CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/11
Paper 11 (Core)

Key messages

To succeed with this paper, candidates need to have completed the full Core syllabus, be able to apply formulae, show clearly all necessary working and check their answers for sense and accuracy. Candidates are reminded of the need to read the question carefully, focussing on key words or instructions.

General comments

Candidates must make sure that they do not make numerical errors especially in questions that are only worth one mark when any good work will not get the mark if the answer is inaccurate. Showing workings enables candidates to access method marks in case their final answer is wrong. Workings are vital in two-step problems, in particular with algebra and others with little scaffolding such as **Questions 9** and **18**.

Candidates should pay attention to how a question is phrased. Work out, solve and find indicate that calculations have to be done to get to the answer, for example, **Question 9**, **12** and **13**. Write down is used when a numerical fact or a mathematical term is needed (**Questions 2,** or **14**) or the answer is to be found from a diagram (**Question 17**).

The questions that presented least difficulty were **Questions 4**, **6(a)**, **6(b)** and **11**. Those that proved to be the most challenging were **Question 7**, interpret an inequality on a number line, **Question 8(c)**, writing a fraction as a decimal, **Question 17(b)**, the equation of a line and **Question 21**, transformations with functions. In general, candidates attempted the vast majority of questions. Those that were most likely to be left blank were **Questions 21** and **17(b**), questions that have already been mentioned as challenging

Comments on specific questions

Question 1

Candidates did quite well with this first question. Some candidates rounded to the nearest ten thousand or nearest hundred or gave 3600, losing a zero. Some rounded up to 37 000. A few gave 40 247 or divided by 1000.

Question 2

The common error here was to list some of the factors of 12 not multiples**.** Occasionally, candidates gave the calculation that would give a multiple but not the answer so this did not get the mark, for example 4 × 6. Also seen was 15, 18, 21, the next three values in the 3 times table after 12.

Question 3

This is a multiple choice question with only 3 answers to choose from, *OA*, *AB* or *CD,* and the large majority of candidates gained at least one mark. Occasionally, candidates answered with a single letter or a number.

Question 4

This was the best answered question on the paper with most candidates showing their working. There were a small minority who, having got their final answer incorrect, were able to access the method mark.

Question 5

The most common error was to answer with 240, the number of centimetres in 2.4 metres not the number of millimetres. Very occasionally, candidates divided by another power of 10 or multiplied. Some candidates changed the digits giving an answer of 2000 or 1200.

Question 6

This was a question where the vast majority of candidates were correct. Both diagrams were not to scale so measuring either angle was incorrect.

(a) Incorrect answers included 120° or the actual angle.

(b) Here, the method was often correct. The final answer sometimes showed that a numerical slip had been made. Some thought that the answer was 110° either because it is the supplementary angle of 70° or because they thought it was the same as the angle to the left.

Question 7

Candidates were not confident in interpreting the diagram and their answers often included both the 2 and the 6. Some candidates gave 1, 7 or 1, 2, 7 as their answer. There were some who gave the inequality represented but this is not what the question asked for.

Question 8

(a) Some candidates wrote down an incorrect value and showed no method to show how it was obtained. Those that showed their method and wrote down $\frac{3}{8}$ 16 were often correct with the answer. As this is only worth one mark the final answer must be correct.

(b) Candidates had to multiply $\frac{1}{20}$ by 100 which cancels to 5 per cent. There were a variety of wrong answers for example 20%, 2%, 1.2%, 10% and 0.25% were all seen; many of these did not follow any working. This was less well done than the first part.

(c) As mentioned at the start, this was not handled well with candidates giving answers such as 0.2, 0.8, 1.8, or 1.08. The last two cannot be correct when a fraction has a numerator of 1. Again, writing down a method, this time of 1.000 ÷ 8, might have helped candidates get to the answer.

Question 9

Many candidates showed careful work. There was a single method mark for a correctly worked area of a recognisable portion of the diagram or two method marks if a full method was seen but an arithmetic error was made on the way to the answer. Some candidates incorrectly joined the vertex above the 2 cm label to the bottom right vertex to turn this into two triangles; however, the new line is not a continuation of the existing hypotenuse. This incorrect assumption gives 27 cm^2, not the correct answer of 28 cm^2. There were a small number who multiplied all the lengths on the diagram together, thus not showing understanding of the diagram and how to calculate area.

Question 10

(a) Many candidates did well here getting at least 1 mark for two answers correct. There were some candidates who did not use the given information to the fullest extent. For the second interval, the frequency is 3 times the first interval so the angle will be 3 times 30°. Similarly, the third is twice the first and the last is 6 times the first. Having got the angles, candidates should have checked to make sure all four angles add to give 360°. Or, candidates could have found that each person is represented by 6° (from 30 ÷ 5) and this used to multiple by 15, 10 and 30 in turn. Some candidates did not appear to know how to make the connection between the frequency and the angle with some giving 35, 40 and 45 or 40, 50 and 60 as their answers.

(b) Candidates could get a special case mark if they drew the pie chart correctly using the angles in part **(a)** provided the angles added to 360. The major problem here was that if the previous answer did not add to 360, the pie chart had a lot of empty space and had in effect five sectors. The pie chart should be labelled with the category labels, for example, $t \leqslant 10$. Some candidates did not copy these labels correctly. It appeared as if some candidates did not see the connection with the previous part. Saying this, they were some excellent, clear, neat and correctly labelled pie charts.

Question 11

This question did not need the calculation for the midpoint to be done as it can be seen from the diagram. The simplest method was to draw in the line *AB* then find half the horizontal (3 units) and vertical (4 units) distances to plot the midpoint at (0, 2). Some candidates gave (3, 4) or (6, 8) as their answer; this last answer was impossible as that point was not on the grid. Generally, only those who drew in the line were successful.

Question 12

Many knew that the answer was to do with 4, but only x < 4 got the mark.

Question 13

Some candidates used the given information and multiplied 128 by 2 (or 128 + 128) getting 256. Many others worked out 2^8 by starting with 2 and doubling until 2^8 was reached. This method had many opportunities for arithmetic errors to be made. The incorrect value 130 showed lack of understanding of indices as 2 was added to 128. There were also answers lower than 128 which is an obvious point to check.

Question 14

The first diagram was often correctly recognised as positive correlation. The second diagram had many incorrect answers such as negative, scatter, diagonal, decreasing, dispersed, low correlation and different. A few candidates counted the number of crosses in each diagram. To describe correlation all that is needed is positive, negative or none. Candidates do not need to qualify the type with the strength.

Question 15

It was common that candidates substituted 26 for *x* so worked out $26^2 + 1$ instead of writing $26 = x^2 + 1$. When candidates got as far as $x^2 = 25$ and saw that two answers were expected it caused some confusion as often 5 and $\sqrt{25}$ were offered as the answers. Other answers included 26 and 26, 13 and 26 or 27 (26 + 1) and 53 (2 26 + 1).

Question 16

Many candidates were confident of the first stage, to find the 60° angle. Only a few went on to find the supplementary angle (at *B*) which was the correct bearing. After the 60° is found, it is helpful to draw the north line in to complete the diagram. This was one of questions most likely to have been missed out by candidates.

