GCSE

Rewarding Learning

Chief Examiner's Report

Mathematics

Summer Series 2018

Foreword

This booklet outlines the performance of candidates in all aspects of CCEA's General Certificate of Secondary Education (GCSE) in Mathematics for this 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 microsite on our website at www.ccea.org.uk.

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GCSE MATHEMATICS

Chief Examiner's Report

Very few centres entered candidates for the new specification examinations in the summer of 2018. The papers in the new format were accessible to a wide range of candidates and it was encouraging to see some very good responses.

Assessment Unit M1 Foundation Tier

Paper M1 covers grades G to D whereas the T1 paper it replaces examines grades G to E. Consequently, as expected, many candidates found the paper challenging. The majority of candidates completed all of the paper in the time allowed and most were able to attempt questions throughout the paper. The paper was constructed to allow candidates to be differentiated across the ability spectrum and partial marks for appropriate method and understanding were awarded in many questions. The new specification places increased emphasis on functional mathematics at this level and it will take time for candidates to adapt to this change. The language used throughout the paper seemed accessible to candidates. It was pleasing to note that a large majority of candidates had access to, and used, a ruler and protractor. Although this is a calculator paper a number of candidates are clearly not using a calculator in questions where it would be beneficial, even as an aid to check their answers and work. At this level it sometimes appears as if pupils either lack confidence when using a calculator or think it is somehow better to perform calculations without one.

Comments on individual questions follow.

Q1 The majority of candidates understood how to interpret a pictogram and those candidates who correctly identified what each symbol represented generally scored at least three of the available marks. A minority of pupils misinterpreted the key but follow through marks were often awarded. Part (d) was misinterpreted by many candidates who simply assumed 160 litres of undercoat were sold and drew 16 symbols.

Q2 In Part (a) a majority of candidates were successful in producing a straight line of the required length. Part (b) was less well done with many candidates not understanding how to convert a decimal number of centimetres into millimetres. Some of those knowing that 1 cm is equal to 10 mm were unable to correctly multiply the given decimal number by 10. There was evidence that some candidates measured the line they had drawn and correctly converted it to millimetres but unless their answer was 117 they were not awarded the mark.

Q3 Most candidates were successful in working out the plumber's cost in Part (a) for the job in this real-life problem. A common incorrect response was £135 where candidates added the call-out charge to the hourly rate before multiplying by 3, showing a lack of understanding of the order of precedence. Part (b) was not as well answered as expected with a sizeable number of candidates dividing their answer to Part (a) by 3, thus incorporating one third of the call-out charge into the plumber's hourly rate.

Q4 It was clear that candidates understood how to find the mode with few incorrect answers seen. However, in Part (b), only half of the candidates were able to change a straightforward fraction into a percentage.

Q5 Candidates showed a good understanding of how to calculate a weekly wage and the correct response of £274.75 was the norm. Incorrect money notation was occasionally seen with candidates answering £274.75p. Some candidates attempted to multiply 7.85 by 35 by using long multiplication, suggesting they either did not have a calculator or preferred not to use it. At this level few candidates were able to successfully multiply the given decimal hourly rate by 35 without a calculator. In Part (a)(ii) the majority of candidates, disappointingly, were unaware that there are 52 weeks in a year. This is basic functional knowledge at this level. A common incorrect response was £13188 which saw candidates assuming 4 weeks in a month which led to 48 weeks in a year. They then multiplied their 48 weeks by 274.74 Other incorrect responses included multiplying the hourly rate by 365 leading to an answer of £2865.25, multiplying the weekly rate of 274.75 by 365 leading to an answer of £100283.75 and multiplying the weekly rate by 12 leading to an answer of £3297 Parts (b) and (c) were very well answered with the majority of pupils gaining the available marks for writing an amount of money in figures and rounding a different amount to the nearest hundred. Some candidates answered 200 rather than 5200 when rounding 5227 to the nearest hundred while others answered 5000 by rounding to the nearest thousand.

Q6 Roughly one eighth of candidates were able to correctly identify the given polygon as a hexagon. Candidates were more successful in Part (b) with over two-fifths gaining the available mark for counting the number of right angles. In Part (c) a significant majority of candidates were unable to split the hexagon into two trapeziums.

Q7 This was generally a well answered question with many candidates awarded the full 3 marks. In Part (a) some candidates correctly calculated the total cost of the ordered items but failed to complete the question by working out the change due from £5. Pupils should be encouraged to reread questions once they have their answer to ensure that they haven't missed any important information. A small number of candidates used incorrect money notation in their answer, presumably writing down their calculator display of 1.1 Quite a number of candidates were awarded a follow through mark for correctly taking their incorrect total away from £5. Part (b) was more challenging but it was pleasing to see so many correct responses with more than one third awarded the available mark. Candidates, in many cases, persevered with the problem set and tried out a number of combinations before arriving at their answer.

Q8 Few candidates were awarded full marks for this problem involving factors and products. A significant number of candidates, however, gained 1 mark for identifying factors of 14 and 15 but many pupils seemed unfamiliar with the term **product**.

Q9 In Part (a) the majority of candidates failed to recognise the incorrect unit of volume given. Many based their answers on the diagram itself and showed poor understanding of the problem. Common incorrect responses included references to hidden cubes or the fact that there is more than one face on each cube. Part (b) was much more successfully answered with many correct front elevations drawn. For those not gaining full marks a large number of candidates were able to access one mark for a partially correct solution of 4 correct squares.

