RECOGNISING ACHIEVEMENT

GCSE

Mathematics B (Linear)

General Certificate of Secondary Education **J567**

OCR Report to Centres

June 2012

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.

OCR will not enter into any discussion or correspondence in connection with this report.

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General Certificate of Secondary Education

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OCR REPORT TO CENTRES

Overview

General Comments

This is the first live assessment of the linear GCSE Mathematics B specification. The specification can be taught either as a traditional linear scheme or using the graduated stages as described in the full specification.

In line with the new subject criteria, about one quarter of the marks on each paper assess problem solving skills. In this session the candidates did well on the AO1 questions which concern recall and use of knowledge. Candidates also achieved well on the AO2 questions, selecting and applying the correct mathematics in context. The AO3 questions, concerning problem solving, did cause some difficulty. These questions involve selecting information and choosing appropriate methods to solve a problem. Some problems have more than one step and often the order of these steps has to be considered.

In addition at least one question assesses candidates' quality of written communication (QWC), where the way the candidate sets out the solution and communicates it are considered as well as the answer. In these papers many candidates did not use all the information that they were given. There are occasions when there is redundant information but this is the exception not the rule. Candidates generally did not set out their solutions in a logical way and they did not explain how their answers or part answers relate to the problem or to their solution. Often, many numbers were written on each page and in no particular order. Candidates should clarify their methods with statements such as "number of litres = …" or "price of fuel per litre = ..." to accompany the numbers. Very few candidates described their method, indeed rarely were any words seen at all, with most responses being purely numeric.

It was noticeable that in the Foundation papers many candidates showed very little working, especially when using a calculator in Paper 2. Responses at both tiers often demonstrated poor numeracy skills. Addition was reasonably well attempted although many tried to do it all mentally and they would have been well advised to write down some working. Subtraction often showed an error of 1 unit in each place where the second digit was greater than the first.

In Papers 1 and 3 there were inconsistent approaches to multiplication. At Higher Tier the traditional method dominates, whereas in the Foundation Tier there are many methods, including multiple additions. A table or column approach is usually the more successful method. Division still appears to be the hardest operation of the four and the most successful approach was traditional division, also known as the 'bus stop' method. Where fraction arithmetic was required many candidates appeared to know the methods vaguely but much confusion appears in the responses. Some just add or subtract numerators and denominators in addition and subtraction, and when multiplying or dividing they often convert to common denominators, generally making the question more difficult.

In the questions where equipment is required there is an improvement in the proportion of candidates who use the correct equipment. Sometimes straight lines are not drawn with a ruler, however. It is not uncommon for candidates to plot points for a linear graph and then not draw a line at all. Loci still presents problems and it is clear that candidates do not know which construction to use. The simplest is probably the perpendicular line bisector and many think that the radii have to be the same length as the line.

Most candidates appeared to have the use of a calculator but this often leads to a reduction in the working shown. There is also a temptation for many to truncate their results and then use the inaccurate result in further calculations. Many candidates still work out percentages using the 10%, 5% and 1% method even when a calculator is allowed and they generally do not use a calculator for these calculations.

In terms of advising centres how to improve it is important that centres support candidates in carefully reading each question, as there was evidence that this did not happen, particularly at the Foundation tier. We also advise centres that candidates practise work targeted at the bottom two grades (C and D grades at Higher and F and G grades at Foundation) since questions on these grades are a high proportion of each paper. Consistent methods for calculations ('the four rules') with decimals and fractions are important as it is common for candidates to invent their own methods to solve these questions. There also needs to be better use of the calculator, particularly avoiding early truncation of figures. Improvement could also be made in the calculation of percentages.

Written explanations, including interpretation of diagrams and geometrical reasoning, still need improvement. In geometry the use of slang terms for angle properties, such as *x*-angle or *z*-angle, are still prevalent – we would like to encourage the correct mathematical terms to be learned. In statistics there is still confusion over the meaning of average and spread. This year many thought that a high spread meant that a larger number was achieved. Candidates need to read the question carefully as there are usually clues to the type of answer required. Generally at GCSE, candidates are required to know that an average gives information about which scores are higher or lower and spread reflects the consistency of those scores.

Centres requiring further information about this specification should contact the OCR Mathematics subject line on 0300 456 3142 or maths@ocr.org.uk.

J567/01 Paper 1 (Foundation tier)

General Comments

Candidates were generally well prepared for this paper and most were able to attempt a good range of questions. Candidates attempted to answer nearly all the questions on the paper and as a consequence were able to receive some method marks on the later harder questions, even if they did not get the correct answer, which was encouraging.

Nearly all candidates appeared to have enough time to complete the paper.

There are more questions of a problem solving nature in this specification. Candidates usually attempted these questions but did not always develop a detailed method and consequently part marks were common.

In the quality of written communication questions (QWC) candidates are expected to:

- present their answers in an appropriate form
- organise their answers clearly and coherently
- use correct spelling, punctuation and grammar where appropriate.

Many candidates did not present and organise their answers effectively, often showing a page full of disorganised calculations. These questions are marked in a different way to the rest of the paper and candidates cannot obtain full marks without showing a full, correct and comprehensive method that is easy to follow.

Comments on Individual Questions

1 All candidates completed the first part well, with just a few computational errors. Some candidates did not know how to tackle (b), but the majority were successful. Some candidates recognised that they needed to find 72 ÷ 3 in (c) but were not able to do the division. However, most candidates worked out the correct answer, often by some form of trial and improvement.

2 Nearly all candidates knew how to interpret the table. In (a)(iii), candidates generally recognised what was required but there were some errors in carrying out the subtraction. Few showed their method in (b), but most found the correct answer. Some used a diagram with a form of repeated addition and generally found the correct answer this way. Errors often came from those attempting to carry out formal division.

3 Many candidates could not convert centimetres to millimetres with 470 and 0.47 being common incorrect answers. Similarly, there were many who could not convert centimetres to metres. Most candidates, however, were able to use the appropriate metric measurement in an everyday setting to give sensible answers to (b).

4 Most candidates had a good idea as to how to write down the coordinates of points in the four quadrants. Most errors came from an incorrect reading of the grid, with only a very small number reversing all the coordinates. The corner of the square was generally correctly marked, although there were a few who did not attempt this part.