Question 17

Candidates found the equation of a line a complex part of the syllabus.

(a) This equation of the horizontal line was often correct. If candidates only gave 6 as their answer, then this did not get the mark. A few gave answers such as $y = 6x + 3$ or the co-ordinates, (3, 6).

(b) The most common wrong answers was (0, 3.5) or (3.5, 7) which are the co-ordinates of *B*. Some found the gradient of the line and then progressed no further.

Question 18

The number of marks for this question implies that this was one of the more straightforward sets of simultaneous equations as no multiplication of the equations was necessary as they already had the same coefficients of x so could be subtracted one from the other to give $5y = -10$ (or equivalent). Another fairly economic method is to write each equation as $x =$..., then the result is $3 - y = 13 + 4y$. This connects up to the previous stated result. Candidates always need to inspect the equations to see which method has the fewest stages to limit the possibility of making errors. Often there were incorrect values for x and y but no working, which can obviously gain no credit.

Question 19

(a) This was most often given as the reverse of the correct answer so set A was shaded and the surrounding area was left unshaded.

(b) Here the answer was often given as $\frac{2}{5}$. Another probability seen was $\frac{3}{7}$, which is the probability of picking a letter in Y. Sometimes candidates gave the elements this referred to, a and e, but not the probability. Occasionally an answer such as $\frac{a}{7}$ and $\frac{e}{7}$ was given.

Question 20

There was no diagram to help candidates work this out increasing the difficulty level of the question. Candidates should be encouraged to draw their own grid to plot the points if that is useful to them. Many candidates had the correct numbers but reversed them in the vector or gave the answer for vector $\overrightarrow{BA}$. Some candidates inserted a horizontal line between the entries as if the answer was a fraction, this is wrong and was not credited.

Question 21

This was the question most likely to be omitted by candidates and of those that give an answer, only a very small number were correct. A common wrong answer was $y = f(x) - 2$, the transformation by the vector $\begin{pmatrix} 0 \\ -2 \end{pmatrix}$. Many candidates were not confident using the correct notation as answers such as $0 - 2$, $(0, -2)$ or $2x$ were frequently seen.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/12
Paper 12 (Core)

Key messages

In order to be successful in this paper, candidates need to have covered the entire Core syllabus content. Errors in basic arithmetic continue to be a source of lost marks for many candidates throughout the paper. A good knowledge of times tables would also have enabled more marks to be awarded in some instances. Candidates would be well advised to show all stages of their calculation clearly and set this out in a logical manner in order to ensure that method marks can be awarded.

General comments

Most candidates were well prepared and strived to achieve their best. There was a good level of success from candidates of all abilities with the early questions.

Time did not appear to be a factor as the majority completed the paper with most candidates attempting the final question.

More work is needed to consolidate candidates' understanding of bearings, as shown in **Question 9**, working with functions in mapping diagrams, **Question 10**, and drawing asymptotes, **Question 13**. The responses in answering **Question 16** showed a shallow understanding of trigonometric ratios and candidates also found interior/exterior angles of polygons difficult, **Question 20**. The cumulative frequency table in **Question 17** was challenging to some candidates.

Comments on specific questions

Question 1

This question tested rounding numbers to an appropriate degree of accuracy.

A good proportion of candidates achieved the mark for rounding, but it was clear that a large number of candidates confused the rounding to the nearest 10 with rounding to two decimal places. Common errors included rounding or truncating to 2 decimal places and some added three zeros to the end after the decimal point.

Question 2

This question was very well answered with the vast majority of candidate scoring the mark. The rare wrong answer was 30 coming after the correct working out (5×7).

Question 3

Another question where almost all candidates were able to show a good understanding of what is required to find a percentage, with a large proportion getting full marks. Of those who did not gain full marks, a good number gave 30%, incorrectly including the percentage symbol in their answer.

Question 4

This is a familiar question and candidates generally performed well and often got both marks for the vertical and horizontal lines of symmetry. Those who did not get both marks very commonly got one mark for drawing only one line of symmetry. The incorrect answers included the diagonal lines or showed little understanding of lines of symmetry.

Question 5

This question was accessible to all candidates and a good proportion of fully correct answers were seen. Candidates who got only one point plotted correctly were not consistent in their understanding or did not check their work.

Question 6

It was apparent that many candidates do not know what a reflex angle is. Centres need to take note to ensure that candidates are familiar with all the types of angles. The most common wrong answers were obtuse and acute, but candidate also used scalene, reflect, right angle and rotational. Some left this question blank.

Question 7

Candidates were able to access this question, with many identifying the correct method and being able to show the correct working out for finding the area of the given shape. Many understood the need to find the area of the big square, 12×12, and take away the area of the cut out square, 3×3, but some were unable to gain full marks due to arithmetic errors. Only a few candidates added the given lengths and tried to find the perimeter instead of the area.

Question 8

This question tested the candidates' understanding of substitution into a formula. The majority of candidates were able to score full marks on this question for an answer of 37. There were, however, a few with the common wrong answers of 63.

Question 9

It is apparent that many candidates have no real understanding of bearing. Centres need to take note to ensure that candidates are familiar and can use a protractor to measure angles correctly. Few candidates answered with the length of the line *AB* or gave a compass direction.

Question 10

This was a twist on a traditional question which proved difficult to many candidates. They saw that 1 multiplies by 2 , 2 multiplies by 4, 3 by 6 so assumed that 5 will be multiplied by 8 without realising the pattern skipped 4 and did not take into account the relationship between the numbers shown in the domain. A frequent pair of values were 9.8 and 40. The most common wrong answer for 50 was 40. Frequently the other answer line was blank. There was no evidence that any candidate worked out that $f(x) = 2x^2$.

Question 11

A sizeable group of candidates scored the mark for part **(a)** of this question. A significant number gave C instead of D for part **(b)**. Those candidates did not seem to remember that the –1 in the equation $y = 2x - 1$ meant that the line crosses the y-axis below the x-axis hence the correct graph was D not C.

Question 12

This was another question where almost all candidates were able to show a good understanding of what is required to find the circumference of the circle, with a large proportion getting at least the method mark for substituting 2×3.5 or 7. Of those who did not gain full marks, a good number were trying to answer with a numerical value without remembering that the question wanted the answer in terms of π.

Question 13

Most candidates were unable to answer this question correctly. Candidates tend to be more used to writing down the equation of the asymptotes rather than drawing them. In this question, the equation for one asymptote was given and if candidates drew this in that should have led them to working out where the other one should be. Many drew in one or more extra curves, particularly under the right hand curve. A few drew in the line $x + y = -3$.

Question 14

This is a familiar question and candidates generally performed well and often got full marks. Those who did not, very commonly factorised 4 instead of 2 leaving ($p + 3.5$) inside the brackets which is incorrect notation for factorising.

Question 15

Candidates generally struggled to answer this question correctly. Many incorrectly evaluated $(-6)^2$ to be -36 and hence gave -12 as their final answer. As this was only a one mark question there were no method marks available and the answer had to be correct.