Q10 Candidates who used the fact that 72 days is 10 weeks and 2 days were successful in this question but this approach was only seen in a minority of responses. A variety of alternative approaches were seen which often led to incorrect answers gaining one method mark. A number of candidates arrived at their answers using inefficient methods such as writing out 72 separate days or recording 72 tick marks.

Q11 The majority of candidates correctly listed the coordinates of the centre of the circle in Part (a) though some candidates transposed these co-ordinates as (1, 2). In Part (b) it was evident that a significant number of pupils had difficulty drawing a diameter from a listed point. One mark was awarded to a large proportion of the cohort who correctly identified the given point, P on the circle but failed to draw the correct diameter or did not attempt to draw a diameter. A common incorrect response was to see a line from the given point, P drawn through the centre of the circle and stopping at (2, 0) on the horizontal axis. Most of the candidates producing the correct diameter gained the mark in Part (c) for listing the co-ordinates of Q though it was noted that a sizeable number of candidates who had not drawn the diameter were still able to access this mark.

Q12 The vast majority of candidates gained at least one mark for writing the temperatures in order with many gaining both of the available marks. Few responses were awarded no marks. For candidates not awarded full marks it is not clear whether pupils were confused by the term **ascending** or if they were unable to identify –11 as the smallest of the negative numbers. Parts (b) and (c) were very well answered and most candidates were awarded full marks. A common incorrect response in Part (b) was –3 rather than 3 for how many degrees warmer one city was than another. In Part (c) a common response of –10 was accepted for the difference in temperature between the given cities.

Q13 In Part (a) almost all candidates recognised that oil was the fuel used most in the pie chart and almost half were able to measure the required angle in Part (b) accurately with a protractor. Parts (c) and (d) proved more challenging. Part (c) required an explanation as an answer but acceptable reasons were rarely provided and many candidates appeared to be confused by what was being asked. Some simply stated that about one quarter of the pie chart was left after oil and natural gas were removed. Others correctly added the required percentages to 76.5% but then failed to change three quarters into 75% and make an explicit comparison. In Part (d) roughly one fifth of candidates were able to provide the correct approximate fraction $\frac{1}{3}$ for $\frac{renewables}{electricity}$.

Q14 Part (a) was answered well by most candidates but again some lost the second mark by not completing the question by subtracting their total from 70 million. A follow through mark was awarded to candidates with incorrect totals who then correctly subtracted from 70 million. In Part (b), where an explanation was required, the majority of candidates again struggled to gain full marks and only the strongest candidates were awarded both of the available marks. Some gained 1 mark for finding 10% of 70 million correctly but failed to produce the total population of NI and ROI as 6.5 million and make the required comparison. Most candidates failed to show an understanding of the question and there were a number of blank responses seen.

Q15 Just under half of the candidates were able to use their understanding of angles at a point to calculate the missing angle, x, in Part (a). There was evidence that some candidates used their protractor to measure the angle despite being told that the diagram was not drawn accurately. A common incorrect response was 105° where pupils subtracted 75° from 180° rather than from 360°. Most candidates were unable to identify the parallelogram as the correct quadrilateral with rotational symmetry of order 2 in Part (b) and only the better candidates (or those who guessed luckily) gained the mark. In Part (c) where candidates were asked to find the number of cubes fitting into a box and the perimeter of its top face, just over one third of the cohort correctly found the volume and one quarter the perimeter. Some candidates added the three given dimensions when attempting to calculate the capacity of the cuboid rather than multiplying them. A number of candidates were fortunate that an answer of 18 resulted from multiplying 6 by 3 when finding the perimeter of the top face.

Q16 In Part (a) the majority of pupils applied the correct method and divided 179 by 7 to find the average amount raised but many failed to round correctly to one decimal place as instructed and lost the second mark as a result. In Part (b) it was pleasing to note that the concept of finding the median was understood by many candidates, although just over one quarter received the full 2 marks while many others gained one mark for correct method. Some candidates ended up with seven values in order, rather than the eight given, while others were unclear what was expected when they were left with two values in the middle. A small minority of candidates failed to order the values and a smaller number still calculated the mean of the given amounts. The majority of candidates failed to understand what was required to gain the mark in Part (c). Answers were often left blank and 'mean' was a common incorrect answer, perhaps suggesting that candidates viewed the manager's wage of £850 as an extreme value, which does affect the mean, but in this case is not the answer which affects it most.

Q17 Although some candidates were able to produce both prime numbers in the 60s the majority of responses to Part (a) were incorrect. A significant number of candidates were awarded 1 mark for one correct prime but it was clear that a large proportion of the cohort were unsure of primes and incorrect responses showed even numbers, numbers less than 60 and numbers greater than 70. In Part (b) a common incorrect response was to circle both 16 as a square number and 64 as a cube number and leave the answer line blank or write down both numbers. Better candidates gained the mark although it was surprising to see a number of blank responses. Just under one third of responses to finding the square root of one million in Part (c) were correct, with pupils either recognising that one million is one thousand thousands or using their calculator's square root button appropriately.

Q18 This question on expressions proved very difficult for pupils at this level. Clearly many candidates did not understand either what was meant by an expression or how to form an expression from a written statement. Only stronger candidates were able to access any of the 4 available marks spread throughout the question's three parts. Common mistakes included giving numerical answers which were based usually on 30, using poor algebraic notation, such as 'b2' or 'h4' in Part (c), including '=' with their expressions and answering 'h- $\frac{1}{2}$ ' in Part (b). Many candidates included units in their answers but were not penalised for this.

