the box plot – this is too ambiguous; candidates need to be more specific about which particular averages they are referring to.

Q14 **(a)** This question on finding the product of prime factors for two numbers was very well answered with most candidates either correctly using the factorising techniques or simply using the FACT button on their calculators. A small number of candidates just wrote the factors with commas between them rather than a multiplication sign.

(b) This question on finding the HCF of the two numbers in Part (a) was not answered as well as (a) but there were still a lot of fully correct answers. A common incorrect answer was 7. Some candidates confused HCF with LCM.

Q15 This question on setting up and solving a linear equation was poorly answered in general with very few candidates obtaining full marks. Many candidates received only one mark for this question, for correctly identifying $x - 1$ and $x - 2$ as the expressions to represent Graham's and Darren's golf ball totals. There was a significant number of candidates who had issues in forming a correct equation, with some having difficulties in using the correct notation to articulate what they intended. A large number of candidates used $\frac{2}{3}$ as their fraction of golf balls remaining for Darren. This error didn't prove too costly, however, as when the equation was solved, all three answers

were integer values which totalled 74. Too many candidates, upon forming the equation, did not know how to deal with the fractions and subsequently proceeded to work with decimal values in their solution, failing to recognise that this could not be correct, given that the answers should have been integer values. When finding decimal answers, most proceeded to round off, rather than amend their working.

Q16 **(a)** In this algebra question candidates had to find the area of an 'L' shape and show that it led to a given quadratic equation. This was answered quite well with a lot of candidates using one of the numerous methods to find the area and let it equal to 47. A common mistake that was made attempting to simplify the equation was incorrect expanding of brackets and therefore candidates were unable to obtain the required quadratic equation. Some candidates tried to find the perimeter or made mistakes in splitting the 'L' shape into two rectangles. For example, 3 was used for the missing vertical side instead of 5. A small number of candidates never used the 47 or tried to let their area equal zero. A small number of candidates misunderstood this question and simply solved the given quadratic equation.

(b) Candidates who were unable to obtain any marks in Part (a) were able to correctly solve the given equation by either factorising or using the formula. This question was relatively well answered. A common mistake was leaving both answers and not realising x cannot equal a negative number due to the context of the question.

Q17 In this question on factorising, using the difference of two squares method, less than 30% of the candidates obtained full marks. Most candidates were able to obtain one mark for finding the common factor of 2. After this factorisation had been carried out, multiple wrong attempts were seen at factorising. Many didn't find a common factor at all and it was common to see $(4x - 10y)(2x + 5y)$ or the equivalent. Many removed the common factor of 2 entirely by dividing the expression by 2.

Q18 There were very few candidates who obtained full marks in this question on finding the total surface area of a compound shape made from a cuboid and a square based pyramid. Only the more able candidates were able to recognise that the height of the triangles needed to be found using either Pythagoras' Theorem or trigonometry. Too many candidates simply used $\frac{1}{2} \times 12 \times 10$ to find the area of the triangles. The majority of candidates were able to obtain one mark for finding the areas of the four rectangular sides along with the square base. Other common mistakes were trying to find the volume, forgetting to add the base, adding the square at the top and using a formula with π in it.

Q19 **(a)** This stratified sampling question was a very well answered question, with the vast majority of candidates gaining a minimum of three marks. Having calculated the sample size from each year group, many did not check that it totalled 50, hence losing out on the final mark.

(b) This was another reasoning question in which candidates continue to struggle to obtain full marks. Responses such as 'more accurate', 'less biased' and 'equal numbers from each group' were seen as an advantage of stratified sampling. Some viewed it as a disadvantage that more people were chosen from one group than another – despite the fact that this is the basis of stratified sampling which actually makes it a fair process. It was clear that whilst many candidates could carry out a stratified sample correctly in (a), a good proportion of these didn't really seem to understand the point of it.

Q20 In this circle theorem question, candidates were required to find given angles and provide a reason for their answer. The majority of candidates were able to get the correct angles but only the better candidates could fully explain their reasons correctly.

(a) A lot of candidates correctly explained this answer using the correct terminology. The key words required were 'opposite angles', 'cyclic quadrilateral', 'add to 180°'. Some candidates left out one key word, such as 'opposite' or 'cyclic' and did not receive the reasoning mark.

(b) More candidates were able to provide the exact terminology required here than in (a) but again too many just said 'it is double 48' or something similar. The full reason as on the mark scheme was required here.

(c) Only a small number used the Alternate Segment Theorem as the reason here. Most candidates who obtained full marks used the second reason on the mark scheme i.e. using the tangent-radius property and angles in an isosceles triangle.

Candidates must be aware of the exact terminology required when giving reasons for circle theorems. As seen above it is not enough to say 'it is double 48' and candidates must say 'the angle at the centre is double the angle at the circumference' etc.

Q21 This standard question on algebraic fractional equations continues to cause difficulties for a lot of candidates but it was a good question for differentiation of candidates. Most of the very capable candidates dealt with this question with ease. The initial difficulty arose from the fact that the format of the question was slightly different to the vast majority of examples that candidates are meeting in school. Most are familiar with having both fractions on the left and in trying to rearrange in order to create this, many erred with signs, some even changing the sign of the 2 on the right hand side of the equation. Predictable errors were made with signs when expanding brackets but generally the standard of answering was quite poor. Too many continue to make errors when applying the quadratic formula, squaring –11 to get –121. Some candidates could form the quadratic but did not have the necessary understanding to solve it. Candidates should be aware that if the question asks for answers to 2 decimal places then the quadratic formula is required to solve their quadratic.

Q22 This question on finding a missing x coordinate using perpendicular gradients differentiated the top candidates from the others. The majority of candidates were able to get the first two marks but did not know what to do next, with a common mistake being trying to use $y = mx + c$. Only a very small number of candidates obtained full marks in this question. A lot of candidates were unable to start this question and left it blank.

