Oxford Cambridge and RSA

# GCSE (9-1)

# Mathematics – J560

General Certificate of Secondary Education

# OCR Report to Centres June 2017

**About this Examiner Report to Centres**

This report on the 2017 Summer assessments aims to highlight:
- areas where students were more successful,
- main areas where students may need additional support and some reflection,
- points of advice 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.

The report also includes:

- **Guidance on how to put your results in context** – using the outcomes of Cambridge Assessment's research that indicates that volatility in schools' GCSE exam results is normal, quantifiable and predictable,

- Links to important documents such as **grade boundaries**,

- A reminder of our **post-results services** including Enquiries About Results,

- **Further support that you can expect from OCR**, such as our Active Results service and CPD programme,

- A link to our handy Teacher Guide on **Supporting the move to linear assessment** to support you with the ongoing transition.

**Putting your results in context**

If you've had results this year that you weren't expecting then the latest research from Cambridge Assessment may help to explain why. You may be surprised to learn that volatility in schools' GCSE exam results is normal, quantifiable and predictable.

Researchers from Cambridge Assessment argue in a report, *Volatility happens: Understanding variation in schools' GCSE results* (April 2017), that fluctuations are to be expected and can be largely explained by a change in the students or even just simple chance. They say that although it might be seen as obvious, in some years pupils will perform better than expected, while in other years pupils will perform worse.

The study will enable you to manage expectations and have conversations with your heads and governors so that they can interpret changes in expected results appropriately. The research builds on an earlier study that ruled out exam grade boundaries and marking as major components of volatility. The current research adds an understanding of just how much volatility can be accounted for by the routine changes in students between years and normal variations in individual students' performance in a particular exam.

Be prepared for conversations about what's normal in terms of outcomes by reading our press release, researcher blog and by downloading this handy GCSE English and Maths fluctuation infographic**.**

Ofqual has also published a report looking at patterns of variability in outcomes of schools and colleges for particular GCSE subjects as one way of understanding the extent of volatility in the system.

**Grade boundaries**

Grade boundaries for this, and all other assessments, can be found on Interchange. For more information on the publication of grade boundaries please see the OCR website.

**Enquiry About Results**

If any of your students' results are not as expected, you may wish to consider one of our Enquiry About Results services. For full information about the options available visit the OCR website.

**Supporting the move to linear assessment**

In many qualifications this was the first year that students were assessed in a linear structure. To help you navigate the changes and to support you with areas of difficulty, download our helpful Teacher guide at http://www.ocr.org.uk/Images/338121-moving-from-modular-to-linear-qualifications-teachers-guide.pdf.

**Further support from OCR**

activeresults

Active Results offers a unique perspective on results data and greater opportunities to understand students' performance.
It allows you to:

- Review reports on the **performance of individual candidates**, cohorts of students and whole centres
- **Analyse results** at question and/or topic level
- **Compare your centre** with OCR national averages or similar OCR centres.
- Identify areas of the curriculum where students excel or struggle and help **pinpoint strengths and weaknesses** of students and teaching departments.

http://www.ocr.org.uk/administration/support-and-tools/active-results

CPD Hub
Your route to OCR's teacher training

Attend one of our popular CPD courses to hear exam feedback directly or drop in to an online Q&A session.
http://www.ocr.org.uk/gcsemathscpd

## CONTENTS

### General Certificate of Secondary Education (9-1)

### Mathematics (J560)

### OCR REPORT TO CENTRES

# J560/01 Paper 1 (Foundation Tier)

**General Comments**

Marks for the paper covered almost the full range. Almost all questions were accessible and the majority of candidates attempted every question in the time available.

Material not included at foundation tier in the previous specification (such as solving quadratic equations by factorising, repeated percentage change and the application of trigonometry) caused difficulty for some candidates.

It appeared that several candidates did not have or did not use a calculator, as many made arithmetical errors and often on very simple calculations. Many appeared not to understand how to calculate a percentage with a calculator. Some had difficulty using a protractor.

Presentation, generally, continues to improve from the previous specification, but there are still a few instances of figures being poorly written and some handwriting was nearly illegible. There were also many occasions where calculations and numbers filled the answer space in an apparently random way with working not set out in a logical order. Candidates need to ensure they read the questions carefully as many tried to calculate exact answers to the estimation question, and several did not give answers in the form asked for (e.g. as a fraction, or to the specified degree of accuracy).

**Comments on Individual Questions**

Q1 All parts of this question were answered well. The large majority were able to measure the angle correctly in (a)(i), although some read the wrong scale on the protractor. (a)(ii) was generally correct. Parallel was generally correctly identified in (b), with occasional mention of perpendicular. Despite the words being given on the page, it was not uncommon to see difficulties with spelling.

Q2 Part (a) was generally correct. In (b) many were correct although some simply wrote 300 or rounded to the nearest ten or nearest thousand. The conversion in (c) was also relatively successful; common errors were 5.8 and 0.58.

Q3 Almost all candidates answered parts (a) and (b) correctly, with the most common error to give 27 as a square number. Part (c) was more challenging. Many identified the correct three numbers, but additionally included 39. Some stated a large selection from the original list, usually the odd numbers, and simply wrote them in numerical order. It was also common to see just two of the prime numbers listed, usually 11 with either 23 or 41.

Q4 Many candidates scored all 3 marks; of those who did not most scored 1 mark for correctly identifying 8 and/or 4. Many correctly arrived at 28, but failed to progress further and give a fraction for the final mark, while others neglected to subtract 12 from 40. A small number failed to read the question and provided their final answer as a decimal or percentage. Some failed to realise that the fraction and percentage were both of the original 40 cakes.

Q5 Parts (a) and (b) were generally correct, showing a good understanding of coordinates. The most common error in (a) was writing the $x$ and $y$ coordinates the wrong way around and similarly, any error in (b) usually resulted in R being plotted at (-3, 2). Part (c) proved to be more challenging. There were many correct answers, the most common error was giving the line $x = 3$.

Q6 Many candidates scored full marks, though several did not round their answer to 1 decimal place. Several non-calculator attempts were seen, but often failed to reach the correct result. Common incorrect methods were 54 ÷ 17 and 54 ÷ 0.17. A small number gained the final mark for an incorrect answer correctly rounded to 1dp.

Q7 In part (a) many correct answers were seen, although it was common to see incorrect terms $10u$ or $2u$ in the answer. Most scored 1 mark for correctly obtaining $12t$. Part (b) was less well answered. Several candidates did not take the factor of 5 out of the second term and gave responses of $5(v + 20w)$. In part (c) fewer correct answers were seen. Those that had some understanding recognised that the solution required a factorisation leading to an expression in the form $(x + a)(x + b)$; many of these then went on to give the correct $(x + 3)(x + 7)$, but failed to give the correct solutions (answers of 3 and 7 often followed). Another common error was taking out a single factor from 2 or more terms.

Q8 Parts (a) and (b) were well answered with a few errors. Many also provided an accurate method in part (c), with a valid calculation and a correct statement to score full marks. The most popular routes appeared to be 550 ÷ 6 × 15 and 550 + 550 + 275 to obtain 1375g, although it was quite common to see the miscalculation of 550 ÷ 2 as 225. An alternate method was to work out that there were only enough apples to make crumble for 14.1… people. Some worked out correct values, but were unable to interpret correctly and lost the final mark. Many of the weaker candidates scored at least 1 mark for 1300g, but there was a minority who offered incorrect work, or no work.

Q9 Part (a) was well answered. In (b)(i) fewer correct responses were seen, though the majority correctly calculated the sector angle of 15° (row 2) and/or 24 goals (row 3). Many candidates did not included Simon's result when calculating the values. In (b)(ii) some candidates with a correctly completed table in (i) seemed to have difficulty drawing the pie chart, yet several scored 1 mark for correctly drawing and labelling one sector. Marks were commonly lost in giving some angles out of tolerance through poor use of a protractor and failing to fully label the pie chart.

Q10 Many candidates scored 1 mark for a correct calculation, usually 52 ÷ 61 leading to either 0.852 or 85.2%, or for 0.86 x 61 = 52.46. The most successful were those who worked out 85%, with almost all then giving a correct interpretation. Many who arrived at 52.46 said that this rounds to 52 and stated he passed, losing a mark. A few compared the 9 marks he lost with 14% and some stated that because he got over half marks he had passed.

Q11 Most candidates managed to identify a correct calculation and many interpreted their answers correctly in the context of the question, however, a significant number of those who obtained a correct result then made errors in the interpretation. Candidates who worked out 320 ÷ 53 sometimes seemed unclear how to deal with the answer. The most successful candidates recognised the significance of this being over 6 requiring an extra coach, but in a number of cases 6.03… was rounded to 6 leading to the incorrect conclusion that Gary only needed 6 coaches. Those who opted to find 53 × 6 = 318 usually realised that 2 people would not have a seat and an extra coach would be required, however, there were others who thought that Gary was correct because there would be 2 spare seats.

Q12 A large number of candidates were able to deduce that Marc's speed was 8 mph without a formal method shown. Where this was not obtained some candidates had managed to calculate the distance travelled in miles to be 32, though without working this mark was not awarded.

Q13 Many correct answers were seen in part (a). Errors tended to reflect a lack of understanding of the question rather than an inability to convert 1 hour to minutes.

Several candidates failed to score. Common errors were 20 and 60. Fully correct answers to part (b) were rare, but a large majority correctly multiplied 25 000 by 6 to give 150 000 for 1 mark. Most gave answers beginning '15…', but not with the correct place values. Many answered part (c) correctly; the most common incorrect answer was $\frac{6}{7}$.

Q14 Parts (a) and (b) were usually correct or not attempted. Part (c) was less successful with many candidates missing the crux of the question, simply completing the calculation and stating that it was the same as the given answer.

Q15 The majority of candidates responded to this question, but many showed a lack of systematic working. Those who achieved full marks were generally those more organised in their attempts, either through forming an equation or through working backwards from the information given. Some candidates gave solutions with no working. Many candidates started by dividing the total cost by 4 or 6 and then tried to create a solution from this.

Q16 A large number of candidates managed to score two marks for an arc of radius 5 cm covering the required region from point B. A lesser number achieved four marks for a completely correct construction, but without correctly identify where the house could be; common errors were identifying an inner region, or a series of correct points rather than the continuous arc. A minority just gave a series of crosses measured 5 cm from B with no arcs; a few candidates just drew arcs and circles seemingly at random.