Question 16

Although this was a standard trigonometry question, many candidates found it difficult to choose the correct trigonometric ratio and, even if they chose the correct one, they did not know how to proceed. Some tried to use Pythagoras' Theorem, others left this question blank.

Question 17

This question showed a major misconception for many candidates. Many did not start correctly with 15 as the first value while others tried to distribute the gap between the first value and the last value evenly.

This question was mostly left blank which showed that candidates were not confident with cumulative frequency tables and they need to improve their understanding in this topic.

Question 18

The probability tree diagram question was meant to test the candidates' understanding of probability without replacement. The first empty space was answered correctly for picking up the first ball. However, when candidates tried to answer the probability of picking the second ball, they dismissed the fact that they no longer have eight balls in the bag so a very common wrong answer was $\frac{5}{7}$ and $\frac{3}{7}$. This meant that the denominators were correct but the numerators had not had one subtracted.

Question 19

Although a good number of fully correct solutions were seen, this question proved demanding for a number of candidates because both equations needed to be multiplied to equate coefficients then subtracted (as all the terms were positive). This created many places for candidates to make errors with the signs. Some candidates worked methodically and only a few tried to solve the equations by trial and error.

Question 20

Candidates found this question difficult especially as they were not given a sketch diagram. It was apparent that candidates confused interior and exterior angles of polygons. That said, some candidates gained credit for starting the process and writing down 20° without realising that they are only one step away from finding the correct answer. A common method was to list the total interior angles of polygons, this did not help because they could not easily use the fact that one interior angle is 160°. Working was very confused and often crossed out.

Question 21

Unfortunately, those who understood the steps in the process to solve this Venn diagram question often did not gain all the marks for part **(a)** as they did not read the question well enough to use x between 3 and 10 only, so the most common error was to give the values of $3x + 2$, when x was 1, 2, 3, 4 and 5, i.e. 5, 8, 11, 14 and 17. Some did solve the inequality but then gave the answer as $x < 6$ or $x = 6$. The first got a method mark but the second did not. For part **(b)**, candidates sometimes put numbers in the diagram more than once and again with the use of x including 1, 2, 3 the Venn diagram contained extra integers. For part **(c)**, if the intersection contained elements, these were frequently given showing a good understanding of $A \cap B$ and those candidates benefited from the follow through mark.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/13
Paper 13 (Core)

Key messages

To succeed with this paper, candidates need to have completed the full Core syllabus, be able to apply formulae, show clearly all necessary working and check their answers for sense and accuracy. Candidates are reminded of the need to read the question carefully, focussing on key words or instructions.

General comments

Candidates must make sure that they do not make numerical errors especially in questions that are only worth one mark when any good work will not get the mark if the answer is inaccurate. Showing workings enables candidates to access method marks in case their final answer is wrong. Workings are vital in two-step problems, in particular with algebra and others with little scaffolding such as **Questions 14** and **20**.

Candidates should pay attention to how a question is phrased. Find, solve and work out, indicate that calculations have to be done to get to the answer, for example, **Questions 16**, **19** and **14**. Write down is used when a numerical fact or a mathematical term is needed (**Questions 3** and **4**) or the answer is to be found from a diagram (**Question 2**). Other command words used in this paper were complete, use, change and estimate.

The questions that presented least difficulty were **Questions 1**, **2** and **3(b)**. Those that proved to be very challenging were **Question 13**, change cm^2 into m^2, **Question 17**, the equation of a line, **Question 18**, the *n*th term of a sequence, **Question 20**, probability using a tree diagram, **Question 22(b)**, estimate inter-quartile range and **Question 23**, transformation of an equation. In general, candidates attempted most of the questions. Those that were most likely to be left blank were **Questions 6**, **11**, **17**, **22(b)**, and **23**; many of these are highlighted earlier as challenging.

Comments on specific questions

Question 1

Candidates did well here with this starting question. There were some that multiplied $3 by 365 days rather than 12 months.

Question 2

This was the best answered question on the paper with very few wrong answers.

Question 3

This is a multiple choice question with a list of 6 values to choose from so there is no need to leave this blank.

(a) The question asks for the prime number so this implies there is only one in the list. 15 was the most common wrong answer followed by 21 or 25. Some answers were lists of up to 4 values.

(b) This is phrased differently to the previous part and there are two correct answers. If candidates gave two answers both had to be correct to get the mark. Although more candidates got this correct, some left this blank. Sometimes, a number can be used twice in this type of question but here a square number cannot be prime as well.

Question 4

Candidates should learn the names of shapes and their properties.

(a) Many did not know the name of this quadrilateral and quite a number left this blank, Wrong answers included rhombus but also other shapes that are not quadrilaterals, for example, pentagon as well as three dimensional shapes such as triangular prism and sphere.

(b) Candidates appeared more familiar with types of triangles as many more were correct here. Scalene and equilateral were seen as answers.

Question 5

Some candidates had problems as they did not change the 12c to \$0.12 or the \$20 to cents. Although the answer was to be given in dollars, the correct cost for the minutes used found in dollars or cents got a mark. Candidates did make arithmetic errors but they did get a mark if the correct method was given.

Question 6

It is possible that candidates were unsure of how to answer as many did not answer the question. Those that gave an integer value generally gave 4, the correct answer. Of those that did not, answers such as square or 3×3 or 9 parts were seen.

Question 7

Candidates need to know the difference between discrete and continuous data. One of the meanings of discrete in English means separate and this is helpful in maths, as discrete data is data that you can count so the number of eggs is the correct answer. Continuous data is data that can be measured on a continuous scale such as time, weight, or height. Here, the word continuous was not used at all and maybe some candidates were not so confident when only discrete was mentioned.

Question 8

There are various methods to use when completing a mapping diagram when the function is not given. Going down the domain, the gap is 1 and the gap in the range is 3 so the quickest way to see what 4 goes to is to add 3 to the last number, 10. It is more complicated to find the value that goes to 22. One way is to see how many more 3s are needed to get to 22 – three more 3s so three is added onto 4. Many gave 5 instead of 7. Some candidates drew a grid to plot each point to make a line or find $f(x) = 3x + 1$ where the gap of 3 in the range is the gradient of the function.

Question 9

Candidates did well here as long as they followed the order of operations. For the first expression the correct symbol was < but if the brackets were ignored it equalled 1. For the second, working left to right, ignoring the order of operation gives 15 not 11. Generally, the candidates who got these correct showed workings, those that did not often gave the wrong symbol.

Question 10

This problem solving question involved two areas of the syllabus – pie charts and percentages.

(a) First, candidates had to find the percentage that chose Mexican restaurants and a mark was available for candidates who got this far in the method. The final step is to find 25% of 360°. Measuring the angle is incorrect as the diagram says not to scale.

(b) Candidates were more confident with this part. A mark was available for the method, 0.22×200 but most who got this far went on to get the answer correct.

Question 11

This question was often missed out by candidates and only a small number were correct. As with **Question 10**, it would not be correct to measure the angle at *A* as the diagram is not to scale. Some candidates answered with the actual angle on the diagram or the distance from *A* to *B*.