Q23 This question on boundaries was well attempted by many. Most were able to calculate the correct upper and lower bounds for s and t, but some did not know how to correctly apply these to a division. Given that substitutions of the various bounds for s and t tended to result in an answer of 0.24 (2dp), it was unclear from some candidates' work which values they had actually used. Some misinterpreted the 'upper bound' element of the question and rounded what was a correct answer to a value such as 0.25

Q24 **(a)** This question on finding frequencies from a histogram was well answered with a lot of candidates obtaining full marks. There were a small number of candidates who made one or two mistakes in calculating the frequencies but still obtained the other four. Only the very weak candidates were unable to gain any marks in this question.

(b) This question on finding the mean from a histogram was not answered as well as Part (a). Candidates who had incorrect frequencies in Part (a) were allowed some follow through marks, but they should have realised their frequencies should add up to 62 as it was written in the question and therefore were penalised a mark if their total was not 62. Candidates must also be aware that

they should not round their answer to a whole number when estimating the mean – this was penalised one mark. Other common mistakes made were incorrect mid points, finding the median or calculating errors in finding fx. A small number of candidates were unable to start this question and left it blank.

Assessment Unit M5 Foundation Tier Non-Calculator

Unit Overview

This non-calculator paper was challenging for many candidates and most questions where more than 1 mark was available proved to be good discriminators of ability. The mean mark awarded was around 40% and candidates tended to be more successful with the earlier questions on the paper. Partial marks for showing understanding through appropriate method were consistently awarded to most of the cohort throughout the paper and it was pleasing to note that nearly all candidates attempted every question.

Comments on individual questions follow.

Q1 Part (a) required candidates to calculate the total price of a games console and a game from two stores and compare the prices. Many candidates found the correct answer of Game Hut being cheaper by £36 and were awarded 4 marks. Others earned part marks for appropriate method if they made an arithmetical error in their working. A small number of candidates were unable to add 329 and 35 accurately while some were confused by the meaning of a £40 deposit and subtracted it from their monthly instalments total of £360 rather than adding it. A minority of candidates who found the correct values of 364 and 400 lost the final mark for careless subtraction when finding how much cheaper one shop was than the other. Part (b) was generally well answered with the available mark being awarded to candidates for stating that Jon might choose the more expensive option if he didn't have the full cash price or would prefer to spread his payments over 6 months. For those who gave the incorrect store in Part (a) they were allowed the mark in Part (b) for giving a sensible reason such as Jon being happier to pay everything up front or not being tied into a credit agreement over a 6-month period. Some candidates misinterpreted the deals on offer and common incorrect responses included reference to better consoles, better games, more storage or better insurance while others stated that paying in instalments is cheaper or that it's advertised to make it seem cheaper.

Q2 It was pleasing to see many correct responses to this estimation question. In Part (a) many candidates either estimated the cost of 74 cups of coffee at £2.70 each as 70 × 3 = £210 or 74 × 3 = £222. Poor knowledge of times tables cost some candidates a mark, for example 70 × 3 = 280 was seen on several scripts. Others were careless when transcribing their 210 or 222 onto the answer line with £21 and £22.20 frequently seen. Inappropriate rounding, such as rounding £2.70 to £2 or 74 to 80 was seen on a small number of scripts. A minority of candidates are still unclear of what the instruction to estimate means and attempts to multiply 2.70 by 74 were awarded no marks. Candidates should realise that it is not appropriate to round estimated amounts: having correctly found an estimate of 210 or 222 an answer of 200 or 220 will be penalised. Part (b) proved to be more difficult for many. For those who recognised that they needed to divide, 2 easy marks were generally accessible if they rounded £77 to £80 and £1.85 to £2. Some candidates rounded appropriately but then multiplied to give an incorrect estimate of 160 bottles sold. Others ignored the instruction to estimate and attempted to divide 77 by 1.85

Q3 This straightforward question on reading values from gauges proved accessible to most candidates with many gaining all 3 of the available marks. Few had trouble marking a reading at 270 volts in Part (a) and the majority of candidates were able to

read the equivalent Celsius temperature to 100°F from the thermometer in Part (b). Part (c) saw a minority of candidates misinterpret the scale on the speedometer and give an answer of 81 rather than 82 km/h. This is a mistake that could easily have been avoided with greater care.

Q4 This was another accessible question for candidates at this level with many correctly answering all 3 parts. In Parts (a) and (b) candidates had to extract information from a table of populations, identifying the county with the largest population and the two counties with the same population. It was pleasing to note that very few candidates gave the population as their answers rather than the counties. A majority of candidates realised in Part (c) that more information was needed to test the likelihood that the probability of a male being chosen at random was the same as that of a female.

Q5 This was a challenging question which allowed differentiation by ability. Only better candidates were able to access all 3 of the available marks with most awarded 1 or 0. For marks to be awarded method was required and there were a number of candidates who gave the required answer of 2 letters but nothing to substantiate their answer. A variety of approaches were seen throughout the cohort with the most successful being to calculate 20% of the number of days in each of the three terms, leading to 14, 10.8 and 5.2 days. Arithmetical errors were common, but most candidates earned at least 1 mark if they attempted this approach. Another approach used was to multiply the number of days absent by 5 and compare with the number of days in each term. Incorrect approaches were plentiful, the most frequent being to subtract the days absent from the number of days in a term and then find 20% of these values.

Q6 Questions on algebra at this level are generally poorly understood and this was once again the case. Part (a) was the most successfully answered part and often provided the only mark awarded to candidates throughout this question on generating next terms of Fibonacci type sequences. The question was a good discriminator of ability as it became progressively more challenging: Part (a) involved positive numbers, Part (b) negative numbers and Part (c) terms involving 'x'. Candidates, who clearly knew what they were doing in Parts (a) and (b), lost marks for careless addition in a minority of cases.

