GCSE

Mathematics A (Two Tier)

General Certificate of Secondary Education **J512**

Examiners' Reports

January 2011

J512/R/11J

This report on the Examination provides information on the performance of candidates which it is hoped will be useful to teachers in their preparation of candidates for future examinations. It is intended to be constructive and informative and to promote better understanding of the specification content, of the operation of the scheme of assessment and of the application of assessment criteria.

Reports should be read in conjunction with the published question papers and mark schemes for the Examination.

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Chief Examiner's Report

General Comments

There was a dramatic increase in entries for the syllabus this January. Though Foundation Tier candidates appeared to be well prepared and familiar with the topics covered in the exam papers, many Higher Tier candidates struggled, particularly with the more difficult topics. Centres should consider carefully whether 'early entry' is the best option for some candidates; a number of Higher Tier candidates would have benefited from having more time to consolidate their knowledge and a summer entry may have produced a grade more in keeping with their ability.

Some pleasing work of a high standard was seen at both Tiers of entry. Work on Shape and Space and Data Handling continues to be very sound whilst work on Number and Algebra is showing some improvement.

Presentation of work continues to improve at all levels. Candidates need to be reminded always to show working, even when it is a calculation they can do in their head, so that method marks can be awarded if the answer is wrong. Work should be checked thoroughly with particular attention given to the accurate transfer of the answer to the answer line. Answers should never be overwritten; always cross out and re-write answers.

The lack of equipment was a problem in many cases. Failure to have access to a protractor, compasses, ruler or calculator cost some candidates dearly. Without a calculator, many candidates sensibly resorted to an alternative method to solve a calculation – for example, repeated addition instead of multiplication – this, however, inevitably led to arithmetic errors. Trial and Improvement is still a popular method for solving a range of problems, particularly in Algebra. Though this can be an acceptable alternative approach, the standard methods should be encouraged. The use of a comma for a decimal point was seen more frequently this session. This should be discouraged.

Centres requiring further information about this syllabus, details of support materials and details of training sessions in the coming year should contact a Mathematics Subject Officer at OCR.

J512/01 Paper 1 (Foundation Tier)

General Comments

The paper was accessible to all levels of ability. All candidates scored well on the earlier questions but the later questions proved very challenging for most, particularly Q17. Generally, candidates remained focused throughout the paper with no apparent lack of time, although weaker candidates left some questions unanswered. Even though there were questions in the middle of the paper that weaker candidates did not understand or attempt, they continued to find parts on latter questions that allowed them to achieve extra marks. The standard of work produced was generally high.

Candidates should be encouraged to show some working for calculations, even those that they do 'in their head' as, in many questions, method marks are available. They should ensure that working for each individual part is contained within the answer space for that question. Candidates should check they have transferred correctly to the answer line any answers written in the working space.

Examiners commented on many candidates' lack of rulers often indicated by freehand drawings seen in question 18. Diagrams should be drawn in pencil, rather than ink, as it is then easier to erase incorrect answers. Candidates need to write clearly and cross out and replace wrong answers rather than try to write over the top of a wrong digit.

Examiners also mentioned the ambiguity of many decimal points and candidates would be well advised to mark them clearly in a small space between the digits and raised above the answer line.

Many candidates had difficulty spelling important mathematical words – forty, ninety, opposite, straight, cube and cuboid caused most problems. It is worth remembering that Quality of Written Communication, QWC, will be assessed on the new GCSE and poor spelling may be penalised.

Some candidates do not realise what is required as a 'reason' in geometrical questions. They explain how they found the answer, rather than the basic fact that they are using. For example, many did not use the word 'quadrilateral' in Q8d.

Comments on Individual Questions

1 This was an accessible first question with nearly three quarters of candidates scoring full marks. Most candidates gave the correct answer in part (a) although 2 was a common wrong answer. Some left the space blank, possibly as they did not see this part of the question. A few misunderstood the question and tried to define, in words, the meaning of 'key'. Part (b) was well answered with a correct use of the scale although a few tried to show the answer with 3 symbols. Those who gave the correct answer in part (a) also scored the mark in part (c). A half shape was already given to indicate that the shape should be enclosed. Part (d) was well answered on the whole with 12 and 16 the most common errors. Most answered part (e) correctly. The majority knew that they needed to add all the values together in part (f). However, most tried to do it in their head without writing any figures down, or indicating that addition was involved. In such cases careless errors led to the loss of both marks.

2 This question was generally well answered. The vast majority answered part (a) correctly with only the occasional digits being in the wrong order or fragmented numbers such as 1000304 and 10003004. Generally acceptable answers were given in part (b) with the occasional wrong answer of tenth(s). Part (c) was very well answered with only a few instances of 'two hundred thousand and ninety four' and 'millions' being used. In part (d), part (i) was well done even by weaker candidates with only the occasional 700 or 770 seen. However, part (ii) caused more difficulty. Candidates seem to find it hard to divide by 60, and there were answers such as 7 mins 71 secs. Many candidates attempted repeated addition often resulting in various errors including miscounting leading to 13 minutes. Those who attempted division by 60 tended to get the minutes correct if not the remaining seconds. A lot of correct answers seen to part (e) but some candidates worked with 48 weeks per year. There were one or two solutions seen using 365 × 2 then ÷ 7, and they were able to score fully. Again, many correct answers were seen in part (f) but some were unable to calculate this, giving answers such as 41, 40, 52 or 32.