Question 12

There were no method marks available here so the answer had to be correct to get the mark. Various wrong workings were seen such as $x = \frac{1}{2} - \frac{5}{1}$ or $x = \frac{-1}{2} \times 5$ or the correct $x = \frac{5}{1} \div \frac{1}{2}$ that became $\frac{1}{10}$ instead of 10.

Question 13

Converting area measures is more complex than converting linear measures. To go from centimetres to metres candidates have to divide by 100 so to go from cm^2 to m^2 they needed to divide by 100^2. Often candidates only divided by 100. Other powers of 10 were used and sometimes candidates multiplied. The digits must stay the same not rounded as sometimes 6.155, 1.23 or 1.2 were seen. Candidates must also be careful that they use the digits in the same order as it can be common that candidates reverse a pair such as in an answer of 1.2301.

Question 14

This was a more complex ratio question than some previously seen. Adil gets $60 for his 3 shares so candidates had to work out how much one share was worth, which was worth a method mark, and then calculate how much Serena gets. Common incorrect answers were $240 (from 60×4), 42 (from thinking the total amount of money is 60) or $420 ($60 \times 7$).

Question 15

This was not handled very well by candidates. Many answers were the results of incorrect methods. To solve this question various calculations had to be performed. The first was to find the difference between the buying and selling prices, which candidates then had to divide by the original price before converting it to a percentage. Some candidates incorrectly used the new price instead of the original price in the division.

Question 16

Candidates were much more confident with this question than the last. Some ignored the instruction to leave their answer in terms of π as many went on to use long multiplication to work out the answer. As this is only worth one mark, the answer had to be left as 25π.

Question 17

Candidates find this area of the syllabus, finding the equation of a line, very demanding and that was seen with this question. This was made more so as there was no diagram to aid candidates, but it is perfectly acceptable for candidates to draw a diagram if they prefer understanding information that way. A line parallel to the *y*-axis is going to be of the form $x = c$ (where *c* is a constant). Common wrong answer included answers of the form $y = 3x + c$ where *c* was often 0 or gave the line $y = 3$. Some gave a pair of co-ordinates as their answer.

Question 18

Often with questions about sequences, candidates are asked to find the next few terms which focuses them on using the common difference, the first stage to finding the *n*th term. Here, candidates had to remember that the process is to find the common difference, +6, then substitute that and the first term, –1, into the formula. Sometimes the values got swapped over which earned no marks. Some candidates appeared to think that the *n*th term is the next term or the 9th term as 26 and 47 were seen.

Question 19

This was another multiple choice question. Candidates had to know which trigonometric function to choose, in this case, as the hypotenuse was given and the side wanted was opposite the angle, the expression 20 sin 47° was needed. Most wrong answers gave 20 tan 47°. Some candidates left this blank.

Question 20

Some questions ask for the tree to be completed before a probability is asked for but here candidates had to find the branches where Yan wins exactly one game. There are two branches as he could win the first game or the second (but not both). It was sufficient for only one correct branch's multiplication to be given by the candidate for a method mark. Answers such as $\frac{1}{4}$ or 25% imply that candidates were treating each branch as equally likely to occur and only picking one of the four. There were also answers of $\frac{1}{2}$ and1 or more.

Question 21

The number of marks for this question implies that this was one of the more straightforward sets of simultaneous equations as no multiplications was necessary because y is eliminated if the equations are added giving $5x = 10$ so $x = 2$, The next step is to substitute this in one of the equation to give y. Another fairly economic method is to write each equation as $y = ...$, then the result is $4 – 3x = 2x – 6$. This connects up to the previous stated result for x. Candidates always need to inspect the equations to see which method has the fewest stages to limit the possibility of making errors. Often there were incorrect values for x and/or y but no working.

Question 22

Here, the word estimate means that the graph must be used to find the answer; some candidates just appeared to choose a likely number by inspection.

(a) For this question, candidates had to know where the median is found for a data set of 50 students and how to read the value from cumulative frequency curve. So, some candidates correctly identified that they should find 25 on the cumulative frequency axis but then did not go on the use the curve to read off the other axis to see what height that equated to. Some knew where to look but were inaccurate finding the exact point on the curve or in reading from the axis. Again, as this was only one mark, the answer had to be an accurate reading.

(b) This caused many difficulties. For the inter-quartile range there are two points to use on the cumulative frequency axis, splitting the axis into two equal parts either side of the median, so, at readings of the curve at frequencies of 12.5 and 37.5. This was made slightly more complex as these two values were between gridlines. These values had to be followed over to the curve then down to the horizontal axis and the difference found.

Question 23

This was the question most likely to be omitted by candidates and of those that gave an answer only a very small number were correct. Some candidates ignored the given curve, $y = x^3$ and gave answers such as $y = –3x + 0$, $y = 0x – 3$ or $y = x – 3$. This is a vertical translation of 3 downwards, which does not affect the x co-ordinate so the function has 3 taken away from original curve, that is, $y = x^3 – 3$.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/21
Paper 21 (Extended)

Key message

Candidates should ensure that they have covered all areas of the syllabus as a wide range of topics across the syllabus are examined. Candidates who show no working for questions worth more than one mark risk losing all the marks if the answer is incorrect.

General comments

Candidates were generally well prepared for the paper and demonstrated good understanding and knowledge across most of the topics tested. Indeed, a number of candidates scored full marks. Candidates generally attempted all of the questions and were able to complete the paper within the time. Solutions were well set out and the correct processes chosen and used efficiently. Arithmetic errors were the most common error seen in the first five questions. Candidates should understand that they will not be required to carry out lengthy calculations which would indicate that either they should be cancelling or they have made an error. For example, they will never be required to multiply by 3.142 for pi. In addition, they would not be expected to write a large number given in standard form, such as 5.2×10^{18}, as an ordinary number. Candidates should take care when reading the question and when transferring their working within the question or to the answer line as simple errors involving changing or omitting signs, powers and multipliers can be costly. Candidates should also check their answers seem reasonable where possible, such as in **Questions 3**, **5**, **7**, **8** and **12**.

Comments on specific questions

Question 1

(a) Most candidates answered this question correctly. The most common wrong answer was 0.9 which showed a lack of understanding of the effect of multiplying by a number smaller in size than 1.

(b) Most candidates were successful with this question. There were errors with arithmetic but these were the minority. It was pleasing to see many candidates using the lowest common denominator and/or cancelling their answer to its simplest form, following the rubric on the question paper.

Question 2

The majority of candidates answered this question correctly. The few errors seen included arithmetic errors, or writing the answers in reverse or dividing 360 by 7 or 2 rather than 7 + 2.

Question 3

Most candidates worked out angle *EDC* correctly. The few errors seen were mainly arithmetical slips. Even so, most candidates scored at least one mark for one of the angles *CED* = 33°, *ECD* = 119°, *ECB* = 61° or *BFD* = 97° more often than not seen on the diagram.

Question 4

The majority of answers were fully correct. The most common errors were sign errors or arithmetic slips but nevertheless, the majority of candidates either scored one mark for a correct expansion or an answer of the form $ax+10y$ or $9x+by$.