Q19 This question on packaging was well answered with the majority of responses gaining at least one of the three available marks and a significant number gaining full marks. Candidates attempted to solve the problem using a variety of approaches, most of which were valid. Some candidates, despite producing 147 tubes or 48000 cm^3 and 47040 cm^3, confused themselves in the process and answered 'yes', again stressing the importance of rereading questions to check the reasonableness of answers.

Q20 Most candidates attempted the two-way table and there was a significant number of completely correct responses. Of the incorrect responses seen many gained 1 mark for a partially correct solution. Part (b) was less successful with few correct responses. Candidates seemed confused by the column headings and were mostly unable, even with a correct table, to infer that 'weekends' comprised of 'weekends only' and 'both'.

Q21 Better candidates generally had no problem with either part of this question on angle theory associated with a triangle. However, it was clear that many candidates lacked the knowledge required to calculate the marked angles. There was evidence that some candidates used a protractor to measure at least one of the angles despite being advised that the diagram had not been drawn accurately. Some candidates worked with an angle sum of 360° rather than 180° for the triangle. Candidates were, on occasion, unable to identify the correct equal angles inside the isosceles triangle

and gave an answer of 70° for x. Others subtracted 70 from 180 and failed to divide their answer by 2 giving an answer of 110° for x. Although overall understanding in Part (a) was disappointing it was encouraging to note that many candidates recognised the fact that angles on a line sum to 180° and were able to access a follow through mark in part (b).

Q22 Both parts of this question were found to be challenging with only the strongest candidates able to access the marks available. In Part (a) about one third of the cohort were able to correctly write $\frac{3}{8}$ as a decimal. A common wrong answer was 0.38 which may have resulted from inappropriate rounding or more likely a confusion of the method and the fact that 3 and 8 formed the given fraction. Part (b) saw few completely correct responses but 1 mark was awarded to a minority of candidates for the use of correct method or for giving rounded answers. A common incorrect answer was 1.44 which came from poor method (9 ÷ 100 × 16). Quite a large number of responses were left blank.

Q23 Most candidates were unable to calculate the area of the triangle presented in this practical context. Common incorrect responses included 17.28 with candidates failing to divide by 2 and 8.4 where they simply added the given side lengths.

Q24 Candidates who understood the key generally coped well with Parts (a) and (b) of this stem and leaf question. It was pleasing, at this stage of the paper, to see so many correct responses in Part (b) for the median and range. The quality of response in Part (c), however, where a written comparison was required, was very poor. Few candidates were awarded both of the available marks and the majority gained no marks. A common incorrect response saw pupils state the four values without reference to the range or median being higher or lower between 1975 and 2015. Others stated that men live longer now and cited reasons such as better medicine and healthier lifestyles.

Q25 A challenging question at this level but many candidates were awarded two of the three marks for their method and over half the cohort were awarded at least one mark. Few candidates were awarded full marks with the mixed units proving to be the main difficulty. A small minority of candidates failed to multiply the call charge by 385 and there was clearly some misunderstanding of the information given in this real-life problem as some candidates multiplied the line rental by the call charge.

Q26 A straightforward question on alternate and corresponding angles which about one quarter of the cohort answered completely correctly. There was evidence that some candidates again ignored the 'diagram not drawn accurately' information and measured the angles with a protractor.

Q27 This question challenged candidate understanding of square roots and using a calculator efficiently. Better candidates produced the correct answer and many incorrect responses gained 1 mark for appropriate method. There were a number of blank responses which may suggest that some candidates did not have access to a calculator. Some candidates failed to understand what the square root symbol meant and simply ignored it.

Q28 About 60% of candidates showed understanding of how to plot points on a scatter graph but marks were consistently lost with inaccurate plotting of one or more points, despite favourable scales on both axes. A number of candidates failed to recognise that each square on the vertical axis represented 2 marks while others misplotted all of the points on the right side of the graph.

Q29 The algebra in this question, like in Question 18, proved difficult with very few correct answers seen and there were many scripts with blank responses for either one or both parts of the question. In Part (a) some candidates who knew how to approach the problem lost marks through careless expansion of the brackets with $3x + 2$ and $5x - 1$ being the most common mistakes. In Part (b) it is clear that the majority of pupils at this level cannot factorise. Some candidates who had understanding of the concept of factorising identified their common factor as 4 rather than 2 and were not awarded the available mark.

Q30 This structured question in context proved to be more challenging to candidates than anticipated. Only a small minority of candidates gained all 6 available marks though a large number did access at least 1 mark for their method or through the award of follow through marks. A common incorrect answer to Part (a)(i) was 1440 which gained one method mark. A mark was often awarded in Part (a)(ii) for correct multiplication of incorrect answers to Part (a)(i) by 60p. Follow through marks were rarely awarded in Part (b) and blank responses were prevalent. Few candidates, aside from those who gained full marks, produced £750, the price Pat paid for the crisps.

Assessment Unit 2 Foundation Tier

This new assessment unit was taken by candidates for the first time and it was pleasing to note that the vast majority made a good attempt at the whole paper. There was little or no evidence of candidates having insufficient time to complete it, which may be largely due to the additional 15 minute time allocation.

It was disappointing that some centres appeared to enter candidates for this unit who should have instead been entered for Unit M1. Those candidates struggled with large parts of the paper and scored very few marks in the grade D and C material.

There was evidence of poor performance in questions on some of the topics that were not previously examined on T2, such as real-life interpretation of gradient and Venn diagrams.

There was much more of an emphasis on functional mathematics in this unit and the majority of candidates made a good attempt at those questions, picking up part marks even where they had failed to obtain a fully correct answer.

It was pleasing to note the quality of some of the responses to questions requiring candidates to explain their answers, with many demonstrating good ability to communicate in a mathematical context.