5 Part (a) was generally quite well attempted, although some candidates had problems with place value – not lining up tenths with tenths in their calculations for example. Consequently, 18.77 was a common incorrect answer in part (i) and 2.6 in part (ii). High scoring candidates generally obtained both marks in ordering the decimals but others had difficulty in fully interpreting place value and tended to make at least one error.

6 Most candidates had a good idea of how use non-calculator methods to find percentages and many candidates obtained all three marks. Most candidates were also successful in the final part, generally starting again rather than using the quicker method of following through from part (a)

7 Many candidates' application of the order of operations was weak and consequently 21 in (i) and 9 in (ii) were very common incorrect answers. Part (iii) was answered better with more understanding shown as to how to work out the answer. Some left the answer as $\frac{12}{3}$ and were not awarded the mark. Many candidates read (b) carefully and were able to come up with valid solutions for both parts. However, there were some errors from not carrying out the given instructions and inappropriate use of brackets etc.

8 Most candidates knew the technique for finding the median and found the answer correctly, although there were a small number who just used the middle value without ordering the data first. There were a minority who found the mean or the mode. Many also knew how to find the range but a significant number did not carry out the subtraction correctly, consequently 1.2 was a common incorrect answer. There were a small number who gave the range incorrectly as an interval, 48.4 to 49.2. For the comparisons, many candidates did not interpret the median and the range in the context of the question and simply stated which is the bigger. Some interpreted the median successfully, stating that Sadiq was faster, but few made an acceptable comment about the range.

9 Part (a) was generally quite well answered with many able to write down algebraic expressions for the perimeters. These were not always simplified. Some did not recognise that they needed to find the sum of the sides to find the perimeter. Most answers to (b) tended to have c or $^{-}5d$ as correct terms in their expression but not both. A small number gave an answer of $1c5d$, having correctly evaluated the two parts in the working but then did not put down the answer in the correct form. Only half the candidates obtained marks on (c). Common incorrect answers were $5y$ and 2.

10 It was clear that some candidates did not know the compass directions. In (b)(i) most candidates gave the correct answer of 60 metres, although some did not use the scale. Very few candidates had any skills as how to find bearings, with the number of correct answers to (b)(ii) very small. Many obtained 1 mark in (c) for using the scale to mark the correct distance but few were able to use the bearing correctly to find the direction.

11 Half of the candidates answered (a) correctly. The common error was to find the perimeter rather than the area. Many candidates found the area of the rectangle correctly but then did not know how to proceed. Again, some candidates worked with the perimeter and were given some credit if they followed through correctly to find their 't' from this approach.

12 Most candidates could identify the kite and find its line of symmetry. Many had some idea as how to approach (b). However, candidates' working was often poorly laid out making it difficult to credit methods when the answer was incorrect. Some thought that the sum of the angles in a quadrilateral sum to 180° and they were given some credit for finding an answer with this approach. Many candidates did not know or could not find the angle in an equilateral triangle, which led to many incorrect answers in both parts of (c). Again, it was often difficult to follow the written methods.

13 Most candidates answered (a) well using appropriate notation, with only a very few giving answers as ratios. Some weaker responses included unlikely, likely and impossible. Candidates need to be aware that, when asked for a probability, a numerical value is required. Only a minority were able to solve (b). Appropriate working was often not shown so few candidates obtained any credit when they did not obtain the correct answer.

14 Many candidates obtained the correct answer of 40 in (a) but others tried to combine the 8 and the 5 in different ways and so (8 − 5 =) 3 and (8 ÷ 5 =) 1.6 were common incorrect answers. Part (b) was also generally answered well. Most candidates used either some form of trial and improvement or a reversed flow chart. However non-algebraic methods do not work so well on the type of equation in (c) and few obtained a correct answer from this approach. The few who did use an algebraic approach tended to make an error so there were very few correct answers.

15 Many candidates knew how to plot points on a scatter graph with most errors from a lack of precision using the scales. The correlation was generally well described with appropriate language. Lines of best fit were nearly all ruled and straight, although a few had an incorrect gradient. Only a small number of lines were drawn through the origin. Most candidates used their line of best fit to find the required value successfully.

16 The fraction to decimal conversions were not well completed. Some recognised that $\frac{3}{50}=\frac{6}{100}$, but then wrote 0.6 on the answer line. Candidates generally had little idea as how to approach $\frac{2}{9}$. Most candidates who attempted the powers of 5 tried to find an answer numerically rather than use the laws of indices. Consequently they had difficulty managing the ensuing large numbers and rarely came up with a correct answer, although some gained credit for their method. Most candidates had little idea as how to subtract the mixed numbers. Even those who recognised the need to be working with a common denominator struggled because one third is smaller than five sixths.

17 There were very few candidates who obtained marks on this locus question. A few drew the arc correctly from C.

18 Although some candidates obtained both marks for the ratio, a few thought that there were 100ml in a litre and consequently did not obtain the correct answer. Nearly all candidates had difficulty using the information given in (b) to solve the QWC question. Consequently, only partial credit was gained. Many did not apply the ratio to the total amount of juice required. Responses were generally poorly laid out and difficult to follow.

19 Candidates who attempted the *n*th term generally established that the common difference was 3. Some then gave an answer of $3n + k$ with a good proportion giving the correct answer of $3n + 5$. Those who lacked a real understanding of this process gave an incorrect answer of $n + 3$. Other common incorrect answers were $5n + 3$ and $8n + 3$. There was a number of correct answers for the terms of the sequence in (b). Some showed a partial understanding, and typical incorrect responses of 12, 7, 2 and $^{-}7$, $^{-}2$, 3 gained a mark.

J567/02 Paper 2 (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 Q.21 and Q.22. Generally candidates attempted the majority of the questions with no apparent lack of time. The variety of questions spread throughout the paper meant that candidates continued to find parts of questions they were able to attempt.

Candidates need to be encouraged to write down their methods, even if they do working in their heads or on their calculators, as in many questions part marks are available if the answer is incorrect.