Question 5

(a) Candidates mainly demonstrated good understanding and manipulation of the $\text{speed}=\dfrac{\text{distance}}{\text{time}}$ formula as well as the conversion of $\dfrac{1}{4}$ of an hour to 15 minutes. The most common errors came from wrong use of the formula, for example 425×100 = 42500 hours, or leaving the answer as 4 h 25 mins.

(b) This part caused more difficulty, and whilst there were a significant number of correct answers, candidates did not always deal correctly with 60 minutes in an hour or 24 hours in a day. Common wrong answers included 25 51, 24h 111 min, 25 11.

Question 6

(a) Some candidates were able to produce the correct five integer solutions by inspection. Other candidates gave only three or four of the required answers, often omitting to include 0. A significant number of candidates who correctly simplified the inequality to $-1 \leqslant x < 4$ but who went no further were awarded a method mark. Candidates splitting the inequality into two parts as their final answer did not score.

(b) Candidates generally solved the inequality accurately. The errors most commonly seen were slips in signs, not realising that the inequality sign needs to be reversed when dividing by a negative number and arithmetic errors. A few candidates had the correct answer but then gave either $x=-4$ or merely –4 on the answer line and these candidates could only score one mark.

Question 7

Candidates who recognised that both numbers needed to have the same power of 10, to enable subtraction of two numbers in standard form, were usually successful. Others were awarded one mark for 52×10^{17} or 0.24×10^{18} or figures 496 seen. Those candidates who approached the question by trying to write the numbers as ordinary numbers were rarely successful as they frequently could not cope with the large number of zeros required.

Question 8

(a) This caused very few problems, with most candidates working out the actual distance correctly. The candidates who did not score on this part had usually multiplied 5 by 4.8, but then tried to further convert the units, with answers such as 2.4 or 24000 seen. Arithmetic errors were also seen.

(b) Whilst a small proportion of candidates used the correct area scale factor of 1 cm^2 = 25 km^2 to obtain the correct answer, most candidates simply calculated $75 \div 5 = 15$ and did not score. Of those who used 5^2 again there were additional conversion with answers such as 3 000 000 km^2 seen. In both parts, candidates should check that their answers seem reasonable.

Question 9

Only a small number of candidates scored full marks. However, the majority of candidates clearly understood the term factorise and they were frequently able to give a correct, albeit partly factorised, expression. These expressions, scoring one mark, were either where the candidate did not take out the factor 2, such as $(2x+6)(x-3)$ or $(2x-6)(x+3)$ or where the candidate did not recognise the difference of two squares and only took out the factor 2, giving $2\left(x^2-9\right)$.

Question 10

(a) The Venn diagram was completed accurately by a large number of candidates. Some candidates omitted one or more of the numbers and a common error was not to include the 7 and 11 which were not in any of the sets *A*, *B* and *C* but within the Universal set. It appeared that some candidates were not familiar with Venn diagrams and they inserted numbers, such as the 2, multiple times.

(b) This was a complex expression to work out the single region required. However, many candidates were successful in giving the correct number of elements within it. A common error was to give the two elements 5 and 12 or sometimes 17 from 5 + 12, rather than give the number of elements.

Question 11

(a) Most candidates were able to work out the correct co-ordinates of the midpoint of *AB*. The most common errors included arithmetic slips, giving the co-ordinates round the wrong way as (4, 5) or finding the length of $\frac{1}{2}AB$ using Pythagoras.

(b) Whilst there were a number of correct equations given, candidates found this question more challenging as there were several aspects that needed to be considered. Candidates generally knew that the gradient involved $\frac{\text{difference in y}}{\text{difference in x}}$ but many did not then go on to find the negative reciprocal and frequently only one of either the reciprocal or the negative was considered. Most candidates knew that they had to substitute a point into $y = mx + c$, to work out *c,* but a common error was to substitute in either (3, 8) or (7, 0).

Question 12

There were a high proportion of candidates who produced fully correct solutions to this question. Candidates who approached this question by equating the two areas to form the equation $\frac{60}{360}\times\pi\times12^2 = \pi r^2$ were most successful. They were, more often than not, able to see that they could cancel the π, cancel the $\frac{60}{360}$ and then divided 6 into 12×12 and simplify to $r^2 = 24$. From here, most were able to give *r* as a surd in its simplest form. Candidates who did not equate the two areas often tried to work out the area of the sector and made the arithmetic over-complicated, especially if they multiplied by a numerical value for π. Common errors included using $2\pi r$ instead of πr^2 and premature rounding of $\frac{60}{360} = 0.16$ and then 0.16×144 rather than cancelling $\frac{12\times12}{6}$. Candidates who used the formulae for cones, spheres or the perimeter of a circle did not score.

Question 13

Many candidates demonstrated that they were able to rearrange the given formula efficiently and it was pleasing to see many multiplying both sides correctly by 2 as their first step. The most common error, however also came from the 2, because some candidates wrongly also multiplied the *h* by 2. Errors with the brackets, such as $(a+b)h = a + bh$ and the length of the fraction line such as $\frac{2A}{h} = a + b$ so $\frac{2A - a}{h} = b$ as well as sign errors, were also seen.

Question 14

(a) Whilst there were a significant number of correct answers, many candidates did not know how to find the value. Common wrong answers included $\log\frac{1}{2}$, 5, $\log 5$, 2 and $\log 2$.

(b) This part was answered well with a good number of correct answers seen. Those candidates not scoring full marks were frequently awarded one mark for demonstrating some understanding of logs, such as $2\log 3 = \log 3^2$ or correct use of $\log A - \log B = \log \frac{A}{B}$ from their working. Common wrong working seen included the answer 7 from $\log 63 - \log 9 = \frac{\log 63}{\log 9} = \frac{63}{9} = 7$ and $\log 54$ from $\log 63 - \log 9 = \log(63 - 9) = \log 54$.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/22
Paper 22 (Extended)

Key messages

- Candidates need to show all of their working. Incorrect answers without working cannot be given credit, whereas partial credit can be awarded if a correct method is shown.
- Candidates must be aware of mathematics in everyday life, for example, know the number of minutes in an hour.
- Candidates must know that for an answer to be in standard form, the 'number digits' must be between 1 and 10.
- Candidates should ensure that when writing 'a square root of a fraction', that they do not write 'short' square root signs that do not cover the required expression.
- On this, a non-calculator paper, candidates are recommended to use exact fractions rather than conversions to inaccurate decimals.

General comments

Candidates were quite well prepared for the paper and demonstrated very good algebraic skills. Many candidates lost marks through careless numerical slips, particularly with negative numbers and simple arithmetic operations. Candidates should make all of their working clear and not merely write a collection of numbers scattered over the page. This ensures it is easier to award partial credit. Candidates should always leave their answers in their simplest form. Many candidates lost marks through incorrect simplification of a correct answer.

Comments on specific questions

Question 1

Nearly all candidates were successful in answering this question. An incorrect answer of $y = 55$ was seen several times.