Q1 Part (a) proved to be a reasonably difficult opening question, with the majority of candidates unable to find the correct answer. This was disappointing as even if they had (incorrectly) counted each incomplete square as a half, they would have obtained the correct answer. Similarly the correct answer would have been obtained by adopting the 'if it's more than half count it, if it's less than half don't' approach.

The vast majority of candidates were able to draw the correct line in Part (b), with only a few opting for an incorrect horizontal line.

Q2 The main issue in Part (a) was candidates writing the temperatures in descending order. In a few cases the negative signs were ignored and candidates gave an ordered list of positive numbers.

The most common error in Part (b) was to give the answer as '−3', which was not accepted. Candidates should realise that '−3 warmer' actually means '3 colder'.

Almost all candidates answered Part (c) correctly, with '10' and '−10' both accepted.

Q3 A useful starting point for candidates would have been to plot the midpoint on the diagram provided (although no credit was given for this), but there was little evidence of this being done. In some cases, candidates gave 2 values for x and y in their answer, by simply halving each of the x and y values given.

Q4 Part (a) proved to be straightforward with very few incorrect answers seen, although a third of candidates were unable to measure the angle in Part (b).

In Part (c) candidates failed to realise the significance of the word 'explain'. Some talked vaguely about the angles adding up to roughly three quarters or 270°, giving no detail. Many correctly stated that the angles added to 76.5°, but did not explain that Sean was correct as three quarters is equal to 75%.

The most common incorrect answer in Part (d) was 4, perhaps because candidates rounded to $\frac{5}{20}$, or simply tried to do it by inspection.

Q5 Most candidates secured at least the method mark in Part (a), with the majority going on to obtain the correct answer. There was some evidence that candidates did not use a calculator, as basic arithmetical errors were seen in pencil and paper additions.

The most common approach to Part (b) was to add 4.6 and 1.9 to get 6.5 This in itself got no credit unless they went on to compare this to 7, which was 10% of 70. A significant number chose to work out 6.5 as a percentage of 70 and this generally led to full marks more often than the first method.

Q6 The most common incorrect answer in Part (a) was 105°, with candidates taking the total as 180 rather than 360.

Part (b) saw a variety of answers with 'kite' quite common.

Part (c)(i) was generally well done with the majority of candidates realising that the question was effectively asking for the volume of the cuboid. A small number obtained their answer by adding the 3 dimensions.

There was evidence in Part (c)(ii) that candidates were unable to identify the dimensions of the top face.

Q7 The difficulty in Part (a) was caused by the fact that the number of wages was even. The majority of candidates secured the first mark for ordering, but some were unable to go any further. A small number of candidates appeared to spend a significant amount of time working out the mean.

While it appeared that many candidates knew the mode would not change, there was evidence that Part (b) involved quite a bit of guesswork, with various combinations appearing often.

Q8 This was generally well answered, with a significant number of candidates obtaining full marks. In general the mark awarded was either 4 or 0, as those who went wrong did so by doing the operations in the wrong order and received no credit.

Q9 In Part (a) the numbers 63 and 69 appeared with disappointing regularity, while Part (b) saw 36 appear a number of times, perhaps because it was divisible by 3, rather than being a cube number.

Candidates who got to 0.375 in Part (c) and then rounded to 0.38 gained the mark, although such rounding is to be discouraged as it not appropriate in cases like this.

Part (d) was not well answered, with little evidence of the realisation that the answer should start off as $\frac{9}{16}$

Q10 This question served to highlight weaknesses in algebraic skills, with a disappointing number of candidates unable to answer even Part (a) correctly. A common incorrect response in Part (b) was h – $\frac{1}{2}$

When attempting to 'multiply out a bracket' in Part (c), many multiplied either the *b* or the 30 by 4, but not both. It was pleasing that a small number of candidates were able to follow through their earlier incorrect responses.

Q11 There were many good responses here, although candidates should be discouraged from giving an 'embedded' solution such as 5 × 4 + 4 = 24 as this does not receive full marks. The solution is $x = 4$.

Q12 This functional question was very pleasing indeed, with the majority of candidates securing full marks and only a small number receiving no credit at all. The most common approaches were to compare 47040 with 48000 or to compare 147 with 150. In a small number of cases candidates had all the working correct, only to say 'yes' instead of 'no' on the answer line. This could be used to highlight the importance of checking through the paper once they have finished.

Q13 Part (a) again highlighted the importance of checking work for errors, as many of the responses given simply did not add up, which could have been spotted with a simple check.

The answer for Part (b) could have been obtained from the information already given, so should have been correct regardless of the responses given in Part (a). It was clear that many candidates failed to realise that 'weekends only' and 'both' needed to be counted.

Q14 From a financial capability perspective, it is disappointing that a significant number of candidates are unable to distinguish between working in pence and pounds. Many obtained the 2233p for working out 5.8p × 385, but made either an incorrect attempt or no attempt at all to convert this to £22.33

Q15 Most candidates showed some working for Part (a), but a disappointingly small number obtained the correct answer in this straightforward question.

In Part (b) some were able to correctly follow through by subtracting their earlier incorrect answer from 180.

Q16 Parts (a) and (b) were generally correct, with (b)(i) causing some difficulty due to the fact that the number of leaves was even.

In Part (c) many candidates chose to talk about 'life expectancy' rather than realising it could be compared in 2 ways, by comparing the median and the range. Some spent time working out the differences, but did not compare them by indicating whether they had risen or fallen in the time period.

Q17 This was a straightforward question which was generally correctly answered. Some candidates attempted to do some calculations, failing to spot that they were simply asked to 'write down' the answers.