Q7 This question testing fractions was well answered by better candidates and was a good discriminator of ability. Many candidates scored the first mark for finding the number of adults as 90 by subtracting 150 children from the 240 total. Candidates who knew how to find $\frac{3}{5}$ of an amount had little problem finding the number of girls as 90 and hence the number of boys as 60. Similarly, candidates who were successful in finding the number of boys and girls were able to calculate $\frac{2}{3}$ of 90 as 60 for the number of male adults which then led to 30 female adults. The final mark was for concluding that Cora is incorrect as there are 120 females and 120 males and a pleasing number of candidates were awarded all 4 of the available marks. Candidates should be encouraged to set their work out carefully and clearly label the values they find, in this case as males/females or boys/girls. Poor or non-labelling often led to candidates with good understanding of working with fractions losing marks needlessly when they then chose the wrong values to add. A common arithmetical error was 240 – 150 = 110 which led to the number of male and female adults being non-whole numbers. Some candidates may have found it difficult to deal with the amount of information presented to them in the question.

Q8 About half of the candidates scored at least 1 of the 2 available marks on this question testing knowledge of the interior angle sum of a hexagon. Candidates who drew the remaining three triangles as directed gained 1 mark even if they made no further progress. Many candidates, however, were able to produce the required angle sum of 720° by multiplying 4, their number of triangles, by 180°, though some arithmetical errors were seen. An alternative method which allowed access to both marks was employed by a number of candidates: (number of sides minus 2) × 180°. It was clear that some candidates had not been prepared adequately for this type of question as triangles were drawn haphazardly and often more than 4 triangles were shown. In a small number of cases candidates took 360° as the angle sum of a triangle.

Q9 This question based on a distance-time graph was well answered by many candidates and practically all of the cohort were awarded some of the 5 available marks. Only a few candidates were unable to interpret the horizontal scale properly and nearly all gave the correct time of 0905 for Seb leaving home in Part (a). Part (b) was also well answered with most candidates giving the outward journey time as 15 minutes. Careless reading of the question resulted in some candidates giving the arrival time of 0920 rather than the time taken. Part (c), drawing the final leg of Seb's journey, was also well answered by many though it was obvious that some candidates did not have a ruler. Some lines were misplotted at (1002, 0) or (1004, 0) while a small minority of candidates failed to start their line at 0950. Part (d), although correct in many cases, was less successful than the preceding parts of the question. A lot of candidates gave 8 km, rather than 16 km, as the total distance Seb travelled, possibly just reading the maximum value off the vertical axis and not considering the context carefully. It was pleasing to see so many correct responses to Part (e) with valid reasons given for the fastest leg of Seb's journey. Most candidates compared the times for each leg of the journey while a small minority compared the steepness of the lines. Some candidates are still providing inappropriate responses such as, 'faster because it is downhill on the way home'.

Q10 This was a challenging question for many and proved to be a good discriminator of ability. Most candidates were able to gain at least 1 of the 2 available marks in Part (a) for completing the table of outcomes though it was disappointing to see marks lost needlessly through carelessness and lack of checking. The majority of candidates failed to gain any marks in Parts (b) and (c) even if they had the correct table as they often answered in words, such as 'unlikely', rather than in fractions for their probabilities. Better candidates did provide the required fractions but others used 7 or 11 as the denominator rather than 12. There were very few correct responses to Part (d) which examined understanding of expectation, in particular the number of odd answers expected from 30 trials.

Q11 It was pleasing to see a minority of candidates scoring full marks on this estimation question towards the end of the paper. Candidates often gained the first mark for rounding the given values to 1 significant figure to produce $\frac{600}{4 \times 10}$. Those who then went on to give an answer of 15 gained the second mark. A sizable proportion of the cohort, however, was unable to calculate 600 divided by 40 without a calculator and 150 was a common incorrect response. Some candidates rounded inappropriately and no marks were awarded, for example, to 593 when rounded to 500 or 1000 or to 4.1 rounded to 5.

Q12 This was another challenging question, changing prize money ratios into fractions, but again it was pleasing to see part marks awarded to candidates for appropriate method. A minority of candidates were awarded the first mark for totalling the ratios to 14. The award of the second and third marks was less common with only better

candidates able to produce the correct fractions. Some candidates who found the correct fractions lost the final mark for either failing to write them in their simplest form or for making errors when attempting to do so. This was another question which proved to be a good discriminator of ability.

Q13 This question on transformations allowed access to some of the 6 available marks to the majority of candidates. It was pleasing to note that nearly all of the cohort were still attempting questions at the end of the paper and many were rewarded for their perseverance by gaining marks for showing knowledge of rotations and translations throughout the three parts of this question. In Part (a) many candidates were able to identify the transformation as a rotation but only better candidates were able to provide the centre of rotation and the angle turned through. Candidates at this level should be reminded to request tracing paper to help with questions of this type. Many candidates were able to successfully translate the kite 2 units to the right and 5 down in Part (b). In Part (c), a large number of candidates were awarded 1 mark for knowing either to translate their kite in Part (b) or to move it 2 left and 5 up, but few managed to give both components of the transformation.

Assessment Unit M5 Foundation Tier Calculator

Unit Overview

Candidates generally performed well throughout the first half of this calculator paper and showed good understanding and competence across a range of topics. The second half of the paper was challenging for many candidates, but the questions did prove to be good discriminators of ability. Partial marks for appropriate method were awarded to most of the cohort throughout the paper and it was pleasing to note that the majority of candidates attempted every question. It was apparent, however, that a small minority of the cohort did not have access to a calculator which made questions such as 9 and 15, which involved multiplying and dividing decimal amounts of money, difficult to score many marks on. Others did not have a ruler or protractor which made it unlikely for marks to be awarded for Questions 3(c), 3(d) and both parts of Question 7, which involved measuring lengths of lines and measuring a 40° angle.

Comments on individual questions follow.