Question 2

Many candidates chose the long method and calculated the interior angle first but then, unfortunately, often subtracted 171 from 360. Some candidates calculated 9 correctly, but then subtracted from 180. There was a significant amount of poor arithmetic, for example, an answer of 90 from $\frac{360}{40}$, and $40 - 2 = 36$. Candidates would be advised to check their arithmetic carefully.

Question 3

A small number of candidates inverted the vector and a number added the co-ordinates.

Question 4

(a) This part was well answered, with the most common wrong answer being 144.

(b) In general, this was well answered, with some of the better candidates often rationalising the denominator. A significant number of candidates attempted to square root first, made a mistake, but then gained the method mark for a correct division. Short square root signs were not uncommon, with many only just acceptable.

Question 5

This question was well answered. In part **(b)**, some candidates stated the upper quartile range, or the inter-quartile range.

Question 6

Another question which was well answered by the majority of candidates. Most candidates demonstrated that they could convert to an improper fraction and then multiply by the reciprocal. Some candidates attempted a decimal approach with limited success. On this paper, candidates are advised to work in fractions in this type of question.

Question 7

Candidates who worked in fractions were more successful than those who tried using decimal equivalents, with the most common error occurring when 50 mins was converted to a decimal.

Question 8

The majority of candidates scored full marks. The candidates who attempted to find *b* first were often less successful. Candidates should be encouraged to check that their solutions work in both equations.

Question 9

Candidates found this question challenging. Some candidates merely restated the original equation. Other mistakes occurred when the *y*-intercept was identified as +7 but then the candidate did not use the correct gradient.

Question 10

This question was well answered by the majority of candidates. The most common incorrect answers were $\frac{1}{9}$, $\frac{1}{27}$, $\frac{-1}{3}$.

Question 11

This question was well answered. Weaker candidates simply placed the given values into the Venn diagram without considering the implications.

Question 12

Candidates were able to demonstrate their excellent algebraic skills. Some candidates had problems with 1 being the coefficient of *a* and *b*.

Question 13

Candidates who converted one of the numbers into a ‘like power’ were successful. A significant number of candidates wrote out both numbers fully, leading to slips when counting zeroes. Candidates should be advised against this method for such large numbers. A few candidates multiplied the given values. Some correct attempts were spoilt by leaving answers not in standard form.

Question 14

There were many correct answers to this question. The common errors were when candidates simply multiplied the two expressions together, or found the lowest common multiple.

Question 15

Candidates were able to demonstrate their knowledge and understanding of circle theorems.

Question 16

This question was well attempted, with almost all candidates attempting to multiply top and bottom by $\left(\sqrt{5}+1\right)$. A few candidates multiplied by $\left(\sqrt{5}-1\right)$. Some candidates did not total the denominator, or stated it as 6.

Question 17

This question was well answered, with some candidates actually rationalising the denominator. The common error occurred when candidates used direct proportion.

Question 18

Good candidates spotted that the numerator was the difference of two squares. Most candidates were at least partially successful with some factorisation. An incorrect factorisation of the numerator as $(y-3)^2$ was a common error. Some candidates simply cancelled terms within the original expression.

Question 19

There were many fully correct answers to this question. Two common errors were seen. In part **(a)**, some candidates left their answer as +/– 8 and in part **(b)**, a significant number of candidates had 'log' in their final answer. Some candidates simply divided the original expression by 'log'.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/23
Paper 23 (Extended)

Key messages

- Candidates need to show all of their working. Incorrect answers without working cannot be given credit, whereas partial credit can be awarded if a correct method is shown.
- Candidates must know that for an answer to be in standard form, the 'number digits' must be between 1 and 10.
- Candidates need to be able to apply their knowledge of circle theorems to non-conventional problems.
- On this, a non-calculator paper, candidates are recommended to use exact fractions rather than conversions to inaccurate decimals.
- Candidates must be aware of mathematics in everyday life, for example, know the number of minutes in an hour.

General comments

Candidates were reasonably well prepared for the paper and demonstrated very good algebraic skills. However, many candidates lost marks through careless numerical slips, particularly with negative numbers and simple arithmetic operations. Candidates should make all of their working clear and not merely write a collection of numbers scattered over the page. This makes it easier for partial credit to be awarded if the final answer is incorrect. Candidates should always leave their answers in their simplest form as stated in the rubric on the question paper. However, many candidates lost marks through incorrect simplification of a correct answer.

Comments on specific questions

Question 1

The majority of candidates answered this question correctly, although a number of candidates gave their answer as 8.

Question 2

Although there were many correct solutions to this question, a significant number of candidates made careless mistakes with the signs resulting in the loss of the mark.

Question 3

There were many excellent solutions to this question. Some candidates incorrectly subtracted 132 from 180.

Question 4

The majority of candidates gave the correct answer to this question.

Question 5

Although many candidates answered this question correctly, there were many answers of parallelogram and trapezium.

Question 6

This question was well answered by virtually all of the candidates.

Question 7

Although there were many correct solutions to this question, a significant number of candidates made careless numerical slips resulting in the loss of marks.

Question 8

The question proved to be a good discriminator.

The majority of candidates converted the numbers out of standard form. Unfortunately, a significant number who started the question correctly did not convert their answers back into standard form.

Question 9

This question was well answered by the majority of candidates. The most common error was made when trying to square 0.3.

Question 10

(a) Virtually all candidates realised that this part was testing vector addition. The common error was omitting to deal with the double negative correctly.

(b) Candidates who knew that this part was testing the modulus of a vector were nearly always successful. A significant number of candidates were unable to start the question with an appropriate method.

Question 11

(a) Nearly all candidates answered this part correctly.

(b) This part proved to be more challenging, with many candidates multiplying by $\frac{125}{120}$.

Question 12

This question was demanding for many candidates. Candidates read the word midpoint and immediately found the midpoint of the two given points. Candidates who drew a small sketch were nearly always successful. Candidates should be encouraged to make a sketch in this type of question in order to clarify the situation.

Question 13

Many candidates were able to demonstrate their excellent algebraic skills, giving perfect solutions.

Candidates who started by dividing by t^2 rarely completed the question correctly.

Question 14

Again, candidates were able to demonstrate their excellent algebraic skills, giving perfect solutions. The most common error involved taking a factor of –4 from 12.

Question 15

Candidates who worked in fractions were more successful than those who tried using decimal equivalents, with the most common error occurring when 45 mins was converted to a decimal.

Question 16

This question was too demanding for many candidates**.** Candidates who started the question correctly, frequently made mistakes when finding half of 90 – x.

Question 17

Although many candidates scored full marks, a significant number of candidates did not calculate the frequency densities with the subsequent resulting loss of marks.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/31
Paper 31 (Core)

Key messages

- Candidates should give answers to the level of accuracy required in the paper or to 3 significant figures.
- Candidates need to be confident in the use of their graphics calculator.
- Candidates need to have covered all the topics in the syllabus.
- Candidates must remember to show all their working out in order to gain method marks.
- Candidates should be familiar with mathematical terminology.