3 Part (a) was generally well answered with most candidates knowing that 11 × 8 = 88. Many knew that the answer to part (b) came from 7 × 8 + 100 but frequently did not know the answer to 7 × 8, commonly writing it as 48, 49 or 54. Others only added on one 50. 56 + 100 = 560 was seen a number of times. It is important that candidates show clear working if they are to gain method marks. Weaker candidates often wrote an answer only. There was confusion amongst some candidates with 11, rather than 8, being used in part (b). Better candidates were frequently successful in part (c), but the answer space was often a jumble of figures with no clear method indicated. The method of starting at 330 and working backwards was rarely seen. Most candidates used trial and improvement, aiming for 330 from a multiple of 8 + a multiple of 50 – the correct answer, reached sometimes more by luck than judgement. If a trial and improvement method is used, all the trials should be left as part of the answer and not deleted. The working was often abandoned part way through and so the 2 multiples were not added. The candidates who began by subtracting 50 from 330 generally had most success as they either spotted that 280 was exactly divisible by 8, or carried on until they had 330 – 250 = 80, which was more obviously divisible by 8. Weaker candidates tried to find 330/8 or gave answers only. At times 11 was still being used instead of 8. It appeared that the successful candidates had a good overall view of the problem. This question differentiated well between the stronger and weaker candidates.

4 Most candidates got the correct answer in parts (a) and (c). The most common errors were to state feet and kg, with a few tonnes seen. Part (b) was not so well answered as part (a). The most common error was to state cm, or use imperial units. Similarly in part (d), most quoted units of length, not recognising the need for a unit of area here.

5 The first part of (a) was quite well answered but rhombus and trapezium were frequent incorrect answers. In parts (ii) and (iii), candidates need to realise that at each vertex of the quadrilateral there are *two* angles, one inside the figure and one outside. So any labelling at a vertex must make clear which angle is intended and candidates often failed to do this adequately. There were many labels placed vaguely near a vertex and the use of arcs would have made their intentions clear. Some used a reflex angle for O, but many were successful with the acute angle. Candidates attempted to pair off two triangles with similar features in part (b) and the left hand pair of similar triangles was often chosen. Some chose the two non right-angled triangles. However, over two-thirds of candidates selected the correct pairing. Part (c) was well answered with most stating cube or cuboid. Wrong answers were seen from only about 10% of candidates with most of these opting, incorrectly, for square.

6 On the whole this question was completed well with fewer than 10% of candidates failing to score. Most of the candidates knew what was required in both parts to answer the questions but many could not carry out the calculations accurately. Most students could multiply 14 × 8 in part (a) using various methods e.g. grid multiplication, partitioning numbers then multiplying etc. The weaker candidates used repeated addition and they were the ones that often did not get the full two marks through making an error. Very few stated 14 × 8 without an attempt at evaluation, so most gained at least one mark. Breaking the number down and performing 10 × 8 and 4 × 8 was often more successful. Simplifying the addition to four lots of 14 and then doubling was also successful. The latter two methods showed a greater 'number sense'.

As with the first part, there were many correct answers in part (b). A popular method seemed to be 10 × 6 = 60 and then use of repeated addition to get to 102. Unfortunately they rarely reached 102 due to errors in their addition. Some, who reached 102, lost the second mark because they did not count up the number of 6s correctly. In both parts, the use of the 8 times table or 6 times tables often gave rise to errors e.g. 8, 16, 24, 30 ... and more care was needed. A few used trial and improvement e.g. 15 × 6, 18 × 6 etc. It was pleasing to see that some candidates checked their answer by multiplying out.

7 Over half of candidates scored all four marks here, with many others scoring three, usually for D, B and C. The most common error was to put E at 0.6. Fewer than one in twenty candidates scored no marks.

8 There were a large number of correct responses to part (a). The most common errors were to include extra diagonal or vertical lines at either end of the hexagon, thus giving 4 or 6 lines of symmetry. A few candidates only drew one line. Some diagrams were unclear as first attempts had not been deleted or erased properly so it was difficult to decide how many lines were intended. Candidates should be encouraged to use rulers as many freehand lines were drawn that were far from straight. Also many of the vertical lines were not centrally positioned very well. A few drew vertical lines at the corners making two triangles and a rectangle.
The majority of answers to part (b) were correct. Occasionally one point was incorrectly positioned when the top and bottom of the image were drawn as symmetrical. Some changed the length of the shape by repositioning the two right hand vertices. Those without a ruler found it difficult to position the vertices at the correct points, resulting in vertices outside the tolerance. Most answers for the angle were correct in part (c) but too often the reason was given as a calculation rather than an explanation. References to 'half a circle' are not sufficient for the reason. Many seemed to think that the aim of part (d)(i) was testing the knowledge that the symbol for a right angle was 90 deg and calculated the size of angle 'f' using the fact that the angle sum of a four-sided figure was 360 degrees. Only a few answers included the word 'quadrilateral'. There were many references to 'shape' and 'trapezium'. There were a number of correct answers to part (ii) but these were sometimes spoilt by also using a contradictory word, particularly 'alternate', 'corresponding' or 'parallel'. 'Vertical' was occasionally confused with 'vertically opposite'.

9 It seems that many candidates failed to remember the fact that there are 360 degrees in a full turn. Quite a few used 120/180 in part (a)(i), whilst others simply gave a fraction without any working. Many did gain one mark from an initial 120/360 followed by incorrect simplifications. There were many correct fully cancelled answers given, showing that many candidates were properly prepared for this type of problem. Most who got part (i) correct were able to progress to get part (ii) correct.
In part (b) it seemed that the majority of candidates can use a protractor accurately within the allowable tolerance, but the apparent use of the wrong scale on the protractor was implied quite often by answers in the region of 70 degrees. A quarter of candidates did not respond to part (c). By far the most common error was to suggest that to increase the angle by 7 degrees would take the total number of degrees above 360, which was not possible. Others suggested that the chart had been completed and that it could not be changed. The candidates who did gain the mark generally explained clearly without contradiction usually by focusing on the fact
1 person = 2 degrees.