Q1 It was disappointing to see that so many candidates were unable to recognise the sequence given in Part (a) as square numbers. Common incorrect responses included ‘odd’ or answers such as ‘nth term sequence’. A minority of candidates attempted to find the next term in the sequence, but few actually found 100 as the next square number. Both parts of (b) were very well answered with the majority of the cohort being awarded 2 marks for drawing the next pattern and completing the table of triangular numbers.

Q2 Most candidates reflected the given shapes accurately and were awarded both of the available marks. However, a small number of candidates lost a mark for accuracy if they were careless in their work. Some vertices were inaccurate by more than half a centimetre square. Candidates should be encouraged to use a ruler when attempting questions such as this.

Q3 Part (a) was answered correctly by the majority of candidates who had no problem identifying the westernmost place on the map as Kesh. The most common incorrect responses were Belfast or Larne which were furthest east on the map. Part (b) was less successfully answered as candidates often gave towns to the north and east of Omagh, such as Limavady or Larne, rather than Ballycastle which is north east of Omagh. Part (c) was generally well attempted by candidates with many scoring both marks for measuring the distance between the towns and then using the

given scale to change their measurement into kilometres. Some measurements, which were shown, lay outside of tolerance but a mark was allowed if candidates then multiplied by 15 correctly. Candidates should be encouraged to write down their initial measurement which, if in tolerance, would gain the first mark. In some cases final answers were given which were outside the accepted range but the initial measurement wasn't shown so no marks could be awarded. In Part (d) many candidates were able to indicate Ballymoney on the map with an X, 2 cm to the east of Limavady. Some candidates again confused east and west but gained a mark for knowing how to deal with the scale, if their X was 2 cm from Limavady.

Q4 This question on words used in probability proved to be more difficult than anticipated with few correct responses seen in the first two parts of the question. Many candidates seemed to interpret the '8 white T-shirts' at the beginning of the sentence as the total amount of T-shirts, rather than 16. In Part (a) the most common response was 'likely', presumably coming from 5 reds from a total of 8 T-shirts rather than 5 out of 16 which would be unlikely. Part (b) saw only a minority of candidates giving the correct response of 'evens' for the chance of choosing a white T-shirt at random. The final part of the question was very well answered, possibly because numbers of T-shirts didn't really need to be considered as there were no green T-shirts so choosing a green one would be impossible.

Q5 This question testing understanding of converting miles to kilometres was answered well by the more capable candidates and was a good discriminator of ability. A minority of candidates were awarded 1 of the 2 available marks for stating '5 miles = 8 kilometres', or equivalent. Common incorrect approaches saw candidates multiply 40 miles by 10, 100 or 1,000.

Q6 In Part (a), most candidates were awarded the available mark for reading the conversion graph accurately at 30 stones. Part (b) was more challenging and it was pleasing to see so many sensible methods being used to convert 900 kg into stones as the vertical axis only went up to 400 kg. The most common approach leading to full marks was to take a reading at 300 kg and multiply this by 3. Other methods were perfectly acceptable but inaccurate readings or arithmetical errors often led to the loss of marks. A common approach, which was awarded no marks, saw candidates carelessly assume 60 stones was 400 kg, the extent of the axes, rather than just over 380 kg.

Q7 In Part (a) candidates were given instructions to draw a triangle from a given point A. It was pleasing to see so many fully correct responses earning 3 marks. Many candidates were awarded at least 1 of the 3 available marks for having one or more of the horizontal 8 cm line, 40° angle at A or 12 cm line correct. Some candidates lost marks when their measures were outside of tolerance and it was clear that others had no ruler and/or protractor. It is disappointing at this level to see some candidates still confusing horizontal and vertical. Part (b) was generally answered well with many candidates drawing appropriate parallelograms (or rectangles) and being awarded both of the available marks. Where marks were lost candidates were either inaccurate with their measures or seemed not to know what a parallelogram looked like, leaving the workspace blank or drawing triangles or other polygons.

Q8 Part (a) was very poorly answered with many candidates clearly not reading the given information carefully. The most common incorrect response given was to mark with an X the probability of it raining tomorrow rather than not raining as instructed. Others, who knew to mark the scale at 0.6, miscounted the tick marks and recorded their answer at 0.5 or 0.7 Candidates should be encouraged to read information carefully and check their work. Part (b) was a challenging question for candidates at this level and 3 marks were awarded infrequently. Many candidates, however, were

able to access at least one mark for either stating that there were 3 primes or 4 even numbers on the given dice. Some gained 1 mark for simply stating that there were more even numbers than prime on the dice but gave no indication of how many or which numbers were which. It was clear that many candidates treated 1 as a prime and 2 as even, but not prime, which led to answers such as 2 primes and 4 evens occurring often. It was evident that some candidates failed to look at the numbers on the given dice and listed 2, 4 and 6 as even and 2, 3 and 5 as prime.

Q9 It was pleasing to see many completely correct responses to this question on comparing family holiday prices to Florida at different times of the year. Where candidates were not fully correct up to 4 marks were awarded for appropriate method and the majority of candidates were awarded some marks in this question. Arithmetical errors were frequently seen, and the wrong values were used from the given table in a few cases. Others misinterpreted 'children will be charged at half the adult price' and divided the cost they had calculated for adults by two. A small number of candidates attempted this question without a calculator but made little progress. A minority of candidates calculated the difference in adult price for the holidays as £250 and multiplied this by 5.5 (4 adults + 3 children ≡ 5.5 adults) to give the required answer of £1375. A small number of candidates consistently worked with amounts such as £21.49 or £18.99 Candidates should be reminded to consider the context of the question they are answering and consider the reasonableness of their answers.

Q10 Part (a) was well answered with many candidates giving the 8th term in the number sequence as 48 and gaining the mark. Part (b) proved more difficult for candidates to access the available mark, especially since they had to state 'yes' along with a valid reason. Acceptable reasons such as '5 is not a term in the sequence since it's odd and the terms of the sequence are all even' or 'the terms are multiples of 6 and 5 is not a multiple of 6' were seen infrequently. Often, however, the mark was not awarded as the question had not been answered with 'yes' as well. An answer such as 'yes, it goes up/down in 6s' was not acceptable.