General comments

Many of the candidates managed to attempt most of the questions. It did not appear as if time was an issue. Some candidates appeared either not to have a graphics calculator or not to be confident in how to use it. This is an essential part of the course and some questions rely on the candidate having a graphics calculator to find the answer. Some candidates left questions unanswered. Either they had not covered the topic or they had forgotten what to do. Some candidates lost marks because they did not show their working out. It is important that the candidate shows their working out. They can then be awarded some marks for correct working even if an answer is not correct. Some questions rely on the candidates knowing the correct mathematical terminology. The correct mathematical terminology should be used throughout the course so that candidates are familiar with these terms.

Comments on specific questions

Question 1

(a) Most of the candidates could write the correct number in words. A few wrote sixty thousand instead of six thousand. Many candidates were not able to spell the word fifteen but were not penalised for this as long as their intention was clear.

(b) (i) Nearly all candidates managed to find the correct answer. Only a few worked out 4×3 rather than 4^3.

(ii) Many candidates found the correct answer. Some candidates did not use their calculator correctly and found the answer to be 128. It is helpful if candidates are shown how to use the fraction button on their calculator to avoid making such mistakes.

(iii) Most candidates found the correct answer with only a few working out 15^2.

(iv) This part was also well answered. A few candidates worked out 30×2.

(c) (i) Nearly all candidates found the correct answer.

(ii) Many candidates knew their prime numbers. Most gave an answer of 23 with a few giving 29 as their answer. Some candidates wrote 21 or 25 and some wrote 17 or 19. Careful reading of the question would have eliminated the second of these errors.

(iii) There were some correct answers here. The product of prime factors proved more challenging for the candidates. Some gave the correct numbers but not as a product and others gave any two numbers that multiplied to give 60. Some other candidates wrote this as a sum of prime numbers rather than a product.

Question 2

(a) (i) Although there were many correct answers here, other candidates found the area and perimeter to be a challenge. Many candidates had problems writing the correct units. Perhaps more emphasis can be given to making sure that candidates write the correct units in their answers.

(ii) Some candidates managed to find the correct perimeter and some others gained follow through marks for using their answer to the previous part and showing their correct working out.

(b) Although many candidates knew that the order was 2, some others wrongly described the symmetry by writing 180°.

(c) Many candidates knew that there were 2 lines of symmetry. Not all candidates used a ruler. All candidates should have a ruler in the examination. Some candidates also drew in diagonal lines of symmetry which were not correct.

(d) Many candidates managed to find the correct answer here either by adding up all the angles or using the formula $(n-2)\times 180$. Other candidates managed to pick up one mark by working out 8×90 or 4×270. Only a few misread the question and wrote down how many angles the shape had.

(e) All but a few candidates managed to write down the correct co-ordinates.

Question 3

(a) Most candidates worked out the correct number of packets. A few had problems with working out the change.

(b) Although many candidates worked out the increase correctly, some candidates misread the question and gave the amount of cereal in the packet after the increase.

(c) Most candidates managed to find the correct percentage. A few candidates multiplied by 300 and divided by 100 and arrived at 153 for their answer.

Question 4

(a) (i) Most of the candidates found the correct answer here. A few wrote 32 instead of 30.

(ii) More candidates managed to find the correct answer to this part.

(b) Although there were many correct answers seen for this part, some candidates substituted 350 for *C* instead of *F*.

(c) Some correct answers were seen to this part. Some candidates managed to gain one mark because they set up the equation correctly but then could not solve it. Other candidates did not know what to do to find the answer here.

(d) There were many correct answers seen to the rearrangement. Some candidates mistakenly wrote $\frac{30-F}{2}$ and others $\frac{F}{2}-30$.

Question 5

(a) All candidates could draw the bar chart correctly and most of them used a ruler.

(b) Nearly all the candidates managed to count up the numbers correctly.

(c) (i) Although some candidates knew how to find the mode, the most common answers were 10 and 35.

(ii) Fewer candidates managed to find the median with 20 and 3 being the most common answers.

(iii) Only a few candidates managed to find the mean correctly. Most of the candidates worked out $\frac{35+25+20+10+10}{5}$.

(d) (i) Many candidates managed to find the correct probability.

(ii) Although there were many correct answers seen in this part, not all of the candidates gave their answer as a fraction in its simplest form.

Question 6

(a) (i) Most candidates knew that they had to add 7 to find the next term. A few candidates mistakenly wrote the formula for the *n*th term which was the following part to the question.

(ii) More candidates are now able to find the formula for the *n*th term. Some candidates mistakenly wrote $n+7$.

(b) The majority of the candidates managed to find the correct two terms of the sequence. A few candidates wrote 28 and 33 for their answer.

Question 7

(a) A good number of candidates managed to draw the correct translation. Some picked up one mark by either moving 4 to the right but not 2 down or 2 down but not 4 to the right.

(b) In this part too, many candidates managed to draw the correct rotation. Some rotated the shape clockwise instead of anticlockwise.

Question 8

(a) Most candidates managed to find the correct answer here.

(b) (i) Although there were many correct answers seen, -17 and 21 were also often seen as the answer.

(ii) Most candidates managed to find the correct answer. A few divided instead of multiplying and gave their answer as 1.25.

(iii) There were many correct answers here. Some candidates picked up a mark for multiplying the brackets out correctly and some others found the answer by trial and error method.

(c) Some candidates knew how to factorise fully. Some others took out 2 or 3 as a common factor and gained one mark. Some others divided by 2, 3 or 6 and could not be awarded any marks.

(d) (i) Candidates found this part difficult, and few correct answers were seen. Many of the candidates found $\frac{x^7}{x^7}$ correctly and then wrote their answer as *x*.

(ii) There were more fully correct answers to this part. Other candidates managed to gain one mark by cancelling either the numbers or the *y*s correctly.

Question 9

(a) It was pleasing to see so many correct answers for this ratio question.

(b) Some candidates managed to find the correct speed. Others managed to gain one mark for showing some correct working out. There were some answers that were unrealistic. Candidates should be reminded to check whether their answers are sensible.

(c) (i) Many candidates completed the cumulative frequency table correctly. A common error was to write 100, 200, 300, 400 in the spaces provided.

(ii) Most candidates managed to plot their points accurately. Not all of the candidates joined their points with a smooth curve. Some used a ruler to join their points.

(iii) There were only a few correct answers to this part. Many candidates managed to gain a method mark by finding the number of cars travelling at 35 km/h but then forgot to take their answer away from 500.

Question 10

(a) Many candidates scored both marks here. Some only gained one mark because they did not write down 153.9…. Others used the wrong formula and did not manage to show the answer.

(b) There were very few correct answers to this part. Most of the candidates did not write the 2 litres as cubic centimetres.

(c) There were even fewer correct answers to this part. Some candidates managed to pick up one mark because they knew that the side had to be cubed to find the answer. A few others gained follow through marks by using their calculation for 2 litres.

Question 11

(a) Most of the candidates knew to use Pythagoras' Theorem in this part. Some lost a mark by not giving their answer correct to 3 significant figures. Some others just added 3.28 and 1.75, some multiplied the two numbers and some others tried to use trigonometry.

(b) Most knew to use trigonometry here. Once again, many candidates lost a mark because they did not give their answer correct to 3 significant figures.