Although use of a calculator was allowed there were a lot of basic arithmetic errors made and unrealistic answers given, e.g. 17 for a prime number between 20 and 30. There were clearly instances of candidates not reading the question properly, and little evidence of checking to see if the answer made sense. Some candidates appeared not to have a calculator and many seemed reluctant to use their calculator for the percentage calculations. This may indicate a lack of appreciation of the use of decimal equivalents. Manipulation of algebraic expressions proved difficult for most candidates. There was also a poor understanding of mathematical terms, especially multiples, primes and factors, as seen in Q.3.

Comments on Individual Questions

1 This question was generally well answered. The main difficulty with this question was the inability to spell the names correctly. Part (a) was generally correct but with some interesting spellings of octagon at times. Hexagon was the next most popular with pentagon seen occasionally. For the triangle isosceles was more popular then equilateral. Scalene was not chosen particularly often. Cylinder was generally correct in (c), again with some interesting spellings. Occasionally, cuboid was seen. There were a very small number of candidates who called it ‘circular prism’.

2 This question was well answered by the vast majority of candidates. Part (a) was very well answered with the occasional 14 from using subtraction. Part (b) was usually correct but the occasional 2 from division and also 12 as some candidates think that the final number is the answer. There were a few difficulties with (c) and some candidates seemed to use inverse operations wrongly to add 11 onto 29. The most common error in (d) was to multiply 42 by 6.

3 Part (a) was reasonably well answered and some gave more than 1 factor e.g. 2 × 3 or 1, 2, 3, 6. 12 was a common error from candidates confusing factor with multiple. Many continued the factors/multiples confusion from (a) into (b) with common answers of 25 and 2, 5 and 10. Sometimes two multiplications to 50 were offered. Lower scoring candidates generally mixed up factors and multiples. Occasionally a candidate wrote one factor and one multiple. Knowledge of prime numbers was weak for a significant number of candidates with 25 and 27 being common incorrect answers. Some gave a prime outside the given range, e.g. 13 or 17. The more common correct answer was 23 rather than 29.

4 Incorrect answers seemed to indicate a failure to read the statements carefully and evaluate them, then relate them to the list of probability terms provided. Several candidates were clearly confused between ‘likely’ and ‘unlikely’ in (a) and (c). ‘Impossible’ was used correctly in (b) 5.

5 Few managed a fully correct enlargement but many scored 1 mark for the three unit vertical line or 2 marks for the correct three unit vertical line and the horizontal line at the top. For the sloping sides many did not get the direction of the lines in relation to the squares on the page correct. The common error was for the left sloping line to be a diagonal of a 4 by 4 or a 6 by 6 square. Generally a ruler was used for drawing the lines.

6 The majority of candidates gave the correct rounding in (a). Many found (b) difficult, apart from higher scoring candidates. The most common error was 15730 – rounding to the nearest 10 as in part (a). Other answers seen were 15700, 16 and 1600. Many candidates scored 1 mark in (c) for 41.748. Many then either left this as their answer or truncated to 41.74 rather than rounding. Several didn't write any working down but gave 41.74 as their answer. Some candidates lost both marks by giving an answer such as 4174.8 without quoting the exact answer first.

7 Almost all candidates got the correct term, although a few gave the sequence rule at this point instead of 29. The majority then managed to include a +7 somewhere in the explanation of how they worked out their answer. However a significant minority explained how they worked out the differences between the given terms but did not specify what to add on. Some candidates did not always express their answers very clearly in words. Part (b) was generally well attempted. A few candidates made the mistake of squaring 6 instead of doubling and a few tried to connect it to part (a) and involved the 29.

8 This question tested candidates' organisation. A number chose to use a scale going up in fives. A few chose a very compact scale which sometimes resulted in them losing the height mark. It was pleasing to see the majority had chosen a scale going up in twos which made it easy for them to pick up full marks. Some candidates aligned the numbers for the scale on the squares rather than the lines. There was good, consistent use of gaps between bars and bar widths; usually bars were 2 squares wide although one and three square widths were seen. There were occasionally errors in bar heights; usually the candidates making an error in only one bar with the rest being correct. Very occasionally, there were lines rather than bars.

9 For (a), 0.4 was seen about a third of the time with candidates seemingly feeling obliged to use at least the 2 or the 5. Unfortunately 2.5 was seen very regularly and 0.2 was also a common response. Part (b)(i) was quite well answered. Only on a few occasions did students score the method mark exclusively for 48/8 or 6 without going on correctly to get 18. Part (b)(ii) did not pose many problems and (iii) was generally well answered, with a few errors of $7 \times 3 = 21$. Rarely was $7 \times 7 \times 7$ seen without evaluation. Candidates using a calculator in (iv) gave little evidence of working being written down, some calculating $80 \div 37$. A significant number used non-calculator methods but invariably made more than one arithmetic error. It was also quite common for candidates to find 38%. Others worked out 10%, 30%, 5% and so on but the method usually fell down when working out 1% and multiples thereof. In part (c), again, little working was shown with calculators being used. Some calculated $94 \div 18$. A number calculated 18% correctly, but did not then do the subtraction, giving an answer of 16.92. There was little evidence of calculating 82%. Again, with non-calculator methods commonly seen there were mistakes in calculating 1%. Some candidates settled for finding 10%, 5% and 2.5% and guessing the little bit extra.

10 Many candidates understood what was required here and gained all 3 marks but it was evident that there were a significant number who had little idea how to proceed. Candidates often realised that they would either have to multiply or divide by 1.6 and, despite the relationship given in the question, it was not uncommon to see an answer of 192 in part (a) and 23.43… in part (b). If part (a) was done incorrectly, few managed to recover in part (b).

11 The majority of candidates were able to give correct answers in both parts.

12 Most candidates understood how to reflect the triangle but many did so in the wrong line. The most common error was to reflect in the *y*-axis, with a smaller number using the *x*-axis. The translation was not completed well; many of the candidates clearly didn't understand what a translation was. Several had drawn triangles with the incorrect orientation. Most images seemed to end up in the second quadrant and one of the vertices of the image was often drawn at (-5, -2). In the few cases where the triangle was translated, only some of these were done correctly. As many candidates translated it by $\begin{pmatrix}-2\\-5\end{pmatrix}$ as did it by $\begin{pmatrix}-5\\-2\end{pmatrix}$, and a few moved correctly in one direction but not in the other. A small number of candidates had not read the question carefully and tried to apply the translation to triangle B rather than triangle A.