Q18 It was pleasing to note that many candidates were able to use their calculator effectively to obtain the correct answer. Some picked up the method mark for indicating the values of the top and bottom lines.

Q19 It was disappointing in Part (a) that some candidates gave a non-integer value for the number of packets of crisps sold. Some found 80% of either 30 of 48, failing to realise that they needed to multiply those values first. In most cases candidates picked up the first mark for getting the total number of packets, even if they could not then find the 80%.

In general candidates correctly worked out the selling price for their number of packets, although some lost the final mark for using incorrect money notation.

In Part (b) many candidates secured the first mark for getting the cost price of the crisps. Those who had a good understanding of this question set their work out neatly and clearly, enabling them to determine whether a profit or a loss had been made.

Q20 Given that this question asked for very simple points to be plotted, it was hugely frustrating to note the level of inaccuracy shown by many candidates. They seem to be under the impression that as long as they put an x anywhere close to the correct point they will be awarded the marks.

Some of the best fit lines given in Part (b) were well out.

Accuracy issues arose again in Part (c), with many candidates reading off an incorrect value.

Q21 It was evident that once candidates saw the right-angled triangle, they assumed it had something to do with Pythagoras' Theorem. Despite the fact that Part (a) clearly asked for area, many chose to complete the Pythagoras calculation here rather than in Part (b).

Those who attempted the Pythagoras calculation generally got it right, probably helped by the fact that the answer was a recognisable square root.

Q22 Most candidates secured the first mark for working out the increase of £396. After that there were many who incorrectly used £2796 rather than £2400. Some got the 0.165 on their calculator, but failed to correctly convert it into a percentage.

It was interesting to note the number of candidates who used the alternative method of $\frac{2796}{2400}$ = 116.5 and picked up at least the first 2 marks.

Q23 This question was perhaps the most relevant functional question on the paper, but was very poorly answered indeed, with many candidates appearing not to know the difference between simple and compound interest. Some got the £140, but then simply multiplied by 3 and added on £420.

Those who performed a single calculation using their calculator, experienced most success, with errors creeping into the work of those who worked out each the total at the end of each year.

The difficult interest rate of 1.75% did not appear to be the cause of the problem with the question, nor were there any issues with the final rounding, as many of the candidates correctly realised they needed to give the final answer to 2 decimal places.

Q24 It was disappointing to see that a significant number of candidates used the formula for the area of a circle, despite area not being mentioned in the question. There was also evidence that some did not realise that putting the semicircles together gave them a full circle, meaning they completed unnecessary working.

This question was useful for differentiation between candidates, with some excellent responses seen.

Q25 Despite the fact that a very similar question had been published in the specimen assessment materials for this unit, it was clear that the vast majority of candidates had no idea how to find the gradient of a straight line.

Some made a reasonable attempt in Part (b) to explain their answer in context, but this was impossible for the large number who left Part (a) blank.

Parts (c) and (d) were much more straightforward and generally well answered by those who had some understanding of the question.

Q26 Again this question was adapted only slightly from the specimen paper, but was very poorly answered. In Part (a) most gained the mark for showing 7 in the central overlap, although a worrying number used tally marks, dots or crosses and failed to insert numbers.

The final statement in Part (a) was rarely understood. Despite the fact that it was clearly different from the others, most candidates simply inserted the 11 in the same way as before, not realising that the 7 needed to be subtracted.

It was hugely disappointing in Part (b) that many candidates simply inserted the 36, 48 and 33 into the diagram, despite the fact that these clearly added to more than the total of 80.

Part (c) was followed through, but could only be successfully attempted by those whose values did not exceed 80.

Q27 A small number of candidates realised that the total was 45 and was equivalent to $5x + 20$, but few were able to show convincingly how they obtained their answer.

Assessment Unit 3 Higher Tier

Overall there was a very encouraging performance by candidates in the first sitting of this paper on the new specification. Most questions elicited responses from the majority of the candidates, giving a wide range of results. There was no evidence of candidates running short of time. There was a range of ability and understanding shown by the candidates, the best of whom demonstrated knowledge of the content right across the new specification. The questions provided scope for differentiation and the grades achieved should therefore reflect on the ability of the entrants. The language used appeared generally accessible to most. Candidates generally produced methodical working out and neat presentation so that part marks could be awarded even when complete solutions had not been achieved.

Comments on individual questions follow.

Q1 Most candidates were able to identify the two prime numbers between 60 and 70 and select from a list of five the number which is both a square and a cube number. Nearly as well answered was the writing of three eighths as a decimal, although when writing £9 as a percentage of £16, some decided incorrectly to round to one or no decimal places.

Q2 Writing algebraic expressions for the costs after sale reductions was completed very well, although there were occasional errors in multiplying the two expressions by 4 in Part (c).

Q3 The simple algebraic equation was generally solved accurately at this level.

Q4 This question on how many small cuboids would fit into a large one was extremely well answered on this paper.

Q5 Candidates generally completed the two-way table successfully, although an incorrect answer of 5 was often misread from the table in Part (b) by interpreting ‘weekends’ to mean ‘weekends only’.

Q6 Most candidates made a good attempt to calculate the phone bill, with the mistakes by a minority being in conversions from pence to pounds.

Q7 The calculation of the angle in an isosceles triangle and then exterior angle were tackled very successfully. The most common error was in taking 360° as the sum of angles in a triangle. Similarly most candidates recognised the alternate and corresponding angles in the third part.

Q8 A significant majority of the candidates interpreted the stem and leaf diagram correctly. When asked to compare the results with those for a previous year, it was surprising how many candidates did not use the median or range in their answer.