Q17 Many candidates scored the full 3 marks on this question, but a large number failed to score at all. A common error was to use simple interest, leading to £276000. Others failed to progress further than one year. It was rare to see the efficient method $240\,000 \times 1.05^3$ used; a large number made separate calculations one year at a time and while they were often successfully, these were much more likely to have an arithmetic error somewhere. Many used non-calculator methods, usually incurring errors.

Q18 The majority gave a correct answer in part (a) and many of the rest scored one mark for a correct product, usually as a start to a factor tree. Some found all the correct factors, but failed to use them in a product in the response, responding either with an addition of them or leaving them as individual factors. In part (b) the most successful method was by listing departure times. The main error was due to using 100 minutes in an hour. A few found the LCM was 200, but found it difficult to change this into hours and minutes and add it to 9:00am.

Q19 In part (a) many scored 1 mark for 0.7, but failed to score the mark for 0.8 and 0.2 correctly placed on the second set of branches. Some placed them in the wrong order, while others used 0.3 and 0.7 again. In (b) only a small number were able to show why the probability was 0.76. It was very rare for 1 − 0.24 to be used; most correct answers involved the addition of 0.06, 0.56 and 0.14.

Q20 The reverse percentage question was attempted by a large number of candidates, however very few managed to gain marks. The most prevalent response was finding 12% of 38.64 and then subtracting it (or adding it), rather than realising that this value was 112% of the actual pressure.

Q21 It was rare to award full marks in this question. Many candidates began by calculating areas rather than perimeters. Some found a correct solution, but failed to round it to 3 significant figures, which resulted in four marks. Most marks awarded in this question were for use of $\pi d$ divided by 2 for the semicircle's arc length and for clearly identifying 60 as the side length or radius.

Q22 Only a very small number of candidates made any progress towards answering this question. Very few identified the right-angled isosceles triangle and consequently used the angle of 45° in part (a). Many of those who offered a response seemed to confuse lengths and angles, using the lengths 25 and 45 to try to give a bearing. A few used Pythagoras' theorem to find the hypotenuse length and then gave that answer as a bearing. A very small number marked some angles on the diagram indicating that they had an idea of bearings, but did not find any relevant angles. Some ignored the fact that the diagram was not to scale and measured the angle. Only a small number of candidates made an attempt to use trigonometry.

Q23 Many candidates scored both marks for accurately plotting four points in part (a). Some had problems using the scales and a small number offered no response. In part (b) many candidates struggled to express their ideas clearly. A number of candidates made two comments from the same category. Some commented on the shape of the graph rather than any meaning, which did not gain credit.

Q24 A significant number of candidates scored full marks on this question, often using algebra to some extent. Many of the rest managed to write two equations, but only a small proportion of these then had any idea of how to proceed. Many who understood the method for elimination then made an arithmetic error in the process and so lost the final accuracy mark. Few attempts were apparent in checking if values obtained for X and Y were sensible. Errors in part (b) involved mention of speed, time, traffic jams and that one route was longer than the other.

# J560/02 Paper 2 (Foundation Tier)

**General Comments**

The paper represented a significant challenge for many candidates. Many did not attempt all questions and these were distributed throughout the paper. The latter questions were found difficult by many students. Lower scoring candidates were often unable to demonstrate the mathematical knowledge they have.

Candidates appeared to have enough time, but it was difficult to judge for some with high numbers of questions not attempted. However, candidates did not seem to return to some of the questions they had missed out, especially some of the numerical questions.

Many candidates seemed to show a lack of understanding in ratio and proportion and candidates had difficulty accessing some of the reasoning and problem solving questions. Candidates often seemed unsure with the rules of fractions and many did not seem familiar with the Fibonacci sequence. Work on representing data in a chart, simple algebra and basic, functional numeracy was handled well by many.

On a non-calculator paper it is important that candidates have good skills with basic arithmetic. Numerous basic errors were seen throughout the paper with addition, subtraction, multiplication and division. Multiplication and division are often tackled with the inefficient method of repeated addition. It was noticeable throughout that many candidates still write the numbers in a division the wrong way round. Poor numeracy skills often made questions more difficult than intended. It is also important for candidates to note when a question requires estimation (as in Q16), since this will allow them to perform calculations with easier numbers.

Candidates should continue to be encouraged to show all necessary working. Presentation has generally continued to improve from the previous specification, however candidates would benefit from a more logical approach to their responses in the higher tariff questions. Working out was often muddled and difficult to follow when a lot of arithmetic was needed and there was little evidence that calculations were checked and corrected as needed. Often calculations are dispersed over a page, which can lead to mistakes or contradictory responses.

**Comments on Individual Questions**

Q1 Most candidates demonstrated a good understanding of tallying and reading a tally in (a). A small number made a mistake with the number of tally marks required to indicate 13, and some only filled in one of the two empty spaces. Marks lost in (b) were generally from incorrectly drawing the height for the odd frequency bars. No problems were seen with the width of the bars and pleasingly the large majority used a ruler to construct bars. In (c) Many were able to identify the fraction as $\frac{18}{60}$, but made errors in converting this to a percentage. Those that didn't score often tried to divide 60 by 18 or attempted to find 18% of 60.

Q2 Those who used a correct method often reached $6\frac{5}{4}$ or $6\frac{10}{8}$, but failed to convert to the required answer. A small number of candidates converted the fractions to decimals and added. A correct improper fraction (e.g. $\frac{58}{8}$) was seen in (a)(i) as frequently as $7\frac{1}{4}$. Several candidates were awarded no marks in this question. The main error was adding the numerators and denominators without attempting a common denominator, thus ending up with a wrong answer of $6\frac{4}{6}$. Some candidates changed to $\frac{13}{2}+\frac{3}{4}$, but here again many just added the numerators and the denominators. The most common and efficient method in (a)(ii) was to divide by 7 and then multiply by 4 and many candidates reached the correct result using this method. Those who attempted the multiplication first usually made errors. Some candidates made arithmetical errors in attempting to divide 63 by 7. Some who successfully divided 63 by 7 did not go on to multiply by 4 and just gave 9 as their answer. Some candidates evaluated 4 × 7, giving an answer of 28. While many candidates in (b) attempted to find equivalent fractions with a common denominator, the inclusion of 9 as an initial value made this challenging, especially for those who tried to use 100 as a common denominator. Although very few gave equivalent fractions over a common denominator of 45 this was the most successful method. Those who attempted to convert to decimals or percentages usually gained a mark for the $\frac{4}{5}$ conversion but failed to convert $\frac{7}{9}$ correctly. Candidates who drew sketch diagrams as a comparison or who gave descriptions relating to the value of the denominator being a bigger fraction gained no credit. The most successful method in (c) was to change denominators to 40 or 100, which enabled a fraction between the two to be easily seen (most commonly $\frac{9}{40}$). When $\frac{4}{20}$ and $\frac{5}{20}$ were used this sometimes lead to an answer of $\frac{4.5}{20}$. Methods again looked at converting to 0.2 or 20% and 0.25 or 25%, but rarely did this lead to a fraction between the two. Many gave incorrect fraction answers of the form $\frac{1}{x}$ where $x < 5$ or $x >$ 4 without any working, although some candidates identified that $\frac{1}{4.5}$ was between the given fractions.

Q3 Many candidates found (a) challenging. Not many responses included both the correctly worked answer and a sufficient explanation. Often candidates did not make the nature of the error clear. Several incorrectly stated that 10 × 12.4 should have been 120.4. Of the candidates who gave a description of the error a significant number didn’t appreciate they were also asked to complete the calculation correctly. Some earned a mark for getting to 248. A number didn’t spot the error and just thought it was not the best way to do the calculation, often following this by attempting 23 x 12.4 using various grid methods. These types of calculations often highlighted problems with multiplication techniques. Those who grasped the decomposition method were usually able to complete the calculation correctly. In part (b) method marks were often awarded for 25.80 or the method to achieve it. There was some confusion seen arising from the wording ‘They **each** pay £6.45’, with this being taken to mean each ticket cost £6.45 and so a very common error was to multiply £6.45 by 3 rather than by 4. Many went on to divide by 3. Some candidates multiplied by 4 and then divided by 4 to work out the cost per person and did not realise that this should have resulted in £6.45, their starting value. Those scoring 0 marks often gave the answer of 2.15 from dividing 6.45 by 3.

Q4 Although a reasonable proportion of candidates gave the correct answer in (a)(i), many gave a response of 3.5 for the division of 6.5 by 2. Although 6.5 was often seen (scoring M1), those who had not written down their measurement first gained no credit for the incorrect answer of 3.5. Some did not use the scale and just wrote down their measured length and a very small number used the scale incorrectly, giving answers such as 13 km. In (a)(ii) few achieved the correct answer of 115, or an answer within tolerance such as 114. A widespread misunderstanding of bearings was evident with a variety of incorrect angles between 020 and 350 given. A few candidates gave compass directions rather than an angle. In part (b) the B1 mark was scored more often for a correct length than for the bearing. Several crosses were quite close, but outside tolerance, indicating more care and accuracy is needed when measuring angles. Other errors in measuring the bearing often resulted in C drawn in the wrong quadrant, commonly in a south-easterly direction. Some candidates also had difficulty with the scale, with a line of length 4.5 cm rather than 5 cm frequently seen. Some candidates did not clearly indicate their point C with a cross, either just drawing a line or having a letter C marked on the diagram.

Q5 Part (a) was well done. A common error was $3x^2 + 5xy$ or, less often, giving the $6xy$ term as just $6y$. Some did expand the brackets correctly, but then went on to try and combine their terms. Although correct answers were very common in (b)(i), algebraic methods were rarely seen. Common errors were an answer of 21 and some simple errors in dividing by 7 were made. In (b)(ii) full marks were not often awarded and it was difficult to award M marks as working was rarely algebraic; clear methods were not seen very often.

Candidates often showed that 9 + 2 = 11, but not in relation to $\frac{x}{3}$. Others multiplied by 3 first, but often a term was missed out (e.g. giving x – 2 = 27). Many problems arose from attempting a trial-and-improvement technique, with a common incorrect answer of 11.