13 Many correct substitutions were seen. Several had written 16.5 – 8 on the answer line but not evaluated it and so only scored the method mark. A fairly common error was adding instead of subtracting the terms. Lower scoring candidates tended to add the 3 and 5.5 and also 2 and 4, giving an answer of 2.5. The correct expansion was not seen very often in (b). Candidates appeared to have little understanding of brackets. A common error was only multiplying one term. Many of the high scoring candidates had had the correct answer to (c). The major error was to subtract 4 from the 100 giving $20x = 96$, leading to an answer of 4.8.

14 Candidates need to understand that on questions where their quality of written communication is assessed (which have * next to the question number) they must show their working. It was pleasing to see that several candidates scored 4 or 5 marks. These candidates had, in the main, set out their calculations in a reasonably formal and logical manner, and so had little difficulty understanding the problem and solving it. Candidates not scoring below 3 often got confused as to what they were actually working out with a particular calculation. This resulted in some very unrealistic answers, without evidence of checking reasonableness. It was common for candidates not to show enough working, particularly arriving at 24 from 15 × 24 = 360 instead of 360 ÷ 15 = 24. Others did gallons multiplied by 1.37, instead of litres. There was a notable lack of attempts to show any calculations by lower scoring candidates.

15 Many correct answers were seen in (a), with diameter and chord (often spelt cord) as the most popular incorrect answers for line CD. The X was generally on the circumference but for some this was a struggle and crosses were floating everywhere, usually on the diameter, chord or tangent. Part (b) was beyond all but the better candidates. Very few scored all 4 marks. Many candidates did not use pi in their calculations. Many earned credit for 65.5 × 3509 but 229839.5 was often their final answer. However, it was almost as common to see 3509 ÷ 65.5 = 53.57. Some attempted to convert the units but most were divided by just 1000 or 10 000 rather than 100000. Some candidates had multiplied or divided their answer by 1.6, presumably as they thought the original units were miles.

16 Most candidates completed the table of values successfully. Many of these candidates went on to draw the appropriate line on the graph. A number of candidates plotted the points but did not join them up. Where errors were made in the table, candidates generally plotted the points from their table. Many candidates did not appear to understand what was required for part (c). Crosses were often on one or other axis, but rarely in the right place in terms of *x* and often at the origin.

17 The table was completed well with many candidates gaining both marks. Some weaker responses introduced other methods of transport. Many candidates were able to obtain the correct probability in (b). Some, however, decided to add together the totals, often incorrectly, despite being told in the stem of the question the total was 500. The most common error was to divide 500 by 15. In (c) many candidates scored the first mark for the fraction but this was another case where candidates did not read the question carefully, giving answers of 25% or 90°. Several that had a correct answer in part (i) went on to score the mark in (ii) and a few correctly obtained the answer in this part from an incorrect answer in (i). Many candidates found (iii) difficult. A common wrong answer was 26760 from just halving the 53520. Some did gain credit for the angle of 200°. A common error was to calculate for an angle of 202.5° from 180° + 22.5° rather than using their protractor to measure the angle.

18 There were lots of 3-D representations seen as some candidates clearly did not understand what is required for a net. The most common error was to add rectangles of dimension 3 by 5 above and below the given rectangle, instead of 2 by 5. Most nets scored for the correct 2 by 3 sides, and the back face was often also correct. A number scored credit having drawn the sides as 3 by 3 when these corresponded to their three 3 by 5 rectangles. In general (b) was well answered. Several candidates were able to score 2 marks for calculating the volume as 180, but then failed to divide by 20. Some weaker candidates added the dimensions rather than dividing.

19 The factor tree method was commonly used in (a) with most achieving at least two marks. Candidates who did not use a factor tree usually failed to gain more than one mark. Errors on the factor tree came from adding rather than multiplying, for example, 100 broken down into 50 and 50 rather than 50 and 2. It was common to see factors with addition signs or commas and to one missing factor when writing the answer. Some wrote a list of factor pairs or made a complete list of factors including many numbers which were not prime numbers. A significant number left the answer blank. Some candidates were able to obtain the correct answer in (b), usually from two lists of times. Many had the correct answer in both lists but because they did not line up their lists it was not recognised as a correct answer and put on the answer line. The adding on of 16 and going across the full hour did cause problems for some candidates.

20 Part (a) was fairly well answered, usually with candidates identifying 0 and/or more than 16 competitions missing. Some got confused about the context thinking the numbers referred to the months of the year resulting in comments referring to ‘16 months was more than a year’ or ‘not able to have 13-16 months’. Other common incorrect answers were ‘there was no box for over 16 year olds,’ ‘the boxes were too wide,’ or ‘not accurate enough.’ A few said that it did not specify the type of competition. It was quite common for candidates to forget to include 0 in part (b) even when they had criticised this in part (a). Covering the range 0 – 12 was the biggest problem with a few using ‘other’ instead of ‘more’. Some only offered 3 groups and a few gave a question but no response groups. There were a lot of examples of overlapping groups. Little working was shown in (c). Only higher scoring candidates seemed able to obtain the correct answer. A few managed to find the midpoints and then multiply by the frequency to get 2110 but then often incorrectly divided by 4. Several just added the midpoints or a number from each group and then divided by 4. Many made the usual error of adding the frequencies and dividing by 4.

21 Usually candidates did not have the necessary algebraic skills to answer this question; rarely fully correct with very few worthy of any marks. Most candidates had an attempt but the significance of getting the steps in the right order was missed, even with those candidates who got full marks in the earlier ‘solving the equation’ question. Candidates often found it difficult even to do a first step clearly. Turning the equation round was common. Candidates didn’t know how to deal with the 5. Occasionally $5t = v – u$ or $(v – u)/5$ was seen. Some candidates did not attempt this question.

22 Only a few candidates used Pythagoras' theorem and many candidates did not attempt this question. Those that did often added the squares instead of subtracting them. A small number of candidates left the answer as 47.19.