10 Some candidates drew number lines to assist them with part (a). Others incorrectly applied the rule for multiplying negative and positive numbers together and getting a negative result here. The most common wrong answer was −11,
(3 + 8 =11 and then made into a negative answer). 12 was a common answer to part (b) but a negative sign frequently accompanied it. There was a good success rate for the division in part (c)

11 Many candidates knew what 'squared' meant and attempted 11 × 11 in part (a). The most common wrong answer was 122. Weaker students worked out 11 × 2 = 22. Many candidates did not know what to do to find the cube root in part (b). Some of those who did know, lost the mark by entering 5^3 or 5 × 5 × 5 on the answer line. Frequent errors were 41.6 (from 125/3) and brave attempts at 125^3. Part (c) was generally done better than parts (a) and (b). Many candidates knew they needed to multiply 2 by itself 5 times. However, 16 and 64 were common mistakes. Weaker students multiplied 2 × 5 to get an answer of 10.

12 There were varying degrees of success with this question and most candidates found difficulty with some parts. Algebra seems to be off-putting to many candidates and hence these questions were often left blank. About two-thirds of students got part (a)(i) correct. The weaker students gave answers of 20, as they did not multiply by 3, or answers of 27 were seen from (3 × 4) + (3 × 5) and 9 from 5 + 4. Here, adding is a basic algebraic mistake when seeing *ab*. Part (ii) was not very well done at all. Several gained one mark for evidence of dividing by 3 or 25 or had values of 50 and 6 visible. However, candidates often did not divide by 3, just dividing or multiplying by 25; some just multiplied 3, 150 and 25, or even did 150-25.
Candidates did much better in part (b), with many correct answers. Incorrect answers tended to be πr^2, $3 \times r \times r$, 3 × radius × radius, $4r$ (algebraic adding problem again) and $3D$ or brackets thus failing to give the answer in the simplest form. Candidates should also take care in presenting the figures. $3r^2$ occasionally looked like 3^{r^2} and consequently did not gain the mark.

13 Many candidates omitted a lot of the questions from this point onward. The more able candidates did well on part (a) but it proved difficult for many to substitute the negative value into the equation. The most common wrong entries in the table were 1, 3, 5 (7) and 4, 5, 6 (7) but many of the figures seen did not follow a pattern. Candidates who scored full marks in part (a) generally scored full marks in part (b). Many candidates had difficulty in plotting from the table and some who did plot the points did not join them up with a line. If the points at each end of the line were correct candidates tended to draw a line between these two points and ignored any wrong ones. It didn't appear to suggest to candidates to check any wayward points plotted. Most candidates who drew the correct line also answered part (c) correctly, but there were a number of candidates who were not able to the read from correctly drawn graphs. Common wrong answers were 1 and –3.

14 This question discriminated well. The complexities of this 'multi-step' question represented a challenge to many weaker candidates some of whom misunderstood the English and frequently found it difficult to show a clear method throughout the question. Answers from the weakest candidates showed little if any structure. Too often steps were left out, as the candidate had done them mentally. ¼ of 600 was often found correctly, although not always identified as Lizzie's amount. 1/5 of 600 proved to be more difficult, with 30 (from 1/10 of 600 then divided by 2) a common error. Basic arithmetic errors were very noticeable in both the divisions and subtractions. Some candidates used percentages and a few proceeded by attempting to add the fractions and find 9/20 or 11/20 of 600. Common misconceptions included: thinking Sam's amount was 1/5 of the remainder (450) after Lizzie's amount had been subtracted; finding 10% of the total for Lizzie and Sam without any subtraction from 600; finding 10% of 600 rather than of the remainder; finding 10% of the remaining amount but forgetting to subtract it; and correcting their 10% to the nearest pound before subtracting from the remainder. Nevertheless examiners saw many clear, well presented solutions from stronger candidates that made it easier for them to award part marks.

15 Ratios seemed an area of weakness with the majority not understanding how to reduce any of part (a) to its simplest form. Many failed to cancel down fully in part (a)(i) and stopped at 15 : 6 or 10 : 4 and a few divided incorrectly. In part (ii) candidates generally failed to realise that any ratio comparison must use the same units and only the strongest candidates scored here. To succeed in part (iii), candidates should be aware that ratios sometimes need to be built up to simplify them and many were still trying to divide and produced answers such as 1¾ : 2½.
The strongest candidates were able to answer part (b) successfully, whereas the weakest ones seemed to guess the way to share the money out. Some realised that Kate's share was a half but were unable to distribute the rest. A common error was to divide the 1600 by 2, 5 and 3 and although two of these values appear in the answer they were in the wrong position and scored no marks. A simple check that the three values add to 1600 was clearly not always applied.

16 Candidates generally scored either 0 or 3 in this question, as working was either not present or quite confused. A lot of students tried to multiply 150 and 60 with a result of 900 that they then turned into 90 minutes. It was difficult to tell whether candidates realised that a speed of 60 mph meant that you would do 60 miles in 60 minutes (1 hour) so 150 miles would take 150 minutes, as they did not explain their working. Part marks were occasionally awarded for 150/60 but candidates often made no further attempt at calculation. Candidates frequently confused decimals with minutes and answers of 2.5 were interpreted as 2 hours 50 minutes and then added to 2:15 to give 4:65, later written as 5:05. There was often confusion between an interval of time and an actual reading of time.

17 This was the most poorly answered question on the paper with only one in five candidates scoring a mark. Very few managed to multiply the number of cars by their frequency and gave 100/5 or 10/5 for their answer or quoted the mode of 2. Some candidates found 193 (or 201 from thinking $0 \times 8 = 8$) then divided it by 5 or 10 or abandoned it, as they did not know what to do with it. Few reached an answer of 1.93. This does not need to be corrected to a whole number. Candidates should be careful to present their division correctly and not as $100 \div 193$.