Q6 Very few candidates recognised that the required term was corresponding angles. Explanations about parallel lines were common; other responses mentioned opposite, equilateral triangle, isosceles triangle, 180° in a triangle and occasionally alternate. Use of F angles was very rare. It was evident from both parts (a) and (b) that candidates were unfamiliar with the terminology angle XBC. This confusion was problematic in (b) as some wrote all three angles of the triangle on the answer line, or added them together and gave an answer of 180°. Where a correct answer of 50° for angle BXC was reached, including both required reasons was rare. Many gave the reason relating to the angle sum of a triangle, but few also mentioned it was isosceles. It was sometimes difficult to follow working, as just a series of calculations were stated and reasons that were often correct were not always linked to specific working. Some thought triangle XBC was equilateral. Others were confused about which two angles in the isosceles triangle were equal. Angles on a straight line = 180° was a reason used by quite a few.

Q7 The erratum had been added to virtually all scripts and, although few scored full marks, the vast majority of candidates made good progress. 6 and 8 for the number of 1p coins and 2p coins were often given, although sometimes these were seen in working and then rejected. A significant number scored 3 marks for answers such as 6 and 8 with a total for their 5p coins and 10p coins of 35p. Many did not approach the problem by recognising that the probabilities needed to be written with a denominator of 20 and quite a number of trial-and-error approaches were seen instead. A common error was to subtract the number of 1p and 2p coins from 57 rather than their total value. Many without 6 and 8 scored 1 mark for having a total value of 57p or very occasionally having a total of 20 coins. Some candidates put the pence in the answer spaces rather than the number of coins; as this resulted in 6 and 16 already being more than 20 coins they then struggled to proceed.

Q8 Most candidates understood the square root sign in (a)(i) with just a small number of responses involving 11 × 11, $11^2$ or 12 seen. Only very rarely was 121 halved, giving 60.5. Although almost all candidates attempted (a)(ii) it was hardly ever answered correctly. The most common answer was –16, with –8, –4 and 2 sometimes seen. Very rarely $\frac{1}{4^2}$ was given, though often not then evaluated to $\frac{1}{16}$. Although there were several correct answers in (b) of 9, more gave the answer of 144 from working through the calculation left to right. Many candidates wrote the word BIDMAS on their paper, however, very few applied BIDMAS correctly. Often candidates changed the order of the numbers and put $(6 – 9)^2 = (-3)^2$, then gave an answer of -9. Some were unable to square correctly and it was not uncommon to see $3^2 = 6$ or $12^2 = 24$. A few attempted to square all the numbers inside the bracket (i.e. 81 – 9 x 4) and proceed from there. The correct answer of 3 was often seen in (c), with the incorrect answers of 25 (from 5 × 25 = 125) and 5 (from 125 ÷ 5) seen almost as frequently.

Q9 Many candidates dealt with the arithmetic well in parts (a) and (b)(ii). Candidates who didn’t achieve full marks in (a) often gained method marks from intent to divide 420 by 5, or 7, or 35. Errors in division were frequently seen from lower scoring candidates however, losing a mark. Many candidates related their explanation in (b)(i) to the amount Lillian’s earnings would be reduced rather than relating it to the reduction in the days she would be working; many answers were along the lines of ‘Lillian is still getting a good wage’ or (surprisingly) ‘£84 is not a big drop’. Few provided a statement that equated 20% to pay for a single day, although a number referred to a reduction of 1 day. In (b)(ii) the correct answer was given by many, but again some found the arithmetic challenging. The most common method was to work out 20% and subtract from £420. Others multiplied the hourly rate by 28. A common error arose from taking 20% of the hourly rate and multiplying by 28.

Q10 Many seemed to struggle with this question. Few were able to give the correct expression for the width in (a)(i). Candidates who realised that it involved 4 and *n* often gave 4 + *n* or *n* – 4. It was not uncommon to see purely numerical answers. There was more success in (a)(ii), with correct answers often containing units. In (b) those attempting a correct method often identified that the area of one rectangle was 16 ÷ 3, which they could not always evaluate correctly. Some then went on to attempt to divide their result by 2 to find the value of *n*, but having used an incorrect or inexact value for the area reached a value that was out of range. Some candidates attempted a trial and improvement approach, which was not successful. Common answers were 2.5 and 3, often with no working shown. Other incorrect answers were larger than 4, demonstrating that candidates had not identified that *n* had to be smaller than the length of the edge of the square. It was very rare to see any equation with (4 - *n*) or 2*n*. Many candidates gave no response to at least one of the parts.

Q11 A large number of candidates were unaware of the properties of a Fibonacci sequence, so were unable to access this question. The most common error in (a) was 16, 22 from adding 5 and then 6. In (b) the common error was to find the difference between 31 and 50 then repeatedly subtract this value (19), sometimes ending with negative solutions. The majority of candidates were unable to deal with the algebraic terms in (c), with some using number terms from the previous answers. Some gained marks for $y - x$ and $x + y$ although sometimes the first term was given as $x – y$. Very rarely was $x + 2y$ seen as the last term.

Q12 Many candidates identified that the reason for rounding the measurements in (a) was that it would make the area calculations easier; a few suggested that it was to give an estimate for the area. Some errors were due to thinking that rounding values always gave a greater answer or that rounded values were more accurate. Others thought the rounding was to help the measuring rather than the calculating of area, or they referred to the shape of the field. In (b) candidates were required to identify a series of processes and carry them out accurately, which most found a challenge. Many candidates attempted all of these stages, but working was often difficult to follow. Most scoring candidates identified that the first step was to work out the area of the field, but many could not use a correct method to find the area of the trapezium and the formula was rarely used. A partial area calculation was often seen, although the ½ was often missing from any triangle calculations. Good attempts to convert the area to hectares and to calculate the number of kilograms were seen, but incorrect attempts at area led to much more difficult figures used in their subsequent calculations (e.g. some did 220 × 150, but then ran into problems converting 33 000 m into hectares and then working out 6400 × 3.3). Some did not convert to hectares, but rather added 6400 kg up in 10,000m² for their area. Other common errors included using the perimeter, multiplying all three dimensions together or simply doing a calculation involving 6400 and 10 000 without an attempt to find an area.

Q13 It was clear in (a) that many candidates did not know what a plan view was and attempts at nets were common, or three dimensional representations of the prism as if it were on isometric paper. Many did not attempt this part at all. Very few candidates were able to calculate the volume in part (b), possibly because they were unable to visualise the prism. There was a general understanding that three things needed multiplying for a volume, but few realised that they needed to find the area of the end face and multiply it by the length. Those that considered the cross-section often treated it as a triangle however most did 3 × 4 for the cross-section and very few counted squares. M1 was often awarded for a length of 6 identified within their volume calculation.

Q14 Candidates using the correct rule for multiplying fractions usually reached $\frac{30}{330}$, but many could not then simplify this fully, or made errors in their cancelling. There was very little evidence of candidates cancelling the fractions before multiplication, which would have simplified the arithmetic. Confusion with calculating with fractions was again evident, with many candidates either inverting the second fraction before multiplying or attempting to convert to a common denominator before multiplying.

Q15 The majority of candidates knew that they were required to divide distance by time; many correctly drew a speed-distance-time triangle or wrote the formula and most were able to identify 160 (km) as the distance. There was less success in finding an appropriate time; many used the time given on the graph at the end of the journey (1130) instead of the length of time taken to complete the journey. Others attempting a time interval used it in an incorrect form, such as 2h 30min or 150 (min). All divisions proved challenging for many, except for those who just used 2 hours.

Q16 Many found this question very difficult and a number of candidates did not attempt this question; responses often suggested little idea as to how to get started and it was very rare to see candidates linking this question with estimation. Approximating to 6000 : 16000 at the beginning was never seen. Some were able to reduce 6400 : 16200 to 32 : 81, but then reached the conclusion that Katie was incorrect because this ratio could not be reduced to 3 : 8 or didn't give a decision. Other good attempts involved calculating 16 200 ÷ 8 and 6400 ÷ 3, but often the working contained errors. A very common error was to divide 16 200 or 6400 by 11. Other candidates simply added or subtracted the two given values. Insecure arithmetic skills also added to problems for candidates, particularly when not estimating. A few did not understand the working of the question and often stopped after 16 200 + 6400 or 16 200 – 6400.

Q17 Most candidates attempted (a), but responses were varied and there was confusion over the order in which to change the subject. Some made an incorrect first step, but then scored M1 for correct follow through to a completed answer. A number of candidates had made use of a vertical column and showed they knew the first step should be to add 7 to both sides, but then could not show working in equation form. Some students used flowcharts, but they often misinterpreted the second row. Many simply switched $x$ and $y$, providing a final answer of $x = 7y – 3$. Part (b)(i) was generally well done although some candidates provided an extra $x$ inside the bracket, giving their answer as $x(x - xy)$. Many (b)(ii) responses were incorrect, but a number contained two sets of brackets. M1 was awarded for $(x + 4)(x + 3)$. A common incorrect answer was $x(x + 8) + 12$.

Q18 Very few candidates reached the correct answer. Most understood mode and range to gain some marks, usually for giving values with a mode of 76. They had more difficulty finding the final pair of values to give a range of 10 and a total 300; some provided numbers resulting in one of these, though not both. Lots of calculations and trials were seen in their working. It was common to see candidates treating the mode and range separately, with candidates writing two values of 76 on the answer lines and then giving another two values with a range of 10, ignoring how the 76 fitted with these values. Fewer realised the total needed to be 300; those that did either had it in the form 75 × 4 or showed attempts to subtract from or add to 300. Candidates occasionally wrote down the 4 statistical definitions, sometimes not going on to use them.

Q19 Most candidates seemingly did not know to connect the two ratios through finding a common number of children, hence very few were able to use the two given ratios to find the ratio of men : women. It was common to see the totals 14 and 7 and then attempts to work with these to get a ratio (often 2 : 1). The most common answer was 11 : 5, from taking the values for men and women from the given ratios. Despite problems with part (a), more candidates were able to attempt part (b) and a few got to the correct answer. Methods were very confused, but many were able to calculate either the number of men or women correctly. Occasionally 18 × 5 and 12 × 11 were shown, but errors were then made when attempting to evaluate.