J567/03 Paper 3 (Higher tier)

General Comments

The paper was accessible to candidates of all ability levels with some candidates demonstrating good understanding of the full range of mathematics assessed. Candidates had time to complete the paper and made attempts at most of the questions, though the later questions were found challenging by many candidates. Lower scoring scripts which showed methods often gained part marks on some of the later questions.

On a non-calculator paper it is expected that candidates show a good grasp of basic arithmetic as well as mastery of higher-level skills and many marks can be lost through simple arithmetic slips.

Candidates performed well on most of the algebra and statistics questions. However the spatial skills required to interpret three dimensional objects were generally weaker.

Presentation was usually clear and working often shown enabling method marks to be awarded. In the problem solving questions candidates need to be aware of the need for clear, logical working to enable examiners to follow their reasoning. Some candidates had clearly been well prepared for the Quality of Written Communication question and annotated each step of their method. Other candidates presented their work in a haphazard manner making it very difficult to interpret their method and so they lost marks.

Candidates generally had access to the required geometrical instruments and diagrams were often neat. They should be encouraged to use a pencil for graphs and diagrams to enable them to correct errors as crossings out make diagrams difficult to mark.

Comments on Individual Questions

1 Many candidates gave the correct answer to (a) but common errors were 0.6, 0.15 and 3.50. After converting $\frac{3}{50}$ to $\frac{6}{100}$ some candidates still gave an answer of 0.6. A general lack of understanding of recurring decimal notation was demonstrated in (b). It was common to see a degree symbol used rather than a solid dot, and this was sometimes positioned well to the right of the final 2. Some candidates knew that the answer should be a recurring decimal but showed insufficient figures with 0.22 given. Other common incorrect answers were 0.2, 0.18, 4.5 and 2.9. In (c), many good answers used the laws of indices to reach 5^3 but failed to evaluate this as 125. The wording 'work out' requires an evaluation and is not the same as 'simplify'. Those who changed the original powers of 5 into $\frac{25 \times 3125}{625}$ were often defeated by the subsequent arithmetic. The more common, and more successful, approach was to change to improper fractions and then subtract rather than to deal with the whole numbers first. Those candidates who started by subtracting 1 from 3 were often confused by the negative fraction, and reached an answer of $2\frac{1}{2}$ or its unsimplified equivalent. Some candidates failed to simplify their final answer as required by the question. Candidates who used a common denominator other than sixths had more difficulty with the conversions. Common errors were doubling $3\frac{1}{3}$ to get $6\frac{2}{6}$, inverting the second fraction and subtracting denominators as well as numerators.

2 Many candidates drew an accurate arc, centre C, but few correct angle bisectors were seen with or without arcs. Candidates who had drawn an incorrect line from A, usually to point C, often shaded the correct region. Common wrong loci usually involved perpendicular bisectors or a series of circles on AD and AB.

3 In part (a) was very well answered by all candidates. Very few candidates used an incorrect conversion of 1 litre = 100 ml leading to an answer of 75 and 25.

On the whole candidates made reasonable attempts, in part (b) at setting out their work, with some annotation and/or units being seen in nearly all cases. Some candidates showed an array of disorganised calculations with no annotation which was very difficult to follow. The need for more annotation should be emphasised in the teaching of this type of question where poor notation and lack of systematic working will bar candidates from gaining full marks.

The calculations 80 × 250 = 20 (litres) and 80 × 60p = (£) 48 were commonly seen with no annotation. Profit, or similar comment, was seldom seen when leading to the final answer.

Poor multiplication skills were shown for some calculations with 80 × 60p variously seen as £480, £4.80 or even £46 and 80 × 250 given as 2000 ml by some.

Those candidates obtaining 20 litres usually handled the ratio correctly and 15 litres of apple and 5 litres of mango were very often seen. Despite the hint in part (a), some candidates split the 20 litres into two 10 litre parts or used 20 litres of each type of juice. The omission of the cost of the cups was a common error when finding the total costs.

The weaker candidates usually managed to earn 2 marks, mainly for subtracting £2.76 from £48 in reaching the final answer.

Some good candidates worked with single cups rather than starting with 80 cups which led to accuracy difficulties and extra calculations.

4 Most candidates answered part (i) correctly.

in part (ii) most candidates identified the 30 and 120 but did not always reach a fractional answer. A very small minority wrote the answer as a ratio or equivalent. Some divided 120 by 30 which led to an answer of 4% or 40%. The other common error was to use 200 as the denominator rather than 120.

More arithmetic errors were seen in part (iii) including both addition errors and the inability to convert $\frac{114}{200}$ to a percentage. Some candidates misread the question and worked out the percentage aged over 18 or under 60, for which a special case mark was available.

In part (b)(i) candidates knew how to construct an ordered stem and leaf diagram. Very few diagrams were left unordered and there were few errors or omissions.

In part (ii) most candidates gave the correct range, with very few answers left as ‘37 to 72’ or similar.

In part (iii) candidates found a number of different approaches to this problem and often scored well. It was common for candidates to obtain 50 minutes as the time to run 10 km at 12 km/h, but then some were confused by the fact that shorter times meant faster speeds.

Candidates who started by finding the median time found it more difficult to convert this to a speed, although some did change this to 5.15 min/km. The distance of 10 km was often divided by 51.5 with no attempt to convert the minutes to hours, and often this was rewritten as 51.5 ÷ 10 which was easier to evaluate. Some candidates used a similar method using 51 as the time of the tenth runner which was given credit.

Other candidates attempted to work out the mean of all or some of the times which was not given credit. Weaker responses gave statements with no reference to the data. Sometimes candidates failed to make the final comparison with a half.

5 Candidates found it hard to visualise solid and few correct answers were seen. Many candidates scored credit for drawing a 3 by 2 rectangle.

In part (b) (i) candidates were more successful at identifying that a 3 by 2 by 1 cuboid would have the smallest surface area. Some candidates were unable to use the isometric paper correctly and drew one of the edges horizontally. A common error was to draw a 6 by 1 by 1 cuboid or, less commonly, use the six cubes not arranged in a cuboid. Some candidates used the wrong number of cubes.