18 The correct answer of reflection was seen from only about 20% of candidates in part (a) but more common were 'flip', 'mirror image' and 'symmetrical'. Some answers were spoilt by a second transformation being given, usually translation, often identified by a vector or 'move down'. Very few gave the equation of the line, with the most common wrong answers being $x = -1$ or $y -1$ or drawing the line on the diagram. About a third of candidates produced fully correct answers to part (b), with another third getting the correct orientation but incorrect centre of rotation (often with one vertex on A). Occasionally the question was misread and B was rotated rather than A or the A was rotated clockwise. Candidates should be advised to use the optional tracing paper in transformation questions having practised this prior to the exams.

19 Candidates were clearly more familiar with the process of multiplying out brackets than factorising. Many weaker candidates left part (a) blank and the correct answer was rarely seen. Many attempts indicated that the candidate was unaware of what was required. Some candidates seemed to understand that insertion of brackets was required: '$3(x - 9)$', '$3(3x - 3)$' ... without being confident of the method involved. Some treated it as an equation and gave an answer of 3 (from 9/3). More candidates made an attempt at part (b). Many scored 1 mark for either $6x + 2$ or $10x - 15$ but were unable to combine them correctly so that $16x + 13$ or $16x - 17$ might result, for instance. Another common error was to add rather than multiply terms e.g. $2(3x + 1) = 5x + 1$.

20 Very few students managed to gain many marks in this question, answer spaces were left blank or jumbled working was seen, indicating that the basic algebraic concepts required here were poorly understood. There were very few fully correct answers seen to part (a). Of those who realised that they needed to substitute $n = 1$ and then $n = 2$ into the expression, errors were made with the first term by getting 5 from $1 \times 1 = 2$ and then adding 3. Once more the adding problem with the algebra of '*ab*' was evident. The second term of 7 was probably found from applying the same error. Rarely were both 4 and 7 seen together.
Many candidates recognised that the sequence in part (b) increased in 4's.
'Add 4', '+ 4' 'n + 4' were common answers but few realised that their answer should involve $4n$, not understanding the significance of the common difference to the generation of the formula. Occasionally, $2n + 4$ was seen with the odd $4n + 2$, but rarely $4n - 2$. Rearranging a formula of the type in part (c) proved to be beyond the majority of the candidates. There were hardly any correct answers. $2n = 2T + 5$ was common. Candidates could have earned marks by showing their working.

21 The response to this question was a little disappointing. Most candidates realised they needed to multiply lengths together but common errors included using the outside measurements $1 \times 2 \times 7$ to give an answer of 14 or using the single dimension inside the end face as 0.6×7 to give an answer of 4.2. Others thought that all four given dimensions should be used with $1 \times 2 \times 0.6 \times 7$ which gave the "correct" answer, but since the method was wrong, scored no marks. The question asked for units to be stated which would score a mark irrespective of the numerical answer given. However, many failed to give any units and a few used cm or cm^2.

J512/02 Paper 2 (Foundation Tier)

General Comments

Candidates were generally well prepared for this paper with most, including those of lower ability, able to attempt a good range of questions. There were fewer questions where no attempt was made to give an answer. It was particularly pleasing to see many good solutions to questions which involved several steps and also to questions that needed some problem solving skills to find a correct answer.

It was clear that the majority of candidates had the use of a calculator. As always, the small number who did not use a calculator were at a severe disadvantage.

Using non-calculator techniques to work out percentages continues to be a problem. These methods, that often involve several steps, are prone to error and often lead to inaccurate answers. Candidates who can use an approach that involves performing one calculation on their calculator generally perform much better than those who use several steps.

The notation used by some candidates to indicate place value can be confusing and make their solutions difficult to mark. Examples of this are replacing a decimal point with a comma or using a point between the hundreds and thousands column rather than a comma or a space. Candidates should be advised to use the standard notation in these instances or they run the risk of losing marks if examiners find their response ambiguous.

Comments on Individual Questions

1 Most candidates obtained the correct answer in part (a), although a few made arithmetical errors when using a repeated addition technique. In part (b) the correct answer was found by many, although an incorrect answer of £48.50 was common, this usually followed from the misapprehension that there are 100 grams in a kilogram. The correct answer was found by most in part (c), using a variety of methods. Candidates were often less clear as to how to approach part (d): many divided by 0.6 instead of multiplying. A few worked out the cost of half a kilogram and tried to add on an appropriate amount to find the cost of 0.6 kg, usually unsuccessfully.

2 Some candidates were confused as to the difference between perimeter and area. Others, rather than simply 'counting squares' in parts (a)(ii), (b) and, to a lesser extent, part (c)(ii), tried to use some kind of formula which resulted in answers that were completely inappropriate. Many candidates could not identify the isosceles triangle, the most common response being equilateral.

3 The vast majority knew 'unlikely' and 'impossible' in parts (a) and (b), but few gave an answer of 'evens' in part (c), usually giving an answer of 'likely'.

4 Not all candidates understood that the lines were parallel. The coordinates given in parts (b) and (c)(i) were usually correct. Occasionally the x and y values were reversed and a very small number used inappropriate notation. In part (c)(ii), the majority of candidates obtained both marks. Some gave the correct coordinates, but did not mark the point and a few others marked the correct point but could not find the correct coordinates. Very few candidates drew a perpendicular line. Common errors were to draw a parallel line or a reflection in the y-axis. A significant number did not attempt this part of the question.

5 Nearly all gave the correct answer to parts (a) and (b). More able candidates generally gave a satisfactory comparison in part (c), but weaker candidates struggled to give a full explanation, with some only giving figures.

6 The response to finding the volume of the cuboid was mixed. Many either gave the wrong units or failed to give any at all. Correct answers to part (b) were relatively rare. Common errors were to do $480 \div (12 + 25)$ or $480 - 12 \times 25$.

7 This question was very well answered with only a few weaker candidates unable to obtain both marks. Some, having obtained the correct answer, attempted to change the answer to hours and minutes, not always successfully, but they were not discredited for this.