Q20 The correct value of 160 pairs of sandals was fairly common, with some candidates having calculated the number of each style of shoe before giving their answer. Some candidates multiplied by 1000 and gave an answer of 8000, even though this was greater than the total stated in the question. Another common error was 80. Very few candidates understood what was required in the assumption, with many thinking it needed an explanation of how they reached 160. When assumptions weren't related to the method, they often referred to time of year, whether or not people were telling the truth or whether the same people would buy the shoes. Comments often related to the 50 people in the sample only, with no understanding that the sample had to be representative.

Q21 Although not attempted by many, candidates who recognised that (a) related to Pythagoras' theorem usually gained at least 1 mark. Not all showed the square root however required for the second method mark. Others used Pythagoras' theorem by squaring and adding 12 and 13. Very few candidates gave a concluding statement, although some indicated the lengths of the sides on the diagrams. In (b) very few were able to explain conditions for congruency. Many comments attempted a definition of congruence, such as they are the same or one is just a rotation of the other one, rather than identifying evidence for these triangles' congruence. Many thought that equal angles meant congruent. Other explanations commonly referred to the two triangles being right angled. Some vaguely referred to them being the same size, but only a very small number of candidates correctly identified that all of the sides were the same lengths, or used the congruence condition SSS or RHS.

# J560/03 Paper 3 (Foundation Tier)

**General Comments**

In the first year of this qualification it was pleasing to see many candidates well prepared for this paper. The majority of candidates attempted all the questions and were still scoring marks at the end of the paper. Most candidates appeared to have the necessary equipment to respond to questions.

Many candidates used a calculator in questions, although too many inefficient pencil-and-paper methods were attempted and usually with limited success. Candidates should be encouraged to use a pencil (with a sharp point) for diagrams and graphs. They may also benefit from practice at using calculators efficiently.

Candidates appeared successful in numerical questions of a ‘real life’ nature, such as Q7 (however some used incorrect notation for money, e.g. £9.64p, although this was condoned in this question). They were also successful with simple probability, although it was disappointing to see so many responses of words (such as ‘likely’) to probability questions when a fraction was required. Candidates were also successful with sequences and understanding Venn diagrams.

Candidates were less successful with accurate construction, particularly bisecting an angle, drawing and using a quadratic curve and giving coherent explanations; candidates would benefit from practising giving explanations to their peers and trying to convince them of the validity of their case. A case in point was the scatter diagram question (Q16), where many candidates had some grasp of the situation yet were unable to express their responses clearly.

Candidates should be encouraged to show working for all questions. A good number of candidates did show reasonable work in support of their answers, but some were chaotic. They should ensure that numbers are written clearly, so that examiners can differentiate (for example between 4 and 9) and that amended answers are crossed out and rewritten.

**Comments on Individual Questions**

Q1 Many good answers were seen to part (a), although completing the column of fractions was a notable challenge. A common error was to think that 3% was equal to 0.3, or $\frac{3}{10}$, or $\frac{1}{3}$. Another error was $\frac{4}{5}$ = 0.45. In part (b) the correct answer was often given, although many could not cancel $\frac{45}{100}$ correctly. Part (c) seemed to be split fairly evenly between the correct answer of $\frac{1}{5}$ and the incorrect $\frac{1}{4}$. A few examples of $\frac{4}{5}$ were seen.

2 Some correct answers were seen, but a very significant number incorrectly worked out compound interest. 8400 was sometimes multiplied by 1.12 and sometimes divided by 12. Non-calculator methods (breaking down 12%) were usually unsuccessful.

3 In part (a) the correct answer was frequently seen, but common errors were to evaluate $5^7$ or give $5^7$ as the answer. For part (b) many candidates found 14, but were not able to give the answer −14. Incorrect second values were unpredictable, but included 14, 98, 196 and 13.99.

4 Some correct responses were seen to part (a). Many candidates correctly expanded $5(x – 2)$ to score 1 mark, but did not always deal well with the second bracket, sometimes forgetting to multiply out and often being unable to deal with the minus sign. Often they had problems collecting the terms. Frequent wrong answers were $3x – 18$ and $7x$ ….. Part (b) was a challenge to many. Some partially factorised the expression; others extracted $x$ as a factor yet still left $x$ in the second term in the bracket with, for example $x(10x + 6x)$. A number of candidates tried to factorise the quadratic into two brackets and some added the terms together to make $16x^2$. $106x$ was another error. In part (c), $x^7$ and $x^{25}$ were often given, or just 10 rather than $x^{10}$.

5 Part (a) was very often correct, although some candidates were not able to calculate 3 × 16 correctly. Many showed working and 1 mark for a reaching 48 and 14 could be awarded. Some did not add their values. Candidates are expected to be able to use the formula in (b), yet success was limited with this part. Common errors were to correctly substitute values, but then carry out the operations in the incorrect order, to square the 1.5 (presumably through misunderstanding of its squared units, i.e. $m/s^2$) and to find $u$ instead of $v$. Part (c) was not well done and candidates had little appreciation of the required processes. Common wrong answers were $d = 7c$, $d = c – 7$ and $d = \frac{7}{c}$.

6 All parts were well answered. Some wrong answers in part (a)(i) were impossible and likely. In part (b)(ii) some candidates lost marks because they used words from the list rather than fractions and others used a ratio, which is not an acceptable form of probability.

7 Many good answers were given. Many candidates showed, and used, correct processes. A surprising number of candidates attempted 11 × 15.65 without a calculator, listing 15.65 eleven times. Although the method was valid, errors usually meant that the answer was not. A common error was to divide 403.51 by 24. Others deducted the cost of one shirt from £403.51 and then divided that by 24.

8 This question was generally not answered well. Some good, efficient methods were seen in part (a), however too many incomplete, time consuming and inefficient pencil-and-paper methods were used, such as such as equating \$50 to £40 and then doubling in long lists to reach \$700 (this method usually broke down because candidates could not deal with the final \$20). Other candidates simply subtracted £10, as the given difference was 10, to respond with £710. A number of candidates divided 50 by 40, but then multiplied 720 by 1.25. In part (b) few candidates realised that this question, at least at the start, could be treated as a mean from a frequency table. A large number of candidates chose to change each denomination of note to pounds, then multiply each result by the number of notes and add these values, rather than find the total number of euros and then change. Where inefficient methods were used, there were also a significant number of numerical errors. A common error was to multiply by 1.17 at the end rather than divide. A number of candidates rounded inappropriately, losing accuracy marks. It was helpful to examiners for candidates to label, or clearly show, stages in the method so this could easily be followed and rewarded.

9 Part (a) was much better attempted than (b), probably due to a combination of decimal places being better understood than significant figures and an easier number to deal with. Candidates should understand that trailing decimal places after the last rounded digit is not correct; this error cost many candidates the marks in both parts of the question. Those who did not score in part (a) usually gave these trailing zeros, or 7.30, or sometimes moved the decimal point so that the number then had 2 decimal places (i.e. 730.65). In part (b), by far the most common error in part (i) was to give 408 and not maintain place value. The other common error was rounding to 2 significant figures.

There were fewer correct responses in part (ii), with trailing zeros and rounding to 2 or 3 decimal places being the most common mistakes.

10 Part (a) was answered correctly by the vast majority of students. In part (i), students occasionally added 4 instead of subtracting it. Other numerical errors were seen in part (ii), where the 2nd value was occasionally incorrect following a correct 1st value. Finding the *n*th term in part (b) proved far more challenging. While some were awarded a mark for $4n + k$, (with $k = {}^{-}1$ being seen most often), the most common wrong answers were + 4, $n + 4$ and giving the next value in the sequence (i.e. 21).

11 In part (a) the figures 7 and 6 were often seen in the answer, but these could be £7.60, £76 or even £760 (expensive grapes!). Candidates are advised to check that their answers are realistic. In part (b) a significant majority failed to see what was being asked. Some divided the exact values and rounded the answer to score no marks. A few rounded £280.25 to £280, but then divided this by 19 using a calculator.

12 Most candidates understood what was meant by perimeter and often showed working. Only a few tried to find area. A common error was to add the given numbers only. Others missed out the width of the small cut-out (2.9 cm) and some did not realise that both sides of the insert were 7.4 cm. In some cases candidates found the width of the insert, but then failed to use it in their total perimeter calculations. Another error was to split the shape into sections and either add individual perimeters or find areas.

13 Only a very small minority understood the idea of error intervals. Few correct answers were seen to part (a). When one mark was awarded it was often for 12.65 correctly placed. In part (b) candidates sometimes described the wood as being between 7.5 m and 8.5 m, but did not give values that answered the question. Some candidates drew pictures of the wood and metal and said "This shows the wood is longer".

14 Many used a ruler to draw the triangle in part (a), though by no means all. Most drawings that were correctly translated were in tolerance; the majority of triangles that were incorrect were translated 1 square too many to the right and/or down. Very few images were in the wrong quadrant. In part (b) some good answers were seen, but many lost one or two marks for incomplete descriptions such as "rotate 90°" or "rotate right about (0, 0)". "Turn" is not an acceptable term for "rotation". Candidates should understand that, if asked for a single transformation, they will not gain any marks if more than 1 is used.

15 This question was best answered using systematic listing. Some very good and well organised lists were seen, but candidates were too often not systematic and started with, for example, French linked to Geography and then History, then moved to the second column to link Spanish with Art, then Music and Economics; in this way they sometimes repeated or missed combinations. Some candidates listed only the combinations with one language and realised that there were $3 \times 4 = 12$ combinations. Common errors were to combine subjects in one column such as French and Art or to attempt to combine $\frac{1}{4}$ and $\frac{1}{3}$ in some way. Another frequently seen wrong method was to find 5 combinations, but think there were a total of 7 combinations, from 4 + 3.
A significant number of candidates made errors in changing a fraction to a percentage, including rounding errors, such as 41.6%.

16 Most candidates identified the outlier on the scatter diagram, but surprisingly few drew a line of best fit to answer part (a)(ii). Few candidates scored 2 marks in part (a)(ii), but many gained one mark for suggesting a likely value in the range 200 to 250. "There is no value at 2mm" was a common wrong answer. In part (a)(iii) many candidates failed to give the simple answer for such questions (that 9 mm is beyond of the range of the data).