Those candidates who had given the correct answer in (i) often gave the correct answer in part (ii), and there were many candidates who followed through correctly with the surface area of the shape they had drawn. The most common error was to calculate the volume of the solid. Few method marks were awarded for incorrect surface areas as working was seldom shown.

In part (c) candidates did not look carefully at the diagram so confused the directions of the *y*- and *z*-axes. Many gave (3,1,0) and (1,3,1) as the alternatives to the correct answers although there were also a variety of combinations of the numbers from 0 to 3 seen.

6 Many correct answers were seen. Candidates usually identified that 3 was involved and common errors were $5n + 3$, $n + 3$ and $8n$.

Again many candidates coped well with part (b), although some had one of the values incorrect. Common errors were to use $n = 0$ for the first term or to reverse the expression and use $5n - 12$, both of which gained the special case mark if applied correctly. Having found the first term as 7 a few candidates continued the sequence 7, 14, 21. The correct answer reversed was also seen occasionally, perhaps where candidates felt that a sequence had to be in ascending order.

7 In part (b) was usually correct.

Candidates attempted to take out a common factor, although some earned just 1 mark for using either 2 or b rather than $2b$. Some candidates tried to factorise into two brackets.

Candidates solving algebraically often set their work out clearly and usually reached the correct answer in part (c). Some difficulty dealing with the -2 was seen with candidates reaching $2x = 5$ and a solution of $x = 2.5$. Trial and improvement methods rarely reached the correct answer.

The inequality in part (d) was often solved correctly. Candidates need to understand that an inequality is required for the answer and an answer of 2 alone or $y = 2$ will not gain full credit. Candidates generally used a line starting from 2 in the correct direction to represent the inequality but some used an open circle or a line rather than a closed circle which was required for the mark.

8 In part (a) fully correct answers were seen. In most cases there was little evidence of the result of reflecting A in the *x*-axis before the translation so the most common part mark was for the translation of the correct answer. Only a few candidates reflected in the *y*-axis before the translation or transformed C instead of A.

Many candidates gave more than one transformation in part (b) despite 'single' being written in bold in the question. Many recognised that enlargement was involved, although often gave rotation or a combination of reflections as well. Many candidates did not recognise a negative scale factor and gave the scale factor as 2. When stated, the centre of enlargement was usually correct.

9 Answers of 61 400 000, 61.4×10^6 and 6.14^7 were seen in party (a) (i) indicating that candidates were unsure of the meaning of standard form particularly as there was no example given in the question. Other attempts at standard form often had errors of 1 in the index.

In part (ii) most candidates could identify a correct calculation that would lead them to being able to answer the question, but they then often failed to choose an appropriate estimation that would allow them to reach a conclusion. Many attempts at long multiplication and division were seen which seldom led to a correct answer. Few candidates used standard form and strings of zeros or misuse of millions were often seen, leading to place value errors and the inability to identify that the answer was ten times too large.

Most candidates could add the figures correctly in part (b), but then failed to correctly convert their answer to standard form or omitted to round it to three significant figures. Some evidence of confusion between decimal places and significant figures was seen.

10 Most candidates answered part (a) correctly, with some converting the fractions on the second branches to tenths.

Most candidates identified the correct probabilities part (b) to use in their calculation and those that multiplied them usually reached the correct answer although some basic arithmetic errors were evident. The main error was to add the probabilities, often incorrectly, with many candidates showing a lack of appreciation that a probability must be less than one.

11 Many candidates answered part (a) correctly, although others failed to relate the equation to the physical situation and did not use $t = 0$. The most common error was 85.

In part (b) many candidates recovered from an incorrect or omitted (a) and produced correct tables. A common error was to misinterpret the equation and compute $90 - (5t)^2$ leading to answers of 90, 65, -10.

Most candidates plotted their points correctly in part (c) with any errors seen usually being misplots of 45 or -35 from careless application of the vertical scale. The curve was generally neatly drawn, although lines of best fit and straight line segments were sometimes seen.

In part (d) most candidates read the correct values from their graphs, although there was some evidence of incorrect use of the horizontal scale in (ii).

12 Many correct solutions to this problem were seen from candidates across the ability range. Most candidates used a trial and improvement method, which was sometimes systematic, rather than a formal algebraic approach. Common wrong answers were for 9w and 1d or 7w and 7d giving a correct points total of 28 with no attempt to get 12 matches.

13 A lack of understanding of histograms and frequency density was evident in part (a). Candidates often gave the frequency density of 2.4 as the answer or made errors when trying to calculate the area of the bar.

Those candidates who understood the concept of a histogram made reasonable attempts at part (b). Some candidates were hindered by their inability to calculate the frequencies correctly which led to figures that were difficult to manipulate for their comparison with the national survey. Others attempted to find the frequencies but then did not try to give a comparison and merely stated that the results were similar to or different from Karen's survey with no comparison of like with like. Weaker candidates made comments relating to the heights of the bars for 30-45 hours with no calculations.

14 It was apparent in part (a) that candidates had some understanding of proportion, but many did not know how to deal with inverse proportion and instead treated this as direct proportion. The most common answer was $F = 5d$ from the use of direct proportion.

If the correct answer had been found in (a) the correct answer usually followed in part (b), although again arithmetic errors appeared. Candidates who had given an equation in F and d could gain a mark here for correctly using it, and many candidates gained this follow through mark.

15 Only the strongest candidates could access part (a) but they often gave $(x + 4)^2$ then failed to find the constant term correctly. It was common to see $(x + 8)^2$, $(x + 4x)^2$ or $(x + 8x)^2$. In other cases $\sqrt{8}$ was seen in place of 4.

Few candidates realised that the constant term from their completed square form was necessary for the answer in part (b). A small number gave the answer –4, the value of x that gives the minimum value.

16 Most answers to part (a) were correct but common errors were $\begin{pmatrix} 6 \\ -3 \end{pmatrix}$ and $\begin{pmatrix} -1 \\ 1 \end{pmatrix}$.

Some candidates gave correct solutions in part (b) although there was little evidence of method used. When algebra was attempted candidates rarely knew how they might deal with their vector expressions and few attempted to draw vectors on the grid provided.