8 For a question that involved three separate steps this was very well answered. Only a few weaker candidates did not know how to approach the question. A small number failed to work through all the stages and gave 4.2 as their answer.

9 Finding the next numbers in the sequence was answered very well by most. The explanations for finding the next number in the sequence were satisfactory in part (a), but the more complicated discussion that is needed in part (b) was beyond some.

10 Many weaker candidates did not know how to approach this question. Those who made sensible attempts usually found the correct answer for part (a), but the answers for part (b) were more varied with n^2 being a common error. There were very few correct answers to part (c). Some candidates added their answers from parts (a) and (b), but failed to add another n.

11 Few candidates gave just the two correct prime numbers for part (a); extras such as 1, 9 and 33 were common. Most understood the meaning of a factor of a number, but many failed to give all six factors. 20 was often omitted, suggesting that candidates had failed to look carefully at the example given in part (a). Even though the introduction to part (c) had a lot of detail, this question was well answered. It is pleasing that Foundation Tier candidates can cope with questions that require a degree of interpretation.

12 Most candidates knew how to use the graph to convert between pounds and kilograms in part (a), but interpretation of the scales proved a problem for some, particularly in the second part. Most could use the graph to convert 32 pounds into kilograms in part (b), although this was not always carried out accurately.

13 Only some weaker candidates did not know how to find the mean and range in part (a). In part (b), many candidates only commented on the numerical values of the mean and range and did not interpret or explain their results, which was necessary to obtain the marks.

14 There were many correct, well ordered tables in part (a). The majority of candidates gave correct probabilities in part (b) as fractions, but there are still a few who use an incorrect form, including a very small number who use ratios or words such as 'unlikely'.

15 Most candidates had some idea how to carry out the enlargement in part (a), but many failed to give a fully correct answer and scored just one mark. In part (b), many candidates did not know how to go about completing the pattern with rotation symmetry of order 4. Some drew a shape with 2 lines of symmetry and other patterns which were not complete; these earned only part marks.

16 There were many correct answers in part (a), although some, having obtained 16.92 and 1.5, did not know what operation to use to complete the calculation. Part (b) was less well done; incorrect rounding was quite common. A few candidates failed to get a method mark by not showing their working.

17 Many obtained the correct percentage for English, but techniques for converting the marks for Science were far less secure. Some did not appreciate that they needed to give the percentage for Science to at least one decimal place to put the marks into a fully correct order with supporting working.

18 Part (a) was generally answered well, although a significant number did not attempt the question, including some more able candidates. The key was often missing or incomplete. The explanations in part (b) tended only to be answered thoroughly by more able candidates.

19 The answer of 100 was found by many in part (a), although a common error was to find 20 ÷ 5 giving an answer of 4. Many different methods were used in part (b) with a significant number trying some form of trial and improvement, sometimes successfully. Those who attempted an algebraic solution were not always secure in their technique, but more able candidates often found the correct solution.

20 Only a few candidates produced straightforward calculator methods leading to a correct answer in part (a). Solutions were often laborious, difficult to follow and inaccurate. Many having found an answer for 93% failed to add it to 81 600.
Part (b) was poorly done with only a very small number of candidates appreciating how the answer can be obtained using simple calculations. Most candidates who attempted this used a form of trial and improvement technique with varying degrees of accuracy and success.

21 The majority of candidates gave a correct answer in part (a), although some seemed to be confused by the diagram and what was required.
Only the most able appreciated the need to apply Pythagoras' Theorem in part (b). Those that used this method often obtained the correct answer.

22 Many candidates did not know how to approach this type of question, but, for those who did, there were some good answers with clear working. Some did not appreciate that there was a need to justify why 2.3 was the correct answer to one decimal place and consequently only obtained three marks. A small number of candidates just gave responses of too big / too small without evaluating the solutions to their trials.

J512/03 Paper 3 (Higher Tier)

General Comments

The general presentation of work continues to impress and answers were, on the whole, clearly legible. Far fewer scripts show answers with no working so that Examiners can award method marks where understanding has been demonstrated.

More candidates than usual failed to cope with the more demanding questions on the paper. It is clear that many would have been better suited to the Foundation Tier of entry or should have been allowed time to consolidate and extend their knowledge and entered for the Higher Tier in the summer.

Though candidates are quite secure in dealing with the short, direct questions, those requiring more thought and stamina were discarded rather than persevered with. Work in Algebra seems to be improving though many are prone to unnecessary slips like $2x \times 3x = 6x$. Arithmetic too, is getting better with calculations undertaken with confidence and accuracy. The thorough checking of work produced is time well spent.

Candidates had sufficient time to consider all questions and demonstrate what they know and can do.

Comments on Individual Questions

1 Though there were many correct answers to all parts of (a), large numbers of candidates did not simplify their ratios far enough or made errors in cancelling. Part (b) was well answered with clear, correct working shown. A few made mistakes in their arithmetic and a number attempted to divide 1600 by 2, 3 and 5 separately for their three answers.

2 Most knew to divide 150 by 60 to get the journey time. Problems then arose for some with the interpretation of the decimal answer.
2 hours and 5 minutes and 2 hours and 50 minutes as well as 2.3 hours were not uncommon answers.

3 On the whole, responses to this question were very disappointing. By far the most common approach was to find 100 ÷ 5 or 100 ÷ 10 showing no clear understanding of what the question required. Even when a 'correct' method was employed, errors still crept in. $0 \times 8 = 8$ and dividing $\sum fx$ by 5 were often seen. Large numbers of candidates unnecessarily rounded their correct answer of 1.93 to 2.

4 The vast majority understood that the diagram showed a reflection but many could not identify the mirror line. Common wrong answers were $y - 1$ or $x = -1$. Weaker candidates did not know the word 'reflection' and referred to 'flip' or 'mirror' or 'symmetry'. Part (b) was answered more successfully with many correct answers. Some rotated in the wrong direction and others chose the wrong centre for the rotation. Few failed to score any marks at all.