Q9 On the whole, this question was poorly answered. Many candidates used an incorrect formula to calculate the circumference of one circle or the sum for two semicircles. There was confusion in determining how to make up a lap of the track. Finally many candidates took 10km as 1000m.

Q10 Most candidates worked their way through this complex profit and loss problem. Many completed it correctly. Some ignored significant information, such as the number of boxes, a mistake which should have been noticed as decimal answers began to appear in the working out. Nonetheless most persevered and gained some marks from the question.

Q11 This scatter graph question was generally well answered, with good lines of best fit drawn. There was a tendency by weaker candidates to read on a grid line even when the answer was clearly midway between two lines, so that an answer of, for example, 53 was appropriate rather than 52 or 54.

Q12 Many seemed unaware that the inclusion of x in the table of values, and the instruction to calculate x, was a strong hint that algebra would be a useful tool. This question differentiated across the entry.

Q13 Most candidates were able to work out the area of the flowerbed and also use Pythagoras' Theorem to calculate the length of the fence. A few mixed up area and length and some forgot to divide by 2 for the triangle area.

Q14 An encouragingly high percentage of candidates were able to calculate the percentage increase although a minority naturally mistook the increased value as the denominator to be used.

Q15 The solution of this equation was generally well started with the expansion of the bracket, but errors in rearrangement of terms were common.

Q16 Many candidates made a good attempt to answer the compound interest question. When using year on year calculations, the most common errors were in using 17.5% or 0.175% in place of the given 1.75%. When using the formula with indices the most common errors were similarly using 1.75 or 1.175 or 1.00175 in place of 1.0175.

Q17 This proved a most challenging problem. Those who used one third of 'the rest' were generally successful, but too many could not identify the rest as being 60%.

Q18 The many candidates who started with the correct formula for the area of the circular base correctly calculated the volume in cubic centimetres and were often able to convert this answer into litres as requested.

Q19 Better candidates took the hint and used the 'x'. Many gained a mark for sight of $2x - 1$ or 21, but only the best combined these two ideas to solve the problem algebraically. Trial and improvement attempts were also sometimes successful.

Q20 While most recognised that the mode was the most suitable average to use in Part (a) and explained why, not so many realised that the median was the most suitable for Part (b) and few of them were able to explain why, not mentioning the extreme value.

Q21 Those who realised the link with lowest common multiple solved this timetable problem easily, with a variety of ways of showing their work, often very efficient. A few could only try to link the information with their own school timetable, usually to no avail.

Q22 This fractional equation with three numerical denominators proved too challenging for many candidates at this level, as would be expected. There was an encouraging minority of well laid out solutions by strong candidates.

Q23 Solutions to factorising the quadratic were disappointing.

Q24 This question differentiated well. Many candidates recognised the need for trigonometry in the first part, some recognised that cos should be used (or even tan followed by Pythagoras) and some of these calculated the hypotenuse correctly. Some continued to use 53.13° as the angle in the square, but a minority were able to use trigonometry or Pythagoras to complete the question correctly.

Q25 In this testing first part, better candidates calculated the diameter of the circle and/or the area of the triangle correctly and a few used these two values correctly to gain the full marks. Many were able to use the stated area value in Part (a) to correctly calculate the force in Part (b) given the pressure. On the whole it was encouraging to see the attempts made at this last question and particularly the understanding of pressure as a new topic on this new specification.

Assessment Unit 4 Higher Tier

The performance by candidates on this paper was poor in general. There was wide coverage of the M4 Specification content in a variety of contexts. There was a vast range in pupil performance, with indications that some candidates had been entered for the wrong tier or had been entered for the examination too early (perhaps in Y10). At the other end of the spectrum there were also some very strong performances. There were enough straightforward questions to enable weaker candidates to still experience success across a range of topics, with approximately 25% of the paper now containing C grade questions. There were also challenging questions (25% A*) to stretch and distinguish the better candidates. Topics which showed success include percentages, factorising and basic linear equations. The presentation of pupil work was generally of a poor standard, however, most candidates showed working out for all questions and this enabled candidates to obtain partial marks if they made mistakes. Questions 1-4 were answered very well in general – the topics in these questions were percentages, linear equations and circumference of a circle. Questions which were challenging and were answered with varying levels of success included Question 19 – formation and solution of a quadratic equation, Q20(a) – simplifying an algebraic fraction using factorisation, Question 20 (b) – expanding an algebraic identity to find constants, Question 21 – solving an algebraic fractional equation, Question 22 – finding the equation of a perpendicular line, Question 23 – problem solving question involving frequency densities and interquartile range. However, these questions did differentiate between the very best candidates. Question 14 also showed that basic trigonometry was a problem for quite a few candidates. Questions requiring reasoning were troublesome for many – in particular Question 16 – reasoning for circle theorems and Question 18 – reasons for using stratified or random samples.

Numeracy skills were tested directly and indirectly (through data, geometry or algebra) in Questions 1, 2, 3, 4, 5, 6, 7, 9, 10, 12, 12, 14, 17, 19 and 21. Questions with a functional element were Questions 1, 2, 4, 5, 6, 7, 9, 12, 17 and 19 and received mixed responses. Literacy and communication were a feature of Questions 8, 16 and 18 and there was a mixed response to these questions.

Comments on Individual Questions:

Q1 Approximately half the candidates answered this compound interest question well. Full working out was not required as this could be worked out easily on a calculator. Common mistakes such as using a multiplier of 1.175, 1.075, 1.00175, 1.017 etc. were only penalised 1 mark with full follow through. However, using a multiplier of 1.75 received zero marks. Simple interest was used by a small number of pupils and received 1 mark for obtaining £140.