17 Some candidates could interpret part (a) as $\left(\sqrt{\frac{1}{9}}\right)^3$ although did not then know how to proceed. Calculations involving $\frac{1}{9}$ and $\frac{2}{3}$ were common errors.

Many candidates, even those with little understanding of surds, made an attempt at part (b) showing that they understood how to expand a pair of brackets and often scored the method mark. It was common to see $\sqrt{10}$ and $\sqrt{6}$ in place of $5\sqrt{2}$ and $3\sqrt{2}$. $\sqrt{4}$ was not always interpreted as 2.

18 Where presentation was good method marks were generally earned, if not full marks. Carelessness with signs caused many candidates to lose one or two marks and others lost the final mark by combining terms inappropriately or by attempting to expand the denominator and reaching $x^2 – 6$. Weaker answers added the terms in the numerator and the terms in the denominator and reached the answer $\frac{7}{2x-1}$.

J567/04 Paper 4 (Higher tier)

General Comments

The candidates appeared to be well prepared for this paper and had sufficient time to complete it. The statistical and geometrical questions were usually well answered and reasoning was a strong feature. The algebra sometimes lacked structure and the best answers came from traditional approaches where the working was logically set out. The number work was sometimes weak, particularly with ratio and percentages and working was not always well set out. There was too much reliance on trial and improvement methods.

The use of a suitable electronic calculator was essential and some candidates did not have use of one whilst there were fewer instances of the calculator being in the wrong mode; for instance with trigonometry. Many answers were rounded or truncated too early and an inaccurate answer was usually the result.

In terms of the presentation of answers, a ruler was required for two questions and it was surprising how many did not use one to draw straight lines. Candidates are advised to show decimal points in numbers clearly and not to use commas to separate thousands.

Comments on Individual Questions

1 There were a few instances of candidates omitting the negative sign before 16.4 leading to an answer of 33.9 but some of these showed 17.5 in their working and gained credit.
In part (b) there were many correct answers; incorrect responses usually had the correct operations but in the wrong order.

2 In (a) the majority of candidates tackled this question using a factor tree and this was a successful method for most, resulting in the correct answer. Some candidates added the prime factors or listed them separated by commas and occasionally transferred the factors incorrectly from their tree to the answer line. Part (b) is a problem-solving question and many candidates struggled to execute a valid method correctly. The candidates did not usually link this part to part (a) in terms of method and the factor tree method was not used very often. However it was successful when used. Many candidates used the approach of listing the times of both trains. Common mistakes here were to make errors in adding 16 minutes (particularly adding to 15:48) or to write two lists both including the correct answer of 16:20 but then to continue beyond this point not realising that a common time had been found. Other candidates listed multiples of 16 and 20 until they found a common multiple. Those who used this method were less likely to gain marks than those who listed the times. A common approach was to multiply 16 by 20 to get 320 but candidates struggled to convert 320 minutes into hours and minutes in order to be able to add correctly to 15:00; 18 20 was quite a common answer.

3 This question was found difficult by many candidates and it was a problem solving question. A common misconception was to count both bicycle wheels so their answer was multiplied by 2 at some point. Some candidates were confused as to whether the circumference or area of the circle was needed. For circumference π was omitted in some cases and a common solution was 65.5 x 3509. The conversion into kilometres was usually completed in two stages. First division by 100 to change to metres was usually correct, but the most common error at all levels of ability was not knowing that there are 1000 metres in a kilometre.

4 In part (a) many answered correctly with the main error being 185 ÷ 100 × 9. Some candidates divided 100 by 9 to give 11·1 only to round to 11, then finding 11 × 185 to give 2035. Some gave an answer of 2035 by just multiplying by 11, without showing method, often thinking that 99% is close enough to 100% for the purpose of this question. A common incorrect method used by some candidates involved finding 10% of 185 as 18.5 which they equated to 1% of the daily amount. Then they added 185 + 18.5 to give 203.5, which they stated to be 10% of the daily amount, and then 100% of daily amount was calculated as 10 × 203.5 giving 2035 calories. In (b) the majority of candidates correctly completed the division method did not appear to understand what they were working out and sometimes selected the wrong answer. This was evident when weight was divided by amount of sodium and the incorrect answer was more often given. Two common errors to this question were either to subtract the values given or to multiply them.

5 In parts (a) and (b) most gave the correct response. In part (c)(i) some did not use a ruler for their line and others joined their line to the origin. Part (c)(ii) was usually answered correctly although some read the value from the wrong axis.

6 Part (a) was a successfully answered question with most candidates knowing to calculate distance ÷ time. Common errors were mainly to represent the time as 2.3 hours or 150 minutes. There were few candidates who, having divided by 150 minutes, went on to convert to km/h. Some candidates divided time by distance. In part (b) most candidates gained full marks. Candidates generally showed clear step-by-step working leading to the correct answer. Errors arose when rounding to 2 s.f. to give 1.3, omitting to square root their answer at the end and confusing the division line with subtraction. A common error was an answer of 4.05 arising from typing the operations into the calculator without using brackets or working out intermediate stages. Some rounded intermediate answers before putting them back into the calculator.

7 Most candidates answered well in part (a). There were observations regarding 'variable band widths' or 'too long a time period to remember' but most were able to recognise the need to allow for 0 or over 16. In (b) there were some very good responses. The common error was to have groups with overlaps, such as 1-3, 3-5, or to omit zero from their choices. The attempt to use 'greater than' or 'less than' signs often led to poor notation. In (c)(i) there were some very clear and concise explanations. However, many could not express in words what the full process was although they did appear to understand it. In (c)(ii) 30/4 = 7.5 or 175/30 = 5.83 were common responses, but many were able to calculate then round down their answer. In (d) most candidates scored the first mark for the midpoints. There were a few who used 42.5, 48.5 and a significant number went on to divide their sum of midpoint × frequency by 4 rather than 40. A few found the mean of the midpoints.