5 Many candidates failed to form an appropriate algebraic equation. Even so, the correct angles were usually found. A failure to divide 180 by 5 correctly spoilt some good work.

6 The factorising in part (a) was usually done correctly. Many candidates coped well with the expansion of each of the brackets in part (b) but then made errors in collecting the terms. Less aware candidates neglected to multiply the second term in each bracket.

7 This question was well answered. The scatter diagram, comment, line of best fit and reading were all well done. Some candidates did have problems coping with the different scales on the two axes, leading to the incorrect plotting of points in part (a) and the incorrect reading of the value in part (d).

8 There was a mixed response to part (a). Though many candidates gave the correct pair of values, it was common to see 3, 4 (from use of n = 0 and n = 1), 3, 7 (where $1^2 + 3 = 1 + 3 = 3$) and 4, 19 (from use of n = 1 and n = 4). As expected n + 4 was a common wrong answer to part (b). Most candidates displayed some knowledge of how to rearrange a formula, with a significant number completing the algebra correctly. Poor notation lost some the final mark, for example when T – 5/2 was written instead of (T – 5)/2.

9 Most spotted that more options were needed for part (a) though a few tried to argue about the balance between hot and cold drinks. Part (b) was less successful; most realised it was a leading question but could not always express themselves clearly. Others referred to the lack of yes/no boxes or suggested ways in which the question could be better phrased.

10 The formal setting out of the solution of linear equations appears to be slowly improving. However, a combination of carelessness with signs and/or poor arithmetic meant that many did not score full marks here. Too many at this level are still using trial and improvement to find their answers.

11 Less able candidates just multiplied all the given lengths together, showing a clear lack of understanding. Successful solutions involved treating the shaded end as either a parallelogram or a trapezium. Of those following a correct method, some failed to evaluate 1.2 × 7 correctly. The units of the answer were often given correctly but just as often forgotten.

12 Good candidates reached the correct answer with little trouble. Quite a few of the others got to £6400 after two years and then made an arithmetic slip in the final step. Less aware candidates treated the reduction as a constant £2000 a year. Very few could not calculate the percentage of an amount.

13 Although there were many correct answers, a number of factor trees contained arithmetic errors. Some candidates extracted all of the correct factors but wrote their answer without connecting them with multiplication signs. In part (b), the most common method was to list multiples of the two numbers. Part (b) was often successful even when part (a) was incorrect.

14 Those who added the two equations to eliminate y were more successful than those who tried to eliminate x. Multiplying the two equations to equalise coefficients before adding or subtracting invariably led to errors in signs or numbers. Many attempted to subtract the original equations thinking that this would eliminate the y terms. These usually found $x = 1$.

15 Many gave 140 as the median height as this was the middle value of the horizontal, height axis. 320 was another common wrong answer being the cumulative frequency value for a height of 140. Parts (b) and (c) were usually correct though some forgot to subtract from 400 in part (c).

16 Finding the gradient and the equation of a line was not understood by many. Only the better candidates got an answer of 2. Some others got ½ where, perhaps, the diagram suggested that 5 was vertical and 10 horizontal. When an answer appeared in part (a), then often the candidate went on to a correct form for the equation in part (b).

17 Very few candidates scored full marks on this 'traditional' geometry question. Many did get the values of the angles correct but their reasoning was poor, often just stating in words the calculation they were performing. More were familiar with 'angles in the same segment' than with 'angles in a semicircle'. A number assumed that triangle OXY was equilateral.

18 Work on indices was quite poor. The value of 5^0 was rarely 1 and usually 5 or 0. Candidates seemed unfamiliar with negative indices so 81 or −81 were the usual answers to part (a)(ii) though 0.0003 also appeared where there was confusion with standard form. In part (a)(iii), the answer was often left as a power and not completely evaluated. Answers of 2^6, 2^5, 8^2, 4^3, 4^5, 4^6 were commonly seen. Work on surds fared little better. Many left the first expression as $\sqrt{49}$, but it was pleasing to see that a good number knew how to rationalise the denominator even if the final simplification was not complete.

19 Better candidates reached the correct expression without trouble. Disappointingly, many said that $2x \times 3x = 6x$ and others had problems in simplifying $+3x - 8x$.

20 Weaker candidates frequently failed to attempt this question. Of the others, most recognised the need for Pythagoras' Theorem in part (a) and many reached 75 or $\sqrt{75}$. Making the final connection to $5\sqrt{3}$ was less successful. In part (b), most success was in finding the area of the sector, though some thought that it was a quadrant. Sensibly, when finding the area of the triangles, candidates often 'put them together' to make a rectangle. Only the very best candidates scored full marks in part (b).

21 This was another question only attempted by the better candidates. In part (a), some got to $2w + 2x = 25$ or $25 - 2x$ but no further. Failure to find an expression in part (a) meant that many could not even attempt part (b). More marks were awarded in part (c) where there were attempts at factorisation and using the quadratic formula to solve the equation. Even then, some were let down by their poor arithmetic skills.

22 Many candidates seemed unfamiliar with vectors. Those who answered part (a) correctly often forgot to use brackets in part (b). Others were unable to cope with the ratio 2 : 3 and used 2/3 rather than 2/5 as the proportion of vector AB. Some, reaching part (c), failed to simplify their answer. Weaker candidates gave a single numerical value for each answer or a combination of letters.

23 This less conventional probability tree diagram caused problems for many. The probabilities on the bottom two branches were invariably found to be correct but only better candidates could complete the diagram. A large number spoiled otherwise perfect work by writing $0.4 \times 0.1 = 0.4$. It was pleasing to see that most knew that they needed to add the probabilities in the second and fourth boxes to achieve the answer to part (b).