Common incorrect responses, among many, were, “There’s no value there”, “It doesn’t rain that hard” and “No-one would go if it was that wet.” In part (b), again many did not give the simple response, that the total number of visitors is unknown. Answers such as “It could be a different day” and “Adults often bring more than one child” were common. Others gave unclear responses such as stating “there are no numbers”, which could refer to the size of the angles.

17 Part (a)(i) was often correct and part (a)(ii) often incorrect (the most common answer was 25 and not 2500). In part (b), many candidates drew an arc of radius 6 cm in tolerance centred on B. Those who did not sometimes scored a mark for showing that 150 m would be represented by a length of 6 cm. Very few candidates realised that for the second condition it was necessary to bisect angle ADC. Of those who did, some did this correctly, but common errors were to join B to D, or bisect AB, or draw a random line. Weaker candidates drew and shaded a box, sometimes 6 cm from B, but with no other construction. In too many cases, random arcs covered the figure and sharp pencils were rarely in evidence.

18 Only a small number of coherent and well-worked solutions were seen. Many candidates correctly combined 4200 with 700 and 2 with 800 to reach 6 ($km^2$) and 1600 (people) respectively. If these were used in their complete method candidates were awarded two marks. Many candidates added 700 and 800 and gave the answer 1500. A number started well with the figures given above, but then did not know how to use them. Solutions often became chaotic.

19 Some candidates wrote 12 and 30 with no working, which scored full marks. It was much more common however to see extended working, often in the form of factor trees, lists or factor products, although this working was often disorganised. Candidates who gave two numbers part satisfying the conditions, such as 12 and 18 (which have a HCF of 6) or 10 and 12 (which have an LCM of 60), scored 1 mark. Few listed all the factors of 60.

20 In part (a)(i) the table was usually completed well, indicating that most candidates did know what ‘product’ meant (or could work it out from the numbers provided). Part (a)(ii) was again answered well. The mistake of double counting the 9 was often avoided by those who marked all the multiples of 3. The vast majority of those who got 1 mark did so through correctly identifying 25 as the denominator. Some lost this mark for including or using incorrect words, or ratio. In part (b) very little working was shown; 12/25 was rarely seen. Many candidates did not attempt an answer. Writing a zero on the spinner was quite often seen. Some candidates used decimal fractions, with 0.48 often being one of them, to complete the spinner. Sometimes the total of the numbers used was 1 suggesting some sort of misunderstanding.

21 In part (a) many correct $y$ values were seen for $x = 4$. Incorrect responses seen did not appear to be consistent. In part (b) points were sometimes plotted and sometimes these were accurate. The use of a sharp pencil and care in plotting is recommended. Many candidates scored 1 mark. Sometimes the points were joined; when this was done as a freehand continuous curve candidates had some difficulty in getting their curve to pass through the points. Candidates should be made aware that if the curve misses a plotted point by further than half a square the curve mark is not scored. Sometimes the points were incorrectly joined by ruled lines. In part (c) very few candidates knew how to solve the equation by drawing a line on the graph. A small number of candidates picked up one mark for giving the positive solution.

22 Considering its difficulty, a pleasing number of candidates scored marks on this question. Many candidates found the volume of the cuboid and a reasonable number found the volume of the cylinder and added the two. There was clear indecision about whether to multiply or divide by 2.7. Also pleasingly, few candidates found surface areas, although

there was some uncertainty about the formula for the cylinder. Solutions were too often poorly structured however and bits of working sometimes covered the available space on the page. Weaker candidates combined the given numbers in creative ways, but not ways that could be awarded marks.

# J560/04 Paper 4 (Higher Tier)

**General Comments**

Candidates applied themselves well to this paper. In the problem solving questions they did generate valid methods to solve them. However they need to show their method more clearly and to show each step in their solution. It helps if each stage has an identifier so that it is clear what the expression or calculation represents.

There was evidence that some techniques had not been learned thoroughly. In trigonometry they had learned the trigonometric ratios, the sine rule and the cosine rule but not when to apply them so we saw trigonometric ratios applied to triangles which did not have a right angle. In a triangle which required the cosine rule to find an angle, some tried to use the sine rule. In algebra, with quadratic expressions, many candidates did not know how to 'complete the square' or how to factorise when the coefficient of $x^2$ is greater than 1. There were often errors when multiplying out single or double brackets. In statistics many could not correctly read information from a cumulative frequency graph or a histogram.

**Comments on Individual Questions**

Q1 Part (a) was answered well, although some candidates did take the square root before dividing by 4. In (b) a few were confused by the powers, giving 7000 as the denominator.

Q2 Most candidates appreciated the level of accuracy needed. The lower limit was usually correctly given, although the upper limit was sometimes in error. Some candidates, in an attempt to exclude 8.35, offered answers such as 8.349… or 8.34.

Q3 The most common method in (a) was to approach this part by drawing a factor tree from 504. The most successful candidates divided by 2 until they achieved an odd number, then divided by 3 and so on. Some did not give the prime factors, but wrote 504 as a product of two factors such as 2 × 252, which is a start although not complete. Some left the prime factors as a list rather than as a product. In (b) the list from (a) was to be used along with the prime factors of 180. Those who didn't reduce these two numbers to their prime factors rarely gave the correct answer. Some gave a common factor of both numbers instead.

Q4 The most successful method was to substitute the values and then evaluate the two terms separately before adding them together. Many worked evaluated $at^2$ as $(10 \times 4)^2$, giving a final answer of 848.

Q5 In order to answer this question successfully candidates have to use either 1.12 or 112% as the multiplier one way and hence as the divisor the other way, so only those attempting 38.64 ÷ 1.12, or equivalent, were successful. The most common wrong answers came from either multiplying or dividing £38.64 by 0.88, giving answers of £34.00... or £43.91.

Q6 Despite the question asking for perimeter, many candidates calculated the area. Most obtained the height, and radius, as 60 m, but did not find the arc length correctly (usually finding the arc length of a semi-circle rather than the quadrant). This question was as much about understanding a diagram as the use of formulas. The question did also ask for the answer to be correct to three significant figures, which many did not do.

Q7 Few knew how to work out bearings in part (a). The best responses drew a diagram and marked the 45° angles clearly. Again for (b) the best responses drew diagrams, marking the known angles and sides and then going on to calculate the required angle using trigonometry. In both parts it was essential to have a clear diagram so that the method to solve the problem could be identified.

Q8 The plotting in (a) was usually completed very accurately. In (b), candidates were asked to compare the years, so had to make correct comparisons of the years; some candidates made the same comment twice, whilst others only referred to the shape of the graph and did not make a comment in context (the question asked for a comment about the number of customers).

Q9 There were many very good attempts in this question. In (a) candidates set up the simultaneous equations and then eliminated one of the variables. Some made arithmetic errors however and did not check their working, so did not get the correct answer. It should have been an easy task to check their answers in both equations and candidates should be encouraged to do this. Rearranging one equation to make X or Y the subject was rarely seen, nor the use of trial and improvement, which was usually unsuccessful. Many candidates answered (b) with “only drives these two routes” or “doesn't make any detours”, which were both acceptable answers. The other usual comments were about speed or hold-ups which did not impact on the distance travelled.

Q10 Part (a) was generally well answered, however sometimes 3948 or 4200 - 3948 = 252 were seen as answers. In (b) it was allowed for candidates to verify the answer rather than to derive it. The preferred method in (c) was to find the assumed number of trees still alive in 2030 by taking $t = 30 – 15 = 15$ to obtain $4200 \times 0.94^{15}$, which is roughly 1660. Candidates then found 60% of the original 4200, giving them a total of 2520, however this is the number predicted to have died, whereas the 1660 is the number predicted to still be alive. Many just gave these two answers as if this was all that was required, whereas in fact they needed to have subtracted this 2520 from the original 4200, giving 1680. This can then be compared with the 1660 to show that the given prediction was correct. Some candidates, after finding the 1660, expressed this as a % of the original 4200, which came to 39.52%, which they approximated to 40%; they should then have subtracted this result from 100. The question does say over 60%, so they needed to give answers correct to at least one decimal place.

Q11 Part (a) was usually answered correctly, though there was a few who confused the directions of the vector or miscounted the number of squares to be moved. When giving a full description of a transformation in (b)(i) candidates need to give all the details. In this case it was a rotation, so both the centre and angle with direction need to be included with the word ‘rotation’. It would help the candidate if the positions of the triangles after each rotation could have been indicated on the diagram. In (b)(ii) indicating the positions of each transformation and then drawing the final triangle would again have helped to decide the single transformation. The most common error however was to think the solution must be another reflection and usually the line $y = -x$ was given as this wrong answer.

Q12 There were many correct methods to answer this question. Most candidates were able to interpret a cumulative frequency graph correctly. The common error was to take the reading as being ‘more than’ rather than ‘less than’. The expected solution was to read off that 55 vehicles were being driven at 40 mph or less. As there were 80 vehicles, 25 of them were going over 40 mph. This 25 was then expressed as a percentage of 80, giving 31.25%, which is more than the allowable amount, so a speed camera needed to be installed. Another common correct method was to find 30% of the 80 vehicles, giving a total of 24 that would be allowed to go over 40 mph, however the graph gave 25, so again the camera needed to be installed. Another less common although equally acceptable method was to find 70% of 80 (which is 56), which is the number that need to be at 40 mph or below; the graph gave only 55, so again the camera was needed. An error made by some candidates was to misinterpret the 55 as a percentage of 80 and think that this 68.75% was a lot more than 30%, whereas it is the 100 – 68.75 that needs to be compared. A further error was made by those candidates who misunderstood the graph, and thought that the numbers read off it at each 10 mph value were the number of vehicles actually travelling at that speed.

Q13 Most gave the correct answers in (a) and in (b). A conditional probability was required in (c), but many gave the probability of ‘red’ with ‘not red’ and worked out 0.6 × 0.7 to give 0.42 as the answer rather than 0.7. The most common error in (d) was in adding the probabilities (e.g. 0.4 +0.2 = 0.6) rather than multiplying 0.4 and 0.2 to get 0.08. In (e) some only considered one or two paths, so just 0.08 or the middle two (0.6 × 0.7 and 0.4 × 0.8) were considered. There were also a few cases of adding up 0.4, 0.2 and 0.7, which were all the probabilities of ‘not red’ in different parts of the tree diagram.