Q11 Candidates were mostly unable to give a reasonable explanation of what is meant by the spinner being described as fair in Part (a). Most considered the numbers on the spinner and the fact that there was the same number of odd and even numbers or that there were no more than one of each number. Other common unacceptable answers referenced the spinner not being weighted or being unbiased. Only a minority of candidates were able to state that the sectors were the same size or that each outcome was equally likely. Part (b) was poorly answered, despite being a relatively straightforward question which involved taking the probability of 0.15 away from 1, to find the probability of the spinner not pointing to a 7. Candidates may have missed the fact that the spinner is not fair which may explain why a common wrong answer of $\frac{7}{8}$ was given. Another common incorrect response was 1.05, coming from 7×0.15, showing a failure to grasp one of the most fundamental properties of probability.

Q12 This question on ratio, although straightforward, proved to be a good discriminator of ability. Better candidates had little problem producing 360 for the number of girls, although some lost a mark for answering 288, for the number of boys. Again, careful reading of the question and checking the correct answer has been given would help candidates achieve better marks. Weaker candidates were clearly unfamiliar with the method required to solve problems such as this and were unable to access either of the 2 available marks.

Q13 This was a very challenging question for candidates sitting this paper and only a very small minority of the cohort were awarded the full 3 marks, mostly for realising that 1 part was 200 ml so 10 parts were 2,000 ml or 2 litres. The most common response, which was awarded no marks, was for candidates to add the 600 ml of fruit juice to the 1,800 ml of lemonade, resulting in 2,400 ml or 2.4 litres which was then rounded to 2 litres on the answer line. A number of candidates were awarded 1 mark for dividing 600 by 3 and 1,800 by 7 but most made no further progress.

Q14 Many candidates understood how to enlarge the given shape by a scale factor of 2 but few were able to use the given centre correctly. The majority of the cohort were awarded 1 of the 3 available marks for producing a correct enlargement about the wrong centre.

Q15 It was encouraging to see that practically all candidates were still attempting questions at the end of the paper and this final question rewarded many with at least 1 of the 4 available marks. The question concerned currency exchange and best value and it proved to be a good discriminator of ability. Better candidates were able to successfully change the given amounts into a common currency for comparison, mostly choosing to change $28 into £22.68, then €25 into £22.94, resulting in a final answer of Evie and 26p. Weaker candidates often produced £22.68 and were awarded 1 mark. They were then unable to convert €25 accurately, often multiplying by 1.09 rather than dividing. Candidates without calculators struggled to make any progress.

Assessment Unit M6 Foundation Tier Non-Calculator

Unit Overview

As in the summer, almost all candidates made a good attempt at answering most of the questions at this level but there was again a considerable range of ability and understanding and thus responses varied, particularly for those questions that were challenging in the latter part of the paper. This paper was constructed to allow candidates to be differentiated across the ability spectrum with grades ranging from G to C* and it achieved this purpose. Part marks for correct method and minor arithmetical errors were made available in all questions where possible. The language used was accessible, though many candidates still failed to read the question carefully before attempting an answer. There was little evidence to suggest that candidates lacked time to complete the papers and it was good to see almost all working through to the end of the paper.

It was noticeable that the new topic of binary numbers had been generally well covered in preparation for the examination. Questions that the candidature at this level seemed particularly comfortable with included the distance time graph, the outcomes table and translation of a shape. Most difficulty was encountered with a challenging inequality involving a negative fraction and the solution of simultaneous equations by a graphical method.

Q1 This opening question proved more differentiating than anticipated, with many candidates not reading the introduction very carefully and not realizing that the terms should be dealt with separately, hence adding the total number of days absent and the total number of days for the three terms. Some candidates understood what had to be done but had difficulty dividing by 5. Perhaps they might have calculated 10% and doubled their answer. Others wrote the answer of 2 with no work shown, despite clear instructions to show working. Nonetheless it was pleasing to see clearly structured complete answers from the best candidates.

Q2 Again it seems that a number of candidates did not read the emboldened instructions for the sequences carefully and simply added 6 each time in (a) and subtracted 8 each time in (b). Many were able to answer Part (a) correctly but only a minority could handle the negatives in Part (b) and the vast majority had difficulty in the more testing algebraic sequence (c), often getting (x + 12) rather than (2x + 12) as the answer.

Q3 Over a third of the candidates were able to work through this fractions problem, showing their method clearly. Some made the error of taking 240 – 150 to be 110, others did not read the question carefully and worked out $\frac{2}{3}$ of 240, while some candidates tried to add fractions.

Q4 This distance-time graph question was very well answered.

Q5 Good attempts were made with triangles being drawn or use of the formula (n – 2) X 180°, although some tried to measure angles.

Q6 Part (a) was very well answered with the majority able to use the table to answer (b) correctly and a minority also able to interpret it for (c). Some words rather than numerical values were given in both Parts (b) and (c). Most candidates failed to make a connection between Parts (d) and (c) and only the very best candidates scored two marks in (d).

Q7 Many candidates estimated correctly to get $\frac{600}{40}$, but nearly half of them did incorrect divisions to get answers such as 150. Some candidates rounded incorrectly to begin with, using 500 or 590 and many others tried to do a complete calculation instead of any estimation.

Q8 This ratio question provided a full range of responses. Nearly a quarter gained full marks, while some candidates failed to simplify correct fractions; others just got as far as knowing to use 14 and others used 10 or 100 as the denominator.

Q9 About one sixth of the candidates gave a full description of the rotation, with about a third leaving out some of the detail. Nearly a half used the wrong transformation or gave a combination of two transformations. The translation was carried out well but in describing the reverse process many omitted the word 'translation'.

Q10 There was a mixed response with nearly 40% multiplying the 4 and 3 and adding the indices, but many only did one of these correctly. About half the candidates knew to multiply the indices in (b) but many added in error.