J512/04 Paper 4 (Higher Tier)

General Comments

Examiners felt that the standard of the paper was similar to previous sessions and that candidates had sufficient time. Good work was seen from many candidates.

However, examiners felt that there were some candidates who were not familiar with the higher tier specification and should not have been entered at this level. These candidates were clearly floundering, getting to the stage when it looked as though they were picking a number at random and writing it down. In particular, the trigonometry question, which gives candidates a chance to use techniques that they have practised well, was very poorly attempted. Furthermore, unnecessary and inappropriate trial and improvement methods were used frequently by weak candidates in the percentage questions and when trying to solve the quadratic equation. Whilst trial and improvement may be a valid alternative method, the standard of mathematics shown by candidates using this approach across the whole paper led examiners to believe that they did not have any other means to answer the questions. For these candidates the Foundation Tier would have been a more appropriate examination and much less of a negative experience.

There was some evidence that candidates did not read the question and either gave explanations that were not required or did not answer the question asked. This was particularly the case in questions 3, 4, 6, 8 and 10.

There were, of course, some very good scripts that were a pleasure to mark. These candidates were confident in their mathematical knowledge and in their ability to use it.

Comments on Individual Questions

1 In part (a), most candidates found the question to be straightforward and scored full marks. Part (b) caused more problems. The correct answer was frequently seen but the candidates made various mistakes when giving the answer to 2dp. The most common error was to incorrectly round the answer to 0.37.

2 Some candidates did not understand what was required in part (a) when the question asks for 'an equation'. The most common mistake was to give the answer 14 in this part. Other mistakes included using a letter instead of the 3 or 5 and occasionally the letter was the x that was already defined. Some gave an answer that didn't involve x. Candidates should be encouraged not to include units when writing an equation. Part (b) generally scored full marks, but many obtained their answer without using an equation at all or having got the wrong equation in part (a). For some candidates, giving the same answer to both (a) and (b), despite the questions asking for different things, was not an issue.

3 There was a very mixed response to this part of the question. Many candidates obtained the mark for ¼. After that some were able to go on to obtain the ½, through either a sum or an explanation implying that the same number of yellow counters as blue counters was needed. Some candidates did not get that point, but managed to get the 2 yellows. A very common misconception was to assume that, as the probability of randomly choosing a yellow counter was to be doubled, the number of yellow counters should also be doubled. This led to two yellow counters in total and an incorrect answer of one yellow counter to be added. Candidates need to read the question to ensure that they have answered what has been asked.

4 Generally, part (a) was well done with candidates knowing exactly what was required for an ordered stem and leaf diagram. The most common mistakes were to use the stem as 30, 40 etc and forgetting to include the key. Part (b) had a very mixed response. There were a number of correct answers with some good explanations – though an explanation wasn't required. Some candidates showed little understanding of which average is which, and others did not explain the effect but just stated their values when Lisbon replaced Luxembourg. The quoted values for the averages were not always correct and highlighted confusion of some candidates between mean, median and mode.

5 In part (a), candidates did not always use the most efficient method of 81600 × 1.93. Many correctly calculated 93% of 81600 and added this to 81600. A fairly common method was to use a step by step approach: for example calculating 10% to find 90% then 1% to find 3%. Candidates using this approach often made one or more errors. Many candidates found part (b) more difficult and, as in part (a), not many used the most efficient method. Some candidates were able to obtain full marks for an answer of 60% because they had shown a full correct method. Those who correctly calculated 30700 ÷ 50900 = 0.60314 did not necessarily multiply this by 100 and those giving 81600 ÷ 50900 = 1.60314 were not always able to give the correct answer. Common errors included (50900 ÷ 81600) × 100% or 81600 – 50900 or (81600 – 50900) ÷ 81600. A surprisingly high number of candidates used trial and improvement but only a few of these reached an answer within the acceptable range. This is not really a satisfactory method at Higher Tier and, if it is to be used, the candidates need to be working towards an answer to 3 significant figures.

6 Part (a) was not attempted very well. Those who found the correct answer $x < 5.25$ in the working, sometimes wrote just 5.25 or $x = 5.25$ on the answer line. Others had not got any idea as to how to solve the inequality and there were attempts at trial and improvement.
Part (b) was more frequently given full marks including for candidates who had part (a) wrong and started again. However, there were many answers giving infinite sequences indicating that these candidates had not associated the two parts of the question, in spite of the word 'also' in the statement of the question. Other errors included not understanding $x > 0$ and giving a series of negative numbers or non-integer answers.

7 In part (a), candidates needed to appreciate that if they are asked to show something then they cannot just state the sum of the interior angles in a pentagon without any justification. The most common mistake was to do this or just write 108 × 5 = 540 and / or 540 ÷ 5 = 108. Part (b) was answered well by the majority of candidates. Very occasionally a correct answer was seen from an incorrect method. There was a mixed response to part (c). The majority of candidates who used the correct equipment were able to obtain full marks. Some candidates drew the bisector with no arcs shown which did not earn full marks. A significant number of candidates omitted this part. It was unclear as to whether these candidates did not understand what an angle bisector is or whether they did not have a pair of compasses.

8 The majority of candidates were able to obtain some or all marks on this question. Nearly all calculated and stated the function value at the x value they were trialling. Many trialled 2.25 after trying 2.2 and 2.3, but not many whose final trials were for 2.2 and 2.3 justified their choice by finding the difference between the function values and 7. A few candidates disregarded the accuracy required for the answer and gave it to two or more decimal places.