Q14 This question was found to be difficult and many candidates could not get started. Three assumptions were commonly made by a large number of the candidates; firstly, that triangles ADE and ACB were similar leading to the ratio 2.9 being used to find AC; secondly, angle ADE was a right angle leading to a whole series of different possibilities for angle DAE, such as 46.92°, 32.45° or 38.16°, but these were seldom used in the sine rule to find AC; thirdly, that DE was parallel to CB making angle AED 72°. Those candidates who realised they needed to use the cosine rule to find angle DAE fell into two groups: those who correctly substituted the lengths of the triangle ADE and were then able to complete the problem with some success (although some lost accuracy by approximating the angle to 30°) and those who either used the implicit form of the rule and couldn’t rearrange it successfully or ended up finding angle ADE.

Q15 Most candidates answered (a) correctly. In (b) they had to compare two values. The most successful candidates were those who started from 30 and worked towards the speed (67.5 mph). Some converted 60 mph to 96 km/h and compared with 108 km/hour. A few started with 60 and changed that to m/s. Many did not show their working clearly and often included a number of calculations in one step, which was difficult to follow. In (c) some candidates realised that they needed to draw a tangent to estimate the acceleration, but a few of them then went on to make errors with the scales, particularly the time scale. The majority of candidates however did not use a tangent and simply took their reading of speed in part (a) and divided it by 7. In (d) the most common response was to write down $v = kt^2$ and leave it as the answer, or to correctly write $30 = k100$, but then wrongly deduce that $k = 10 \div 3$ or 3.3. The majority of candidates in (e) responded along the lines that “the graph only had valid information up to 10 seconds” or that “the car will eventually reach a maximum speed”. There were some predictions based on what (they incorrectly thought) the graph showed up to 10 seconds, for example “the line is starting to straighten out” or “the acceleration has stopped increasing at the end”.

Q16 This topic was regularly not answered well on the previous qualification and this continues here. In the bracket there were some who wrote $x + 5$ instead of $x – 5$ and there were many who thought the value of $b$ to be + 16.

Q17 Many candidates identified that it was a circle and with a radius of 3, but often did not include that the centre was (0, 0).

Q18 Part (a) stipulates a method, so there is credit for this method as well as credit for the correct answers. Some used the quadratic formula so could not be awarded the marks for the method. Those who tried to use factors could still gain credit for a good attempt. One common error was to see a factor of $(2x - 3)$ leading to an answer of $x = 3$, so it appears some have learned that the number at the end of the bracket is the negative of the answer. Part (b) states ‘correct to 2 decimal places’, which should hint that this part requires the quadratic formula. Some made errors in writing down the formula and substituting the values in, the most common being the fraction line often failing to go under the whole of the numerator.

Q19 The key to (a) was to spot the patterns in the numerator and in the denominator. Many candidates instead tried to find the first and second differences and at this level this will only work for linear and quadratic sequences. There are two clear methods to answer (b). Many found a second difference of 6 and then a few gave $a = 3$. This method involves learning how to arrive at " revised differences" and then proceed from there, which was less successful. There were a handful of attempts at using simultaneous equations, but these often did not get beyond the formation of equations.

Q20 The majority of responses showed just $4 \times 16 = 64$ or $16 \div 4 = 4$. There were only few that realised they had to find the area under the graph and the most common attempts to do this used triangles and rectangles.

# J560/05 Paper 5 (Higher Tier)

## General Comments

There were some excellent scripts showing clear systematic working and concise, clear conclusions when required. Some candidates showed excellent problem solving and reasoning skills and were able to communicate their thinking clearly and concisely. Most candidates were entered correctly at Higher tier and were able to access most of the paper. All candidates appeared to have enough time to complete the paper and where there were omissions this was due to lack of understanding or familiarity with the topic.

Many candidates did not present their work in a logical order or systematic way however, particularly in the decision making and problem solving questions and this is an area for development. Examiners were frequently faced with random working that often gave conflicting information and in these cases where the working shown does not lead to the answer, method marks may not be awarded. The candidates who worked with greater accuracy than was required in questions were usually more successful.

The stronger areas included multiplying fractions, standard algebraic manipulation, interpreting growth formulae, using ratios, solving inequalities and equations and the product rule for number. Weaker areas included average speed, making assumptions, vectors, reverse percentages, using correct mathematical terminology in reasoning questions, algebraic proof, interpreting and sketching graphs of quadratic functions.

## Comments on Individual Questions

Q1 This was a straightforward start to the paper and most candidates earned the 2 marks. It was noticeable that multiplying the numerators and the denominators before cancelling was the method used by most candidates, but this occasionally resulted in errors in multiplying 15 by 22 and cancelling to the lowest term after obtaining $\frac{30}{330}$.

Q2 Many candidates struggled with this question and were seemingly unsure of how to find average speed. Of those that divided 160 by 2.5, a number made arithmetic errors. Many others were unable to use the correct time interval, with 2 hours, 3 hours and 11 hours 30 mins sometimes used. Many candidates tried a 3-stage calculation for each stage of the journey, which was often left incomplete. A few found the area under the graph. Working in this question was often very random with candidates trying a variety of different and often conflicting methods.

Q3 There were various methods used in this question, such as simplifying the ratio 6400 : 16200 to 32 : 81, attempting to compare equivalent amounts (such as 6400 ÷ 3 with 16200 ÷ 8, or 8 × 6400 ÷ 3 with 16200) and approximating 6400 and 16200 and then simplifying the ratio of the approximated values. Candidates earning 2 marks often made the wrong conclusion after a correct calculation. The candidates who attempted a calculation to compare values often gained only 1 mark as they ignored decimal places, resulted in an inaccurate answer. The working in this question was rarely set out in a structured way and often required much work to interpret what a candidate was trying to do.

Q4 This was generally well answered in parts (a) and (b), though slightly less well answered in (c). Most recognised the significance of 1250 and 1.03 in the growth formula. Errors seen included 1325 in (a) from using $t$ = 1, 103% or 1.03% in part (b) and selecting the first graph in part (c).

Q5 Part (a) was well answered with the vast majority of candidates earning both marks. Candidates giving an incorrect answer without working made it impossible to earn a method mark for a correct first step or the follow through mark after an incorrect first step. Both parts of (b) were very well answered and most candidates factorised both expressions correctly.

Q6 This question provided challenges for all abilities and assessed how well candidates could use and apply their knowledge of averages and range to a problem. Most were able to score at least 1 mark, either for having values with a mode of 76 or for showing in working that the total of the 4 numbers should be 300. Fewer were able to ensure the four numbers had all three properties required and the range of 10 proved the hardest of these properties to address.

Q7 In part (a), many were able to combine the two ratios with equivalent ratios using a common multiple for the children; the correct solution was given as common as the incorrect 11 : 10 (obtained by showing the ratios as the fractions $\frac{11}{14}$ and $\frac{5}{7}=\frac{10}{14}$). There were many correct solutions to part (b), but with careful arithmetic many more candidates would have earned full marks. Very common errors were 12 × 11 = 121 and the incorrect addition of 132, 90 and 36.

Q8 This question assessed candidates' ability to explain their reasoning in the context of angles of polygons. There were many clear correct and concise answers to part (a) using either the exterior angles or interior angles of a hexagon and pentagon. As this was a 'Show that…' question it is very important that candidates show every step of their working clearly and without errors. A few showed values such as 60° and 72° and 108° and 120°, but did not show how these were obtained. Others showed the correct method but then made errors, for example, by marking the interior angles of the polygons as 60° and 72°. Part (b) proved to be more difficult for candidates and here there was more confusion about interior and exterior angles, with a number stating that the interior angle sum was 360°. There were a number of successful approaches including finding the exterior angle as 48° and showing that this was not a factor of 360° or calculating the interior angle of a 7-sided and 8-sided regular polygon and showing that 132 lay between these two values and so it was not possible.

Q9 Most candidates gained 2 marks for calculating 160 as the number of pairs of sandals required. It was rare to see an assumption that related to the sample being representative of the population; most statements referred to the availability of sandals or the weather.

Q10 This question on solving a simple inequality and an equation was very well answered. A few candidates lost the inequality sign in part (a) and gave an answer of $x = 4$. In part (b), the most common error was with those that reached $10x = 3$ being unable to complete the solution correctly to $\frac{3}{10}$ or 0.3. It is important to note again that showing clear steps of each stage of working is advantageous as follow through marks were available from a previous error in method, provided it was clearly shown.

Q11 This was a weak area for many and very few candidates earned the 2 marks for representing the two vectors correctly on the grid. Some omitted the direction arrows from one or both diagrams or omitted the enclosing side of the vector triangle in the second diagram. The majority of candidates scored 0 with many axes seen with points plotted or objects translated or rectangles drawn. There were a significant number of candidates giving no response to this question. In part (b), many candidates recognised that the vectors were in different directions, but some thought that vector **a** was going left and vector **b** was going right or that **a** was up and **b** was down. A few candidates did not make a comparison, making a statement about only vector **b**. Only the strongest candidates gained marks in part (c). Vector notation was rarely consistently used and the negative sign was often omitted from –12, resulting in the common incorrect answer of 3.

Q12 Many candidates found this question difficult. Some did not realise that they should be using reverse percentages to work backwards. Weaker candidates often increased (or sometimes decreased) 72 by 50% and then decreased that answer by 20%. A good proportion of candidates performed one of the two steps correctly, either reaching 144 then going wrong by finding 20% of 144 before subtracting, or (less often) having found a wrong total for Tuesday, they divided that by 1.2. Even the stronger candidates did this problem in two steps and did not combine the two multipliers to get 0.6 and then divide 144 by 0.6, which was the concise method for the problem.

Q13 In part (a) most candidates gained the mark, but often their notation for the recurring decimal had more decimal places than the was needed. Other errors made were to evaluate 9 ÷ 7 or 7 × 9 as $0.\dot{6}\dot{3}$. In part (b), many candidates approached this question by trialling various pairs of numbers with little or no success. Of those who recalled the process needed to convert a recurring decimal to a fraction, many gained 1 mark for 318.18… seen in working, but of these most omitted to subtract 3.18… and gave 318 and 99 as the answers. Few candidates noted that two digit numbers were required and those who reached 315 and 99 often gave these as their answer.