8 Basic understanding of this topic was good with many fully correct answers seen throughout, although some did not recognise and use the scale of the diagram correctly. Almost every candidate got (a) correct. In part (b) the majority plotted the points correctly. However some lost marks for failing to draw the straight line and occasionally it was obvious a ruler had not been used. In part (c) many fully correct answers were seen. However some candidates mixed up axes and a thicker cross was seen at (0, -4) or at (0, 0). In part (d) the most common error was misreading the scale, with 1.5 being a common wrong answer. A few confused the horizontal and vertical values giving an answer of $^{1}/_{3}$. Part (e) was answered better than (d) and it was due to candidates using the written equation rather than the graph to answer this part.

9 Most performed at least two correct trials although some wrote their values to only one figure. It was common for candidates to do two correct trials and then give an incorrect answer, such as 2.8 or 2.9.

10 Their method was generally shown clearly and the most common one was to evaluate 6400×0.85^3. Occasionally 6400 was multiplied in stages by 0.85 but this was less successful and could lead to too many multiplications being carried out, with some rounding or truncating in intermediate stages. Common errors were using a multiplier of 0.85×3 or evaluating 6400×0.85^{2015}. Some candidates also rounded 0.85^3 to 0.6 giving an answer of 3840.

11 In (a) the majority were successful with the answer of 53°. The distractor of 77° led a few candidates to state 'corresponding angles' as their reason. The reason 'alternate angles' was often described as 'z-angles'. Some responses contained a lot additional explanation such as 'angles on a straight line' or 'opposite angles on parallel lines'. In (b) most of the good responses showed working on the diagram with an indication of 90° or 28°. Angle APB was commonly considered as half of 124°, which lead to an answer of 59°. Others considered triangle ABP to be equilateral.

12 In part (a) Pythagoras' theorem was correctly used and the answer usually given to three significant figures. Some candidates rounded to two significant figures, which was appropriate for this question although three figure accuracy is usually advised. Some tried to use sin, tan or even the sine rule; they usually found an angle but not the side requested. In part (b) some thought angle *a* was angle DAC and used the wrong triangle or, using the correct triangle, they truncated their value of AC so that the answer was incorrect for angle GAC despite their method being correct.

13 This question differentiated well between the candidates. Structure was lacking from the weaker responses. Flow diagrams and trial and improvement do not usually lead to the correct answer. In part (a) many candidates were unable to deal with the division by 4. It was the order of operations that gave the problem. Many tried to collect the '*x*'s and 'numbers' before dealing with the 4. In part (b), as the first three terms were usually correct, the most common problem was $-6 \times +6$, where -12 or $+12$ were often seen. Part (c) appeared to be an invitation to use the 'quadratic formula' and, in most cases, candidates failed to reach the correct answers. In part (d) the square root was dealt with correctly but often before the 4π. Many subtracted the 4π instead of dividing and those who did divide often did two separate divisions.

14 Many candidates answered this question correctly. The most common and successful method was $21 \div 5 = 4.2$ followed by $4.2 \times 8 = 33.6$. Common mistakes were: $21 - 5 = 16$ leading to $8 + 16 = 24$ and $5 \times 4 + 1 = 21$ leading to $8 \times 4 + 1 = 33$. Some attempts to use trigonometry were seen, particularly the sine and cosine rules.

15 Part (a) was well answered but occasionally one region was omitted. In part (b) the problem was writing the equation of the line and $xy \le 8$ was a common response. Some wrote the equation correctly whilst others reversed the inequality sign. A variety of correct answers were accepted.

16 In part (a) the most common error was $30 \div 47 = 0.6382978$ leading to the incorrect answer of 63.8% or 64%. Some candidates started with the 17 and attempted to break the 30 down into 50%, 5% and 1%, arriving at 56%. There were many trial and improvement attempts and few succeeded. Most candidates answered (b)(i) correctly and showed working by writing down the upper or lower quartile. A few found the range for GB or the IQR for Australia and sometimes the median (20.5) was used in the calculation leading to a wrong answer. Part (b)(ii) was usually answered correctly though some thought that Australia won more medals because their range was larger.

17 Many candidates used the correct formula and substituted $r = 8$ and $h = 24$. The better answers showed an understanding of the significance of 'correct to the nearest centimetre' and the request for the 'upper bound' for the volume. Some candidates tried to use upper bounds but used 8.4 and 24.4 with the occasional 8.49 and 24.49 seen. A few times the wrong formula was quoted, using r^3 for example, and some candidates incorrectly approximated ⅓ to 0.3.

18 Candidates found this question difficult. Many did not attempt the question. There were very few who were able to deal with the -3 correctly. A few candidates came very close but gave $y = (x^2 +3) +2$ as their answer. Sketches showed that a number of candidates knew that the curve had been moved by 3 left and 2 up but they could then not relate this to x^2. Some did show the +2 at the end of their function to gain credit.

19 Candidates found this question challenging but many made a reasonable attempt at it. The most common approach was to multiply the equations by 2 and 3 respectively and then to attempt to eliminate x. A few candidates managed to do this successfully and found the correct three term quadratic equation. However most made a mistake when multiplying the equations. Most commonly there was no multiplication of the 'y' term. When subtracting the equations, common mistakes were $2y^2 – 3y = y$ and $4 - -3 = 1$. Some candidates eliminated the x terms without subtracting the equations, leaving them with two equations in y (e.g. $2y^2 = 4$ and $3y = -3$). A more successful approach was to square the second equation and then equate to give $3x + 2 = (2x - 1)^2$. However, many candidates struggled to square the bracket correctly. Of the candidates who derived a three term quadratic equation, the majority knew how to use the quadratic formula and went on to substitute the appropriate values in, although there was evidence of premature rounding in the calculation of the x or y values.

20 The standard of work suggested that most struggled with this question. There are three stages to completing this problem: calculation of an angle, application of the area formula and working out the number of horses. Of the three stages most candidates were more successful with the final stage. If they had an area they knew to divide by 4046.856 and in most cases rounded down their answer. The second most successful stage was application of the area formula. Some could not complete the substitution as they were unable to calculate any angle. A small number attempted to use ½ × base × height after attempting to calculate the height with a variety of trigonometric methods. The first stage was by far the least successful stage. Many could quote the correct cosine formula but they were unable to apply it to this problem.

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