Q11 Some did get as far as $6y \geq -3$, but then got 2 or – 2 or 18 or – 18. Some candidates changed the inequality sign to an equals sign but forgot to change back. Part (b) was very poorly answered.

Q12 Only about half the candidates seemed to be familiar with the topic of binary numbers, with occasional errors in working out and sometimes the answer of 105 in (b) being changed to 10.5 or 1.05

Q13 Only the best candidates made much progress at this level with algebraic rearrangement. Some tried to use arrows to indicate reverse operations but would have been better to take a new line for each step.

Q14 Most candidates gave three ways to make 7 with the dice and about 30% gave the reverse orders for full marks.

Q15 Only the very best candidates scored any marks on this final question. Most did not know that the line $y = 2x - 2$ had to be drawn, while some drew random lines, others started a table of values for the line and of those who drew the correct line, many read the coordinates as (0.8, 0.4) rather than (0.8, – 0.4).

Assessment Unit M6 Foundation Tier Calculator

Unit Overview

Again, almost all candidates made a good attempt at answering most of the questions and the overall response was similar to the non-calculator paper M6 1.

The questions on the map, the conversion graph, the construction of a triangle and finding the eighth term of a given sequence proved the most accessible. The locus question was more straightforward than the question in summer 2019 and proved more accessible, while better candidates produced encouragingly good responses to exchange rate, trial and improvement and nth term of a sequence questions. Changing miles to kilometres was the most noted disappointing response, given its straightforward nature.

Q1 This opening question was generally very well answered by many candidates, with some scale conversion errors by a few candidates.

Q2 Nearly all candidates could use the conversion graph directly for 30 stones, but in its use for 900 kg just over 40% used it correctly; about one eighth knew what to do but were not accurate enough in their reading or calculation, while the remainder did not know how to break down the 900 kg into manageable amounts.

Q3 Over 20% of the candidates completed this conversion from miles to km correctly, a few knew the conversion factor but calculated incorrectly, while nearly three quarters gained no marks for this straightforward conversion.

Q4 The triangle was generally well constructed with occasional errors in measurement or use of 'horizontal'. Just under 60% constructed the parallelogram correctly and just under 40% gained no marks for this part.

Q5 A large minority of the candidates correctly marked 0.6 as the required probability on the given scale in (a) while there was a full range of explanations, complete, partial or erroneous offered in (b).

Q6 An encouraging 45% of candidates completed this question correctly while only about 20% scored no marks at all. Most made some progress through the problem involving interpretation of holiday prices.

Q7 Three quarters of the candidates found the eighth term of the sequence and just under half explained why 5 could not be a term in the sequence.

Q8 About 35% of the candidates at this level were able to explain the idea of 'fair' in their own words, while over half the entry were able to calculate the required probability in (b).

Q9 Too many did not know how to start to use the given ratio or else divided by 4 or 5, while over half were able to answer the question correctly.

Q10 The simplest method of noticing from the instructions that 300 ml and 700 ml would make a litre was not noticed by many candidates. A large number divided 600 by 3 and 1800 by 7 but were unable to see the next step in the solution. This proved a much harder question than anticipated.

Q11 Many correctly enlarged rectangles were presented, with about 30% of the candidates using the correct centre of enlargement.

Q12 Many correctly converted 28 dollars to £, some correctly converted 25 euro to £ and about a quarter of the candidates did both and answered the question correctly.

Q13 Generally reasonable attempts were made by nearly 60% of the candidates at this trial and improvement question, with about a quarter of the entry including all the necessary steps.

Q14 Finding the nth term of the sequence proved beyond about half the candidates, but some realised $5n$ was involved and over 35% gave the fully correct answer.

Q15 Arcs of 5 cm radius were often drawn from P. Lines were often drawn 3 cm from QR. The top 10% of candidates did both and completed the shading to earn all three marks available.

Q16 Only the very best candidates interpreted the table thoughtfully and correctly although quite a few more were able to calculate the appropriate answer for (b).

Assessment Unit M7 Higher Tier Non-Calculator

Unit Overview

Overall, this was a good, well-balanced paper which clearly identified candidates' strengths and weaknesses. Candidates were able to pick up marks in parts of most questions and demonstrate their subject knowledge. Questions 2, 4, 6, 7, 10 and 12 were generally well attempted by many candidates while Questions 1, 11, 13, 14, 15 and 16 were only done well by the more able candidates.

Q1 Quite a challenging question to open the paper and a lot of work required for one mark. It was very poorly done with only the stronger candidates gaining the mark. A lot of candidates ignored the algebra element of the question and continued the sequence with numbers only. Others demonstrated very poor algebra skills.

Q2 All parts of this question were very well answered and many candidates got full marks.

Q3 It was clear from the marking that a lot of candidates were not aware that the sum of the interior angles in a polygon was based on the number of triangles with many not drawing the triangles. A lot of candidates did use $(n - 2)$ X 180^0 correctly to gain the marks.

Q4 The first three parts caused few problems but Part (d) proved to be a challenging question for many candidates with only a minority gaining full marks. A lot of candidates did not check that their answer was sensible with many answers given as fractions or numbers bigger than 30. A little more thought about their answers given might improve their marks.

Q5 There are still several candidates who do not understand what estimation means as they attempt to work out the answer using decimal multiplication and division. A surprising number of candidates were unable to calculate 600 ÷ 40 correctly with an answer of 150 quite often seen. A number of candidates incorrectly used 590 as their estimate for 593

Q6 Well answered but often not fully simplified. Most candidates gained some marks in this question.

Q7 The majority of candidates scored at least 1 mark in Part (a). Three marks indicates three key pieces of information required. Part (b) was usually correct. Some candidates lost a mark in Part (c) because they omitted the word 'translation'. Candidates who use vector notation to describe the translation must get the notation correct.