Q14 This was answered quite well with very few candidates failing to score any marks. In part (a) the justification was usually done correctly, but often in two stages. In part (b) there were fully correct answers, although many candidates thought there were only 48 or 24 or 32 possible combinations and did not realise that the total number of combinations was the sum of these products.

Q15 Many were well prepared for part (a). In part (i) many scored a method mark for $\sqrt{2} \times \sqrt{25}$, but those who converted this to $5\sqrt{2}$ did not always simplify to $6\sqrt{2}$ as the answer. The common errors were answers of $\sqrt{52}$, $\sqrt{100}$ and $\sqrt{50} = 2\sqrt{5}$ in the working. In part (ii), most candidates rationalised the denominator correctly, but few cancelled $\frac{10\sqrt{6}}{6}$ to its simplest form. Part (b) tested AO3 in evaluating a given method. There were very mixed responses to this question; although many appeared to understand the correct process, the use of accurate terminology in describing the correct method was weak. For the negative power, the use of the term reciprocal was rarely seen and the power of – 2 was sometimes described as the negative reciprocal or fraction or square root. It was very common to award only 1 mark, for the answer of $\frac{1}{16}$.

Q16 Most calculated the value of the angles correctly, but fewer were able to give the correct geometric reasons leading to these values using appropriate mathematical terminology. In part (a), some candidates simply said one angle was double the other. Other attempts at a correct reason were often inadequate with the use of words such as ‘origin’ instead of ‘centre’ or ‘edge’ instead of ‘circumference’. There were fewer correct angles in part (b). A value of 76 was relatively common as a wrong answer. Where the angle was correct the second mark could often not be given because the term ‘cyclic quadrilateral’ was not used; candidates often gave more general descriptions, such as ‘quadrilateral in a circle’.

Q17 In part (a) those who knew to factorise the numerator and denominator usually gained full marks. Some candidates equated $x^2 - 16$ with $(x - 4)^2$, whilst the weaker candidates cancelled the $x^2$ terms and 16 by 4 to reach the incorrect answer of $\frac{-4}{-3x}$. Part (b) assessed the new topic of expanding three sets of brackets and it was tackled quite well by the more able candidates. It was surprising to see how many candidates correctly expanded the brackets in the working, but then wrote $b = 60$ in the answer space. The answer of 4 was less often achieved.

Q18 There was a mixed response to this question, with more able candidates often scoring all 5 marks. Most candidates gained some credit, but it was often only 1 or 2 marks out of the 5 available. Candidates who did not recognise that a Venn diagram would be a good method to use to obtain the values needed made little progress. Many obtained the value 22 as a starting point however. A common error when drawing the Venn diagram was to omit a key value or not to consider the universal set. A few candidates having shown appropriate working did not appreciate the conditional element to the probability and gave responses such as $\frac{22}{120}$.

Q19 In part (a) 1 mark was often awarded for a sketch of a U shape graph. The minimum was rarely at the correct point, with (0, -3) being the more popular turning point. A number of candidates created a table of values in an attempt to draw an accurate graph rather than a sketch. Most found part (b) very challenging. The most common answer was $a = -3$, $b = -1$ and $c = 12$, which earned 1 mark. Occasionally candidates attempted to use the roots as factors and $(x + 1)(x + 3) = x^2 + 4x + 3$ was seen in the working with no further progress made. Some attempted to read the $x$ and $y$ values from the graph and form simultaneous equations; those who used this method had more success, but were often let down by errors when combining the two equations. It was extremely rare for full marks to be awarded.

Q20 This question tested a number of elements and linked different areas of mathematics into the problem. There were a number of excellent answers showing clear step by step working. Most candidates were able to make some progress and earn marks for their method, but few gained full marks. Working again was often randomly set out and steps not explained fully, but method marks were awarded if key values were seen and used. The usual starting point was to use Pythagoras' theorem to find the length of AC as 13 km; this was done quite well, but a few were unable to work out $\sqrt{169}$ correctly. Most candidates were also able to find the area of triangle ADC as 30 km². Finding the area of triangle ABC proved harder and some candidates either did not recognise the use of the correct trig area formula for a triangle or made arithmetic errors in the calculation. Candidates who used the correct area formula usually also knew that sin 30 = 0.5, but many could not deal with the fractions and arithmetic involved in the calculation; 9.5 instead of 9.75 was a common error.

Q21 In part (a) many candidates gave a clear explanation referring to $2n$ being even and so adding 1 would give an odd number, but others tried to justify it by using values. In part (b) many candidates gained one mark for two or more numeric examples demonstrating the property. Of those who attempted the proof by using algebra, some achieved full marks, but others made errors (often with signs) when expanding $(2n + 3)^2 - (2n + 1)^2$ resulting in the loss of 2 or 1 marks.

# J560/06 Paper 6 (Higher Tier)

**General Comments**

The majority of candidates entered were appropriate for the Higher tier and made a good attempt at almost every question. There were some candidates, however, who may have found the Foundation papers to be a better experience. They typically scored part marks on the questions that were common to Foundation, and very little elsewhere, with the second half of their papers often comprised of a series of 0 marks or omissions. All candidates appeared to have sufficient time to demonstrate their knowledge and ability.

There were some excellent scripts that scored very high marks, including full marks. These not only demonstrated a very thorough understanding of the content, but also mathematical maturity in their formal style of presentation and precise use of terminology and general communication.

There are a number of ways that other good candidates can improve their marks in future. In questions where a decision or conclusion is required (e.g. Q10(b), Q11), candidates need to make clear the evidence they are using rather than presenting a range of calculations or jumping to a conclusion without providing the justification; perhaps in the latter case more note should be taken of the number of marks allocated to the question. In geometric proofs (e.g. Q13) candidates need to communicate the sides or angles they are referring to using appropriate notation rather than just making general statements. There was only one 'Show that…' question on the paper (Q17), requiring rewriting of fraction with a cube root as a single power, but even amongst the most able who made a valid attempt there appeared little appreciation of how to proceed.

Middle grade candidates looking to improve should hope to score the majority of the marks that were common to the Foundation Paper. That was not always the case here, and topics like loci and using a quadratic curve to solve an equation can generally be improved. The level of clarity and precision of the written explanations for the common statistics question (e.g. Q3(a)(ii), Q3(a)(iii), Q3(b)) was also lower than might have been expected from Higher candidates.

**Comments on Individual Questions**

Q1 Part (a) was well answered and it was very unusual to see a wrong answer. Part (b) was also found to be fairly straightforward and most candidates gained full marks. Some gave the correct answer with no working suggesting they may have made appropriate use of the $\times 10^x$ or EXP keys on their calculator. The usual error by those showing working was to give an answer in ordinary number form or as $10.2 \times 10^6$. Often these candidates had converted the populations into ordinary number form, found the sum, and then converted back to standard form. The response to part (c) was extremely variable with strong candidates gaining full credit, but the majority gaining only part marks. Many used the population of England as their population of the UK, thus failing to perform the required summation of the four populations. Although the mark scheme catered for this, candidates often continued with their value used as the numerator rather than the denominator in the percentage increase calculation. There was a fairly even split between the standard methods for finding the percentage increase, although trial and improvement to find the percentage multiplier was in evidence. Those using the population difference as their numerator usually interpreted their answer correctly as a percentage increase to two significant figures, whereas those using the 2037 population divided by the 2012 population sometimes made an error in the interpretation of their final answer, such as 1.1507… becoming 1.2 and so a 20% increase.

Q2 In (a)(i), most candidates interpreted the scale correctly. The majority went straight to 9.6, often not showing the division 240 ÷ 25. A few candidates multiplied instead of dividing, or confused the units involved. There were many answers of 25 in (a)(ii) caused by failure to make the units consistent. Others used an incorrect conversion. In part (b), the arc centre B was usually correctly drawn so most candidates gained at least 2 marks in this part. Interpreting 'closer to AD than to CD' as the angle bisector of D was found to be much more difficult however, with many candidates bisecting sides or simply joining BD. Some had arcs centre A and C. Those who interpreted the angle bisector correctly often constructed it well and usually went on to identify the correct region.

Q3 Almost all candidates correctly identified the outlier on the scatter diagram. Candidates' use of language to express mathematical ideas clearly and unambiguously was a problem for many throughout the paper and part (a)(ii) highlighted the issue. Most earned at least one mark, usually for mentioning/drawing a line of best fit. Those who did draw a line of best fit were most likely to get the second mark by stating a supporting value from this. Other acceptable justifications included negative correlation, but these sometimes lacked a reference point. Invalid responses often commented that there were no visitors when there was 2 mm of rainfall. Few gained the mark for part (a)(iii). Too many missed the obvious answer that 9mm is 'outside the range' and tried to use the line of best fit or the fact that there was no data around 9mm. Candidates frequently tried to answer in terms of real life experience of heavy rain and visiting attractions. Part (b) was quite well answered with most candidates recognising that the 'total amount of visitors was not known', however phrases such as 'no numbers' or 'no values' were not clear enough to distinguish from 'no angles' and so did not earn the mark. Comments referencing the limitation of the pie chart, such as it only showed the proportion of adults, were accepted.

Q4 This question proved to be very difficult for many candidates with only a minority scoring all 3 marks. Many candidates scored B2 for calculating the proportion who study Spanish as $\frac{4}{15}$ and candidates who approached the question using a tree diagram were often successful in reaching this stage at least. Many candidates worked on equivalent fractions for $\frac{2}{3}$ $(\frac{10}{15})$ study a language and $\frac{2}{5}$ $(\frac{6}{15})$ study Spanish and so gave the ratio as 6 : 10. Many others concentrated on the proportion of students studying Spanish to not Spanish from just those studying a language and so 2 : 3 was a common incorrect answer. Some candidates answered the question nicely by choosing a hypothetical number of students. Those who chose a number divisible by 3 and 5 progressed better than those choosing other numbers where rounding errors crept in and an exact solution was more difficult to obtain.

Q5 In (a)(i), most candidates attempted to use rise/run or difference in *y*/difference in *x*, and gained at least 1 mark despite having some difficulties in calculating with negative numbers. Common wrong answers were ¼, 4 or $^-4$. Those who answered (a)(i) correctly generally proceeded to get the correct equation in (a)(ii). To find the value of the *y*-intercept, the strongest candidates often substituted a point into $y = mx + c$ , whilst others often used a similar triangle approach on the diagram. Part (b) was fairly well answered and many candidates who had lost marks earlier on were able to gain full credit by follow through from their previous answer. Weaker candidates often realised that the *y*-intercept was $^-2$ for 1 mark, however, some strong candidates confused 'parallel' with 'perpendicular' when giving their answer.