Q2 The majority of candidates achieved full marks on this percentage increase question. However, some candidates attempted to find a percentage without considering the actual increase (396). A common incorrect answer was 14.16%, found by using 2796 as the denominator. An answer of 116.5% was awarded 2 out of 3 marks.

Q3 This linear equation question was successfully completed by the vast majority of candidates. Most candidates expanded the brackets correctly and if mistakes were made after this they were still able to pick up follow through marks.

Q4 Just under half the candidates were successful in deciding that 22 laps were essential to complete 10km. However, a significant number of candidates calculated the perimeter incorrectly (counting the dotted lines, including two whole circles, only including one semi-circle, etc.) or calculated the area. Some were not able to convert 10km into metres. Quite a few tried numerous multiplications to see how many laps were necessary instead of dividing 10,000 by 457.08. Some forgot to round the number of laps to the nearest whole number, leaving an answer of 21.88

Q5 This problem-solving question on percentages and fractions was not answered as well as it should have been considering it was a grade C question on an M4 paper. About half the candidates got full marks, but any who did not get full marks were generally getting zero as they started incorrectly. These candidates could not see that $\frac{1}{3}$ of the rest meant $\frac{1}{3}$ of 60% = 20% men.

Q6 **(a)** This question on the volume of water in a tank was well answered by quite a few candidates, but a significant number did not know how to calculate the volume of the cylinder, with some trying to use the formula for the volume of the cone. Of those who did reach the answer of 753982.2369 cm^3, quite a few were unable to convert to litres correctly. Some did not know the link between cm^3 and ml, whilst others forgot to round to the nearest litre having divided by 1000.

(b) About half the candidates obtained full marks here; however, there were too many candidates who did not know how to calculate the curved surface area of a cylinder. Some who did, proceeded to add the area of the circular ends and obtained 1 mark for doing so. Quite a few candidates confused their methods for Parts (a) and (b), resulting in solutions for Part (a) in the place of Part (b) and vice versa.

Q7 Overall this question was answered well with candidates setting up a linear equation and solving it or just working backwards numerically. Candidates who did not get the correct answer picked up marks for having Matthew's age as $2x - 1$ or for getting 21 for the total of their ages. Common mistakes were having Matthew's age as $2(x - 1)$, $2x + 1$, $x^2 - 1$ or multiplying the 7 by 2 instead of 3 or using 7 as the total instead of 21.

Q8 **(a)** This was a challenging question for a lot of candidates with approximately two-thirds getting zero marks. Many could not choose the appropriate average (quite a few opting for mean) and of those who could, many could not give a suitable explanation, with most simply stating that the median is "the middle value". Only the best candidates referred to the extreme values, with some using good language such as "outliers" and "anomalies".

(b) This question was answered more successfully, with approximately two-thirds of candidates getting the mark, as a simple definition of mode was enough to gain the mark. A small number of candidates chose 'range' even though the question gave the 3 averages to choose.

Q9 This LCM question was answered quite well in general, with over half the candidates getting full marks. The more able candidates used the product of primes method, while the less able listed the multiples until they found the LCM. A minority of

candidates forgot to include units and lost a mark. Some candidates found a multiple such as 600 or 900 but could not see that this was not a reasonable answer or that the LCM was required. Candidates who started by finding the product of primes or listing multiples and then made mistakes were able to obtain part marks.

Q10 This was a good linear equation with fractions question which differentiated between those who really understand how to remove denominators from an equation and those who depend on the method of "crisscross multiplication" of numerators and denominators. Those who knew how to handle the fractions generally did very well and were able to solve correctly. Some tried to multiply across by each denominator in turn. The fraction which caused the most trouble was $\frac{x}{6}$, with many ending up with $6x$ in their working. Some successful methods involved working with the first pair of fractions initially, finding a common denominator of 6 and then including the third fraction. Quite a few candidates did not deal with the 8 correctly on the right-hand side.

Q11 In general, this basic factorisation of a quadratic question was answered well as almost two-thirds got full marks. Common mistakes were using incorrect signs or going on to solve a quadratic equation. The less able candidates clearly did not know how to factorise basic quadratics.

Q12 This rounding question obtained a mixed set of responses. Some were able to find the correct answer with ease by using the correct boundaries, but all too often, answers of 32 and 32.9 were appearing.

Q13 **(a)** In general a lot of candidates struggled with this question on showing what the area of a composite shape is. However, the majority were able to pick up at least 1 mark for correctly finding the area of the triangle. The main problem in this question was rounding too early and therefore not getting the accuracy required on the page. Clearly candidates are not used to working to more significant figures. Some candidates tried to find the area of the triangle using the diameter as the base and then finding the perpendicular height instead of seeing the right angle made it easy to calculate using the two sides of length 1cm. Some candidates tried to use the 1.285 and work backwards which is incorrect and received zero marks.

(b) This question on pressure was quite well answered considering it is new on the specification. Common mistakes were dividing instead of multiplying or using their incorrect answer from Part (a). Some candidates who could not attempt Part (a) were able to get full marks here by using the answer given on the page for the 'show that' in Part (a).