Q8 **(a)** Well answered by the majority. Where incorrect, the common wrong answer was $12y^{12}$

(b) Well answered by almost as large a majority. Where incorrect, the common wrong answer was m^9

Q9 This question was a good differentiator. In Part (a), many candidates gained the first mark for the $6y \geq -3$ but the majority had difficulty with dividing the -3 by 6 with -2 and -18 being commonly seen attempts. Also, a number of candidates used an equals sign throughout the question and failed to revert to an inequality sign at the end. Also, many candidates just wrote -0.5 on the answer line without the inequality. Part (b) was very poorly done, even if Part (a) was correct. A minority of candidates got the correct answer of zero.

Q10 Most candidates seem to have a good understanding of binary numbers. In Part (b) a few candidates were confused by use of the term 'decimal form' and thought that their answer had to have a decimal point which was fine if they wrote 105.0 but not if they wrote 1.05

Q11 Another good differentiator. The stronger candidates scored full marks here. A range of incorrect methods seen including giving answers of $m = H - s - r$ or $m = \frac{H}{r} - s$ Most candidates scored either 2 marks or no marks.

Q12 A relatively straight forward question in which the candidates gained at least one mark. Not giving the reverse order of the options was commonly seen.

Q13 A challenging question for most candidates. Only a very small number of candidates gained 4 marks. However, some candidates gained 2 marks for correctly drawing the straight line. A few good candidates got 3 out of 4 by mistakenly giving the coordinate as (0.8, 0.4). There were some attempts at solving the simultaneous equations by algebra which gained no credit.

Q14 Another poorly done question with only the strongest candidates scoring marks. -4 and 4 were very common answers. The vast majority of candidates did not know how to handle a negative index.

Q15 This was a difficult question on which only the more able candidates were able to score marks. A lot of poor algebraic skills were seen here which was disappointing. The majority of candidates did not know how to deal with the square root and gained no marks. A few knew to square the equation but only squared the y or the b instead of both.

Q16 Only the stronger candidates drew the line $y = -x$ and correctly reflected the shape. Many chose to reflect across the x-axis, the y-axis or the line $y = x$ and gained no marks.

Q17 In Part (a), many candidates correctly answered 15 with the most common incorrect answer being 8 seen quite often. In Part (b), about a quarter of the candidates got the correct answer of 40%. Some candidates were let down by their inability to express a fraction as a percentage correctly. 25% was a common wrong answer seen from those candidates who had got a wrong answer of 8 in Part (a). Some gave 60% instead of 40% and usually got 1 mark.

Assessment Unit M7 Higher Tier Calculator

Unit Overview

The paper allowed candidates of different abilities to answer questions and differentiated between them successfully. There were some questions in the second half of the paper that the weaker candidates struggled with (Questions 7, 13, 15, 17 and 19), whereas the early questions allowed candidates of all abilities to gain marks.

Q1 Part (a) was well attempted. Most common mistakes were giving the bearing from C as 307 or 053. Part (b) produced even more fully correct answers. There were some mistakes in converting using the scale.

Q2 In this question, lack of understanding as to what was being asked for was the biggest problem for a lot of candidates. Incorrect answers of 72° and 540° were seen too frequently.

Q3 This question proved good at differentiating the candidates. Many recorded 1 as a prime number and 2 as even only. There were many poor explanations evident. Only the best candidates used probability language in their explanation and there was quite a bit of misunderstanding of what a prime number is.

Q4 In Part (a), almost everyone managed to find the correct answer. In Part (b), quite often candidates did not state if Daniel was correct or not but did give a suitable explanation.

Q5 In Part (a), common wrong answers included stating that each number appears once or that there is not more than one of each number but there were many good attempts at explaining what 'fair' meant. Part (b) was done very well.

Q6 Some candidates did not apply the method of ratios correctly and a few mixed up the ratios, giving an answer of 288 but the vast majority of candidates gave the right answer.

Q7 This question proved to be one of the most difficult on the paper. A large number of candidates were unable to make a sensible start. It seemed that most could not understand that the lemonade could not be all used. Even the good candidates struggled to make any progress. Common wrong answers included adding the 1,800 and 600 to produce an answer of 2.4 litres.

Q8 This question was well attempted. Some candidates used the wrong centre while others had the top 2 corners correct but the bottom corners 1 square too far down but most scored full marks.

Q9 A very good question for the better candidates who knew when to multiply and when to divide. Many candidates multiplied both times when converting to pounds. A frequently seen wrong method was to multiply 25 by 1.09 instead of dividing, leading to £27.25 and an answer of £4.57 In this case only 1 mark was possible if the candidate had worked out £22.68

Q10 This question was generally very well attempted. Many candidates lost 1 mark for failing to test at $x = 2.55$

Q11 Generally done quite well with many candidates getting full marks. Common wrong answers included $n + 5$ or an expression starting with $3n$.

Q12 There were quite a few correct answers seen but many candidates only scored a mark for drawing the 5 cm arc. Difficulties arose when candidates tried to use two arcs or two straight lines. Many candidates found the 'more than 3 cm from QR' difficult to visualise. Several candidates had the correct method but lost marks due to a lack of accuracy.

Q13 This was probably one of the poorest attempted questions on the paper. The phrase 'relative frequencies **so far**' was just not understood as most candidates failed to check where the 3 relative frequencies given in the table came from. As a result, most gave the answer in Part (a) as 0.09 Regardless of this there were more correct answers given in Part (b) than in Part (a), with many candidates showing understanding of the concept of relative frequency.

Q14 Part (a) was done quite well. Common wrong answers had no minus sign in the index or no decimal point, as in 385×10^{-6} In Part (b), quite a number of candidates thought that they were being asked to write the answer as a decimal number as they believed it already was in standard form.

Q15 Only the top candidates managed any marks in this question. Many candidates showed a lack of understanding of graph work. In Part (a) using $x = 0$ was rarely seen. In Part (b) using $x = 2$ was not seen often enough and even if they knew the x coordinate was 2, they did not calculate the y coordinate correctly.