Q6 Very few candidates failed to complete the grid accurately in (a)(i). Some however counted the 3 × 3 entry twice, or failed to include 3 as a multiple of itself when calculating the probability. A few candidates gave $\frac{9}{16}$ as their answer. There was a very variable response in part (b). A large majority filled in the spinner appropriately with no written workings needed. The inclusion of zero cost some candidates some marks. Even when the spinner was left blank some scored an M1 for 12/25. Some good candidates however made little or no attempt to answer.

Q7 The vast majority of candidates completed the table correctly and the graph was generally well done. Most realised it should be a curve and ruled lines were rare. Some feathering appeared at times and occasionally a point was missed when drawing the curve. In part (c) it was common to see only one answer despite drawing an appropriate straight line on the graph, as the line was frequently not extended to the left of the *y*-axis and so missed the negative *x* solution. Some candidates could not relate the equation to the graph and were just picking numbers from the equation; 0 and 2 were often quoted as a result. Some candidates attempted algebraic solutions, despite the question saying 'Use your graph to solve'.

Q8 Many candidates were able to tackle this question correctly and obtain full marks. These candidates tended to present their solutions in a well-structured and annotated fashion. Most candidates correctly calculated both volumes earning M2. Many found the mass of the cuboid correctly, although it was not uncommon to omit this step leading to a mass (158) subtract a volume (128) calculation. Many also did not appreciate that they needed to find the mass of the cuboid first before they could find the mass of the pyramid. A few lost the final mark due to inaccuracy caused by premature rounding, particularly 80 ÷ 3 = 26.6 being used as the volume of the pyramid. Final answers between 2.70 and 2.71 were accepted for full marks, although it would be more appropriate to have given this as 2.7. Weaker candidates presented their working poorly, with calculations appearing randomly in the workspace.

Q 9 A high proportion of candidates drew the correct triangle. A common mistake was to draw the image in the wrong position, often with a vertex at ( $^{-}1$, 5). Those that could not deal with the fractional scale factor could earn a mark for drawing the three rays from the centre of enlargement. Part (b)(i) was very poorly answered. Many candidates who appeared to understand the idea of area scale factor struggled to express themselves clearly enough to gain credit and a correct answer was rare. There were many references to ¼, or insufficient phrases such as 'ratio of area is not the same as ratio of height'. Unsurprisingly after missing the hint of (b)(i), there were few correct responses to (b)(ii). If a candidate knew the scale factor was $\sqrt{3}$ in part (b)(i) then they were generally able to calculate the volume of P correctly. Most commonly, despite the question suggesting that the scale factor was not $\frac{1}{3}$, candidates divided the volume by 3 or sometimes 4. There were few part marks awarded as most candidates who understood were able to gain full credit.

Q10 Many candidates scored all 4 marks for a fully correct labelled histogram. Candidates seemed to fall into two groups; some seemed confident in what they were doing and scored 4 marks, with 1 mark sometimes lost for not labelling the vertical axis as 'frequency density'. Others showed little knowledge of the topic, drawing a simple frequency chart that scored just 1 mark for the correct bar widths. It was also common to see these candidates plotting the values of frequency × midpoint, or frequency × class width or even cumulative frequency. In part (b) most candidates managed to find 25% of 140 correctly, and then went on to give an answer in the £15 to £20 range, often either £15 or £20 for 2 marks. Some gave an answer between £17 and £18, but very few could give justification for this. Many seemed to have the right idea but did not provide enough explanation or calculation to get the final mark. The method of finding 34 people at halfway through the £15 to £20 group, therefore close to 25%, was well used where it was seen.

Q11 Most candidates recognised this as a bounds question, but only a minority went on to earn all four marks. Many had problems deciding the bounds for the soup and values such as 7.45 and 7.55 were frequently seen. There was more success with the portion size, largely because it was an integer and only to the nearest 10, although 290 and 310 were common errors. Those that attempted a division of the bounds usually earned the M1 for a calculation involving at least one bound. If they had the correct bounds they were more likely to earn all four marks. Those that multiplied 24 with the upper bound of the portion size did not fare as well, as they often omitted the required comparison. In general most candidates had a weak understanding of the topic, including some of those with four marks; rather than hone in on the one calculation that was needed, many simply attempted all four combinations and chose the answer that best suited the question.

Q12 Many fully correct answers were seen with candidates using '*y* is inversely proportional to the square of *x*'. Unfortunately, a significant number of candidates failed to understand or to read the question carefully and used '*y* is inversely proportional to *x*', leading to the common incorrect answers $y = 15$ and $x = 22.5$. Also seen were *y* proportional to *x*, $\sqrt{x}$ , $x^2$ or $\frac{1}{\sqrt{x}}$ . Usually the question was either entirely correct or entirely wrong. Very few M2 marks were awarded, but M1 for $y = \frac{k}{x^2}$ or $k = 900$ was quite common. A small number showed little idea of how to tackle the question and tried to spot a pattern whereby the *y* value was one less than the *x* value and so completed the table with 5 and 5.

Q13 Full marks were awarded only occasionally and these responses were usually characterised by their clarity and brevity. Many used an essay style with the commentary not linked to specific sides or angles. In particular, for AC = BC many candidates omitted to mention that these tangents met at a point. When dealing with angles OAC=OBC, many omitted either 90°, tangent or radius (for example 'The tangents meet the circumference at 90°' was frequently seen). Although the award of full marks was rare, many obtained 2 marks for giving pairs of equal angles/sides without sufficient reasons.

Q14 Part (a) was well answered with nearly all candidates able to complete the table correctly. Hardly any working out was shown, although just a few arithmetic errors were made. In part (b) the vast majority of candidates knew that the inverses – 4 and × 5 were required, but a substantial number gave them in the wrong order within a flow diagram or spoilt their algebraic answer by poor notation such as $y = x - 4 \times 5$. Many candidates found part (c) difficult and only a small minority produced a fully correct answer. The question required candidates to apply the order of operations in composite functions and to express this algebraically. Those who worked backwards from the output of $2p + 4$ tended to be more successful, but most started with the input *m* and frequently quickly went wrong through poor algebraic notation such as $2m + 3$ instead of $2(m + 3)$. Using this latter method, some failed to use the output of function A as the input for function B, for example $2(m + 3) + m/5 + 4 = 2p + 4$. Expressions such as $m + 3 \times 2 \div 5 + 4 = 2p + 4$ were also common. Weaker candidates simply rearranged $m = 2p + 4$ to make *p* the subject.

Q15 Weaker candidates often made no attempt, however the sine graph was normally well drawn by most and two marks were commonly awarded. Even incorrect graphs usually showed an appreciation of the shape of the curve and that it should go through the origin, with the usual errors being multiple cycles and/or incorrect maximum/minimums. In (b), M1 was often scored for $\sin x = {}^{-}0.6$ but many could not progress successfully from there.

Some earned M2 for $^-37°$. Trial and improvement methods occurred fairly frequently with some success, partly because the answers accepted were whole numbers. Candidates often were unable to find the second correct answer, which suggests a lack of understanding of the symmetry of trigonometric graphs and its role in finding solutions.

Q16 Only a minority of candidates simplified the indices correctly in part (a). There was a wide variety of wrong answers, the most common coming from adding the powers to get $3y^{-1}$, but others included $2y^7$, $2y^{-1,}$ $3y^{-7}$ and $3y$. Many candidates scored full marks in part (b) however and many others made a very good attempt, often scoring 2 method marks. The multiplying out of the $4(x - 1)$ bracket to $4x – 1$ led to many lost marks. Quite a few candidates reached the correct answer and then went on to try and simplify the fraction, even though there was no common factor between the numerator and denominator. Some candidates expanded the numerator correctly, but then collected the terms as $7x – 2$. There were some answers of $\frac{7}{2x+1}$ and $\frac{7}{(x-1)(x+2)}$.

Q17 The vast majority scored zero and merely converted the given terms into approximate decimal form. The award of part marks was rare, since if candidates knew what to do, then they usually correctly completed the question in full. There were some excellent responses, which showed clear step by step working starting with $\frac{\sqrt[3]{81}}{3}$ and ending with $3^{\frac{1}{3}}$. At least three different ways of doing this were seen, but starting by writing 81 as $3^4$ was the most common approach.

Q18 Most candidates made a very good attempt at part (a) and many scored at least 2 marks. Some of the stronger candidates calculated the internal diagonal in one step, but most used two steps. Most candidates accurately used Pythagoras' theorem in 2D, but there were many who were unable to progress to 3D. Those who found the diagonal of the base first were more successful in continuing to find the diagonal of the whole crate. Those who started by finding the diagonal of the front face as 71.7 often subtracted this from the length of the stick, yet they hadn't considered the third dimension. Some lost the final mark because of premature approximation. Weaker responses did not use Pythagoras' theorem at all and calculated the volume of the cuboid instead. Part (b) was less well done but here, too, there was some good work from the stronger candidates. Those who stopped at 2D Pythagoras' theorem in part (a) usually were unable to identify the correct angle to be found.

**About OCR**

OCR (Oxford Cambridge and RSA) is a leading UK awarding body. We provide qualifications which engage people of all ages and abilities at school, college, in work or through part-time learning programmes.
As a not-for-profit organisation, OCR's core purpose is to develop and deliver general and vocational qualifications which equip learners with the knowledge and skills they need for their future, helping them achieve their full potential.



**OCR (Oxford Cambridge and RSA Examinations)**
**1 Hills Road**
**Cambridge**
**CB1 2EU**

**OCR Customer Contact Centre**

**Education and Learning**
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

**www.ocr.org.uk**

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored

**Oxford Cambridge and RSA Examinations**
**is a Company Limited by Guarantee**
**Registered in England**
**Registered Office; 1 Hills Road, Cambridge, CB1 2EU**
**Registered Company Number: 3484466**
**OCR is an exempt Charity**

**OCR (Oxford Cambridge and RSA Examinations)**
**Head office**
**Telephone: 01223 552552**
**Facsimile: 01223 552553**



Cambridge Assessment