Q14 This question provided an excellent opportunity to gain six marks. However, as aforementioned, many candidates struggled with basic trigonometry and Pythagoras' Theorem. Most were able to gain at least three marks by correctly calculating the length of the diagonal (either by using cosine and finding it directly or by using sine, which found the vertical and then Pythagoras to calculate the diagonal). Some candidates were met with problems when trying to manipulate $\cos 53.13° = \frac{9}{x}$, with many unable to rearrange correctly. When moving to the square, many incorrectly assumed that the angle between the diagonal and the horizontal was again 53.13°, rather than 45°. Of those who used Pythagoras' Theorem at that stage, many were able to set up the initial working but did not know how to proceed, often assuming that the length was half of 15. A significant number of candidates lost a mark by forgetting to round to 1 decimal place.

Q15 Approximately half the candidates recognised the difference of two squares and answered this question well. Similar to Question 11, the less able did not know how to start this question. Some candidates struggled to deal with the 4 at the start.

Q16 This was an excellent question for assessing Circle Theorems. Most candidates were able to state that tangents were equal or that there was an isosceles triangle present for Part 1. In Part 2, quite a few were able to either state "Alternate Segment Theorem" or define it correctly. Part 3 was very poorly answered. Some made an attempt at referring to the supplementary nature of the angles but omitted the words "opposite" or "cyclic" from their reason. Part 4 was the most successfully answered element of this question. Most were able to gain a mark by referring to the straight line (or saying that a tangent makes up 180°) whilst many simply detailed the correct calculations. Part 5 was very poorly answered. Only the very best candidates mentioned alternate angles, with most opting to define parallel lines instead ("they will never meet" was quite a common answer). Others just stated that the angles were the same but didn't think to say why.

Q17 **(a)** This histogram question received a mixed response from candidates. The majority tried to find the frequency densities; however, some candidates got the last one wrong as they did 15 ÷ 6 = 2.5 instead of 6 ÷ 15 = 0.4 Those who found the frequency densities usually went on to draw and label the histogram correctly. Only a minority of candidates incorrectly labelled the scales using the inequality signs. Weaker candidates just drew a bar chart.

(b) This stratified sampling question was poorly answered in general with well over half the candidates obtaining zero marks. Only the more able candidates were able to obtain the correct sampling fraction and calculate the correct answer. Common mistakes were using a total of 75 or 40 instead of 47 or using 14 instead of 15.

Q18 **(a)** This reasoning question about sampling was answered well by the good candidates whilst others struggled to give a fluent explanation as to why a stratified sample is better than a random sample. Vague answers such as "fairer" or "more accurate" weren't enough to gain a mark. Words such as "representative" and "proportionate" were not often used. Quite a few candidates referred to weights of children in this question, obviously following on from the context of the histogram in Question 17.

(b) A good number of candidates knew that a random sample would be easier or quicker to carry out but there were some disappointing responses here with quite a few trying to reason that a random sample would give "a better range of results".

Q19 This question on setting up and solving a quadratic equation differentiated between candidates. Weaker candidates were able to gain the first two marks in this question, but almost half the candidates were unable to do this and obtained zero marks. The stronger candidates were able to rearrange the equation correctly and use the quadratic formula to solve it. A very common mistake was leaving the answer as 12.5 as the other answer was –32.5, whereas they should have reread the question and related their answer appropriately. Those who used the alternative method got x = 32.5 or –12.5 and therefore did not have this problem.

Q20 **(a)** Some poor algebra was on display in this question on simplifying an algebraic fraction, with the weakest candidates trying to cancel x^2 terms from the numerator and denominator. Many candidates were able to gain one mark by correctly factorising the numerator. The denominator was more challenging to factorise and some were unable to get the signs correct.

(b) This question on expanding an algebraic identity to find constants was answered poorly in general with very few candidates getting full marks. Many candidates were able to gain one or two marks here by expanding one or both sides

correctly. Most did not know how to proceed with finding the values of *a* and *b*, with little or no attempt being made to equate coefficients. Very few candidates obtained full marks in this question.

Q21 This standard question on solving an algebraic fractional equation was answered poorly. About half the candidates could not start this question or started by inverting each fraction and having a linear equation. Only the very strong candidates gained full marks. However, there were a lot of basic errors made in the 2nd and 3rd lines of candidates' work from strong candidates. The main errors were $-5(3x + 5) = -15x + 25$; in rearranging the equation to let it equal zero and making mistakes with signs, expanding brackets incorrectly – with some candidates getting $6x$ instead of $6x^2$ at the start and therefore not getting a quadratic. Very few candidates factorised their quadratic and used the formula instead which still received full marks.

Q22 This question on finding an equation of a perpendicular line was very poorly answered – approximately three-quarters of candidates got no marks here. The structure of the given equation meant that many were unable to find the gradient of the original line. Of those who did find the original gradient to be 1.5, many then proceeded to state the perpendicular gradient as $-\frac{1}{1.5}$, rather than $-\frac{2}{3}$. Getting as far as substituting (3, –5) into $y = mx+c$ was rarely correctly done. Most candidates used an original gradient of 3 and the perpendicular gradient of $-\frac{1}{3}$ which received zero marks. Only the top candidates gained all four marks here.

Q23 **(a)** This problem-solving question on frequency densities was poorly answered in general – approximately three-quarters of candidates got no marks here. The very able candidates (but only a minority) used algebra to set up the equation correctly and get 16; however, some mistakes were made in solving the correct equation or multiplying the wrong side by 2 at the start. Some of the less able candidates were able to get full marks by using trial and improvement and getting the correct answer. This question was left blank by a lot of candidates.

(b) This question on estimating an interquartile range was the one that caused the most problems on the whole paper. Only a very small number of candidates obtained full marks. Most candidates who attempted this question obtained one mark for identifying 18 and 54 but could not continue after that. Approximately three-quarters of candidates got no marks. A small number of candidates used the $n + 1$ method to find the quartiles.

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