Q16 This question was poorly done. Answers of 10, 100, 1,000 were frequently seen. It appeared that most candidates were not sure what to do here. Perhaps they had not covered this topic.

Q17 Many candidates did realise that $\frac{4}{9}$ twice was required but unfortunately added them instead of multiplying them. $\frac{8}{18}$ was the most common wrong answer. $\frac{4}{9}$ was another common wrong answer.

Q18 Part (a) was generally well attempted but sometimes there was a lack of labels/ probabilities on all the branches. A few candidates wrote the day 2 probabilities incorrectly in sevenths. Part (b) was poorly answered. $\frac{15}{64}$ was a common wrong answer. Many candidates just did not understand how to attempt to answer the question.

Q19 There were a lot of good solutions to this question seen. However, despite the wording in the question, there were lots of trial and improvement attempts seen. Even if they got the equations, it was not uncommon for them to resort to a trial and improvement method to solve the equations.

Assessment Unit M8 Higher Tier Non-Calculator

Unit Overview

This proved a well-structured paper which allowed candidates of differing abilities to respond positively to the questions posed. Even the weakest candidates were able to attempt many questions, although it appeared that a number of candidates may have been more suited to entry at a different level. There was no indication that candidates did not have sufficient time to complete the paper. The standard of answering was generally very good.

Q1 **(a)** There was a very good response to this question with most candidates multiplying 4 and 3 and adding the indices for y.

(b) A majority of the candidates gained full marks for this second indices manipulation.

Q2 **(a)** Generally reasonably well answered but many solved as if an equation, but did not revert to an inequation for their answer.

(b) Not so many recognised that 0 was the smallest integer greater than or equal to $-\frac{1}{2}$ but a significant minority gained the mark available.

Q3 Most candidates were confident in dealing with binary numbers.

Q4 Generally well answered with good algebraic rearrangement.

Q5 A majority of the candidates drew the correct line and about half of these candidates then read the point of intersection correctly to solve the equations.

Q6 This question was very well answered with a minority of candidates only listing three of the required six ways to total 7.

Q7 About three eighths of the candidates took notice of or understood the meaning of the negative index –2, a common answer being 4.

Q8 Again, about three eighths of the candidates gained full marks for the algebraic rearrangement, with the common error being not to square all the terms involved.

Q9 This reflection question was very poorly answered by more than half the candidates with only a minority correctly drawing the line $y = -x$ before attempting to reflect the shape.

Q10 **(a)** This was very well answered.

(b) This part was answered correctly by the better candidates.

Q11 **(a)** Several valid methods were used by candidates to rationalize the denominator.

(b) Many candidates expanded the square correctly and simplified it to the correct value.

Q12 **(a)** Generally the curve was sketched well, but with many taking 2^0 as 0.

(b) Most candidates realised that the value of y increased, but were not specific enough to say that it doubled.

(c) The graph was generally well followed through from Part (a).

Q13 Few candidates attempted a logical step by step simplification of the expression, trying instead to deal with all indices at once.

Q14 This question was generally well answered with a minority assuming the first badge was replaced before the second one taken.

Q15 Most candidates identified at least two irrational numbers correctly, but often chose a third which was rational. Half the candidates gained full marks.

Q16 The better candidates calculated the gradient of the radius correctly, but only the stronger of these realised that the origin lay on the line OP. The very best completed Part (c) correctly.

Assessment Unit M8 Higher Tier Calculator

Unit Overview

This proved to be a fair paper in which all candidates were able to access marks in the lower grade questions and there were plenty of straightforward questions testing knowledge acquired by most of the entrants. The last four questions were intentionally pitched at a higher level and only the top candidates achieved marks in these questions, which clearly differentiated between candidates. Many candidates failed to grasp the basic requirements of these questions, for example, in Question 11 that the triangle was not right angled, while Question 13 proved by far to be the one where most candidates had no idea how to begin.

There was quite a range of marks achieved by candidates; in a few cases, there were very low marks but also some very high marks indeed. Overall most candidates attempted all questions with only a small number of blank spaces.

Q1 This trial and improvement question was well answered with only a minority failing to test an intermediate value.

Q2 Most candidates found the correct expression for the nth term of the given sequence.

Q3 This locus question was generally well answered by candidates at this level of entry.

Q4 **(a)** Those who read the table thoughtfully were able to calculate the missing relative frequency so far.

(b) Many candidates realised that the answer in (a) should be used in (b), and then calculated the required relative frequency correctly.

(c) They also continued to multiply this correctly by 15,000 in (c).

Q5 **(a)** The decimal was usually correctly written in standard form.

(b) A minority wrote their answer in decimal form rather than standard form.

Q6 **(a)** Finding the y-intercept was reasonably well done, although brackets for coordinates were often omitted.

(b) Nearly as many could find the highest point on the curve.

Q7 A majority of the entry realised that the factor would be squared.

Q8 The algebraic simplification in both parts of this question was generally well done by over 40% of the candidates, with more picking up part marks in (b) than (a).

Q9 The tree diagram was consistently completed sensibly in Part (a) and then used to answer Part (b).

Q10 An encouragingly good response was offered to this simultaneous equations problem.

Q11 Just under half the candidates recognised the need to use the cosine rule to calculate BD first and were then able to calculate the area correctly.

Q12 This three-dimensional trigonometry question proved a good discriminator, while allowing most candidates to score some marks. Many candidates recognized the need to calculate the angle EAD using the given lengths. Less were able to calculate another length needed to find the angle EBD.

Q13 Disappointingly few candidates moved from $\frac{16}{25}$ as a factor for area to $\frac{4}{5}$ as the factor for length and hence could not proceed to volume.

Q14 Many started well to find that $y = \frac{120}{x}$ the stronger candidates then solved $x + 7 = \frac{120}{x}$ successfully.

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