9 Part (a) was done reasonably well with most completing the table correctly. The most common error was to treat $2x^2$ as $(2x)^2$. Most candidates plotted their points correctly in part (b) and were reasonably accurate in drawing a smooth curve. Some candidates did not attempt the plots of points found in part (a) and not all the candidates who did show the plots attempted to draw the curve. There was a mixed response to part (c) with about half of the candidates achieving full marks. Common errors included $y = 4x - 5$ confusing the scale and $y = mx - 5$. Of those candidates who had obtained a curve and a line, very few answered part (d) completely correctly. Those that made an attempt sometimes just gave one answer and others gave their answers as coordinates.
In part (e), many candidates showed an inability to show sufficient steps, using correct algebra, to rearrange this equation into the given form. In part (f), very few candidates answered this standard quadratic equation question correctly and there were many who appeared not to have any knowledge of a method to solve such equations. Some gave no response, some resorted to attempting a trial and improvement method and some tried to factorise the left hand side. Of those that used the quadratic formula, some made errors in the substitution and others did not put the numerator 'all over' the denominator. Candidates who did obtain the correct solutions using either the formula or completing the square generally rounded their answers correctly to 3 decimal places, as required.

10 A significant number of candidates knew how to answer part (a), and of these, most gave the answer as 4.1, so they knew what the appropriate degree of accuracy was. However, candidates should be encouraged to write down their answer on the calculator before then writing it to an appropriate degree of accuracy. Common errors included finding the diameter or using the area formula or using calculations that didn't involve π at all. Occasionally a trial and improvement method was attempted, without success. Part (b) was answered better than part (a) with a significant number scoring full marks. However, the most common wrong answer was to find the area of a circle and not a semi-circle, despite both the question demand and the diagram.

11 There was a mixed response to the indices questions. Part (a) was generally well answered with the common error t^6 or t^{10}/t. Candidates seemed to find part (b) easier. However, there was sometimes the usual mistake of multiplying the indices instead of adding. Candidates found part (c) more challenging with a variety of answers given.

12 This question caused a problem for many candidates. Even those who knew that 16% was 1 million were not always able to go on and find 58%. A common mistake was to equate 1 million to 8% or even to 58%. This was another question where candidates resorted to using trial and improvement, but without success. Most of the candidates who attempted this question knew that 1 million was 1 000 000.

13 Part (a)(i) was generally answered well. Part (a)(ii) was answered quite well with most candidates showing that a common factor was required. However, many only partially factorised the expression. Candidates found part (b) quite difficult with many unable to write down a correct first step. The two common errors at the first step were to square root both sides giving $\sqrt{E} = mc$ or to subtract giving $c^2 = E - m$.

14 Some candidates had no knowledge of what was required for standard form. There are still too many writing the answers directly from the calculator with no understanding. Part (a)(ii) was most frequently answered incorrectly or not attempted. Part (b) produced the most correct answers as many candidates were able to use their calculators appropriately.

15 It was clear that many candidates have some understanding of this topic. There were good explanations for part (a)(i) although some did not give a full explanation, and just said 'because the line drops'. Most candidates scored full marks in part (a)(ii) and in part (b). Part (c) however, was poorly answered with very few completely correct answers. The majority of candidates showed no working in the working space making it difficult to award part marks where plotting was outside the tolerance. Although the answers to parts (a) and (b) had implied that the candidates understood how a relative frequency was calculated, part (c) made it obvious that this was not the case with a significant number of candidates plotting points at 1. The most frequently seen reasonable, wrong points were at 0.4 and 0.5. Where working was shown, there was evidence of some relative frequencies being added together. Occasionally a relative frequency was subtracted from 1.

16 Candidates answered part (a) quite well with the majority writing down the lower bounds correctly and, although a few omitted to add these together, most went on to give 400 g. Part (b) proved more challenging. As in the first part there were those who did not appreciate the significance of the weights, correct to the nearest gram, and so gave 258 g – 143 g = 115 g, with some candidates going further and adding 0.5. Another error was to give the correct bound for 158 g but also give the upper bound for 143 g and thus write down 258.5 g − 43.5 = 115 g. The upper bound frequently had .4 instead of .5.

17 Many candidates either did not attempt this question or wrote nothing of any value in the working space. All parts of this question were straightforward and candidates who have entered Higher Tier should have, as a minimum, been able to attempt part (a). These comments refer to those candidates who did make a valid attempt. Part (a) was generally answered correctly. A few candidates incorrectly attempted to use cosine ratio. The majority of candidates used the cosine rule successfully in part (b), showing clear method throughout. A few candidates made a mistake with the sign or incorrectly collected the a^2+b^2 with the 2ab before multiplying by cos 147. One error was to drop a perpendicular and to think that would bisect the 147° or to try and apply the sine rule. Several decided that 'tan' ought to appear somewhere, so dutifully involved the tan of an angle in their calculation. The fact that using tan 147 gave a negative answer for QR did not put them off. In part (c), those who started with the sine rule could not always rearrange it correctly. Some took the sine of sides rather than angles, and some gave up on the sine rule completely.

18 In part (a), only a minority of candidates used a correct method and, of these, some misread the vertical scale giving, for example, 10 × 1.2 rather than 10 × 1.3. The majority of candidates attempting this part used only the heights so it was common to see such things as 2 + 1.25 + 0.6 or 2 + 1.3 + 1.3 + 0.6 + 0.6 + 0.6.
Part (b)(i) was rarely answered correctly with the most common wrong answer being 'frequency density'. Those who were able to answer part (i) generally went on to answer part (ii) correctly with a suitable age and reason about retirement or an age when people don't/can't work. An occasional error following a correct answer in part (i), was to give an age based on a pattern from the ranges of the other classes and give this as their reason.

19 Many candidates did not attempt any parts of this question. Some very elegant solutions were given to part (a)(i), but most candidates had very little idea and just used the 225, 360 and 4 creatively to make 2.5. Some calculated the area or arc length of one of the figures, but then weren't sure how to use it, so gave up. Part (a)(ii) was often incorrect as candidates used 4 in the formula without any realisation that Pythagoras' Theorem was required to find the perpendicular height of the cone. In part (b) many candidates did not know the relationship between the volumes of similar shapes and so stated 3 as their answer.

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