Question 12

(a) Many of the candidates found the correct co-ordinates of the *y*-intercept. Some candidates mistakenly wrote the *x*-intercept instead.

(b) Many candidates managed to sketch the graph correctly. More care is needed when sketching graphs to make sure that the graph crosses the axes in approximately the correct place, any turning points are approximately correct and the shape is correct.

(c) Few candidates managed to find both correct answers here. 3 and -3 or 1 and -1 were common answers. Many candidates tried to use algebra to solve the equation rather than finding the points of intersection on their graphics calculator.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/32
Paper 32 (Core)

Key messages

To succeed in this paper, candidates should have completed full syllabus coverage. Working should always be shown, and answers must be given to a sufficient degree of accuracy. Candidates must make full and correct use of the functions of the calculator.

General comments

Most of the candidates approached this paper confidently and completed it in the time available. The questions in all syllabus areas were answered. The topics that the majority of candidates handled well were number, simple algebra and simple mensuration. Curve sketching, transformations and manipulating functions caused the most difficulty, and some candidates found the scales on axes challenging. Candidates must not make assumptions from a given diagram but must use the given information.

The use of pencils for any drawing should be encouraged, enabling corrections to be easily made, if necessary.

Comments on specific questions

Question 1

The majority of candidates were able to answer this question well.

(a) Most candidates wrote the correct words here.

(b) Nearly all the candidates were able to write the fraction correctly.

(c) Although most candidates chose 36 or 49, a few wrote these as 6 squared or 7 squared which was not sufficient although it indicated the candidate's understanding. There were a few answers of 25 from candidates who ignored the last part of the question.

(d) This was answered very well by nearly all the candidates.

(e) Although there were many correct answers, the value 1.452... appeared quite frequently, indicating incorrect use of the calculator.

Question 2

Most of the candidates found part **(a)** straightforward but there were many more errors in part **(b)**.

(a) (i) This was nearly always correct, except for a few candidates who did not take into account the number of adults and/or children in the family.

(ii) Nearly all the candidates gained this mark, subtracting their answer to part **(a)(i)** from 100.

(b) Although there were many correct answers, a large number of candidates divided 6 by 90 but then forgot to multiply by 60 to convert the speed to kilometres per hour. There were those who wrongly preferred to divide 90 by 6, and a few who converted the distance to metres.

Question 3

In part **(a)**, some candidates made mistakes in reading the scale on the vertical axis. Part **(b)** was done very well by a large majority.

(a) (i) There were many correct answers but a significant number of candidates read the scale wrongly and gave 2.5 and 4.5 for the number of oranges and bananas respectively. The context of the question should have alerted them to the possibility that their answer was not right.

(ii) This answer was usually correct for their values, although the mark was only available for an accurate answer.

(iii) Candidates who had read the scale correctly had no difficulty in finding the probability.

(iv) Although many correct answers were seen, a large number of candidates gave the inaccurate answer of 16.6. A three-figure answer must be corrected accurately to 16.7, although answers with more figures can be truncated instead. The importance of showing their working is illustrated clearly in this question, since candidates who wrote 16.6 without showing any working could not earn the method mark in this part.

(b) (i) This part was usually answered correctly, although there were some candidates who confused the mode with the largest number in the list.

(ii) Most candidates were able to find the range, although some gave answers such as ‘6 to 45’.

(iii) This was generally done well.

(iv) The majority of candidates had no difficulty in calculating the mean.

(v) The lower quartile was given correctly in many cases, although some weaker candidates evaluated one quarter of the largest number in the list, and others one quarter of the sum of the numbers.

(vi) Most candidates knew that they must subtract the lower quartile from the upper quartile to answer this part and this was done successfully, except in the case of those mentioned above who made a similar error finding the upper quartile.

Question 4

(a) Few candidates scored highly in this part. There was considerable confusion about the geometrical terms and the difference between a two-dimensional and a three-dimensional figure was not always appreciated.

The triangle was often described as ‘regular’ or ‘isosceles’, and candidates who did use the word ‘equilateral’ often omitted to write ‘triangle’ as well.

Few candidates gained the mark for trapezium, with quadrilateral and parallelogram being among the incorrect answers.

Cube and rectangle were the common errors for the third figure. Although cuboid was the correct term, the phrase rectangular prism was accepted but not prism alone.

The fourth diagram was the only one where nearly all candidates gained the mark for a correct answer.

(b) The mistake a large number of candidates made was to assume a right angle on the diagram at angle *EFC*, instead of focusing on the parallel lines that were marked on the diagram and described in the question. This led to a variety of wrong answers in nearly every part of the question. Quite often, the only parts where candidates scored were part **(b)(i)** with the correct answer, and part **(b)(v)** where a follow-through mark was available if they gave an answer that was equal to their answer for angle *DBE* in part **(b)(ii)**.

Question 5

(a) (i) Most candidates realised that they must use Pythagoras' theorem here, with only a few incorrectly adding 20^2 and 16^2 instead of subtracting.

(ii) Many candidates gained the mark here for using the correct formula for the area of the triangle using their answer from part **(i)**.

(b) (i) A large number of candidates ignored the fact that part of the fence was being used and they divided 36 by 4 instead of by 3.

(ii) Again, candidates who used their answers to part **(b)(i)** to find the area of the square were able to earn the follow-through mark.

Question 6

The number of candidates who caused themselves difficulty by using pens rather than pencils in this question was of some concern. Even when pencils were used, there were a number of untidy or messy responses.

(a) Nearly all candidates were able to write down the zeros of the graph.

(b) The line of symmetry was expected to be ruled, to pass through the point (4, 0) and to look parallel to the *y*-axis. Candidates who neglected one or more of these requirements did not gain the mark.

(c) Although some candidates did not appear to understand what was required here, most gave the correct co-ordinates.

(d) (i) A number of candidates wrongly drew the image after reflection in the *y*-axis. Of those who drew the correct reflection, many did not give a sufficiently accurate drawing. As a reflection, their sketch was expected to pass through the zeros identified in part **(a)** and to reach a maximum at approximately (4, 4).

(ii) A large number of candidates did not know what was required here. The sketch should have been a vertical translation of the given curve, with its minimum at (4, −2).

(iii) Even fewer candidates were able to sketch the graph of $y = f(x + 3)$. What was expected was a horizontal translation towards the left, with a minimum at approximately (1, −4) and zeros at about $x = -1$ and $x = 3$.

Question 7

(a) It was surprising that so many candidates were unable to answer correctly this question about time. Candidates who worked out the answer correctly but preferred to use a 12-hour clock often neglected to include pm in their answers.

(b) Many candidates gave very poor responses to this part and the correct values of 9 and 15 were not seen as often as expected.

(c) A number of candidates gained marks here by correctly multiplying the dimensions of the given box and the dimensions in their answer to part **(b)**. Incorrect answers often seen were the sum of the dimensions or the total surface area.

(d) Candidates who wrote 'large box' with no supporting work did not gain marks here. There were many who subtracted the volumes and the prices of the boxes and did nothing more. The expected method was to find either the price for 1 cubic centimetre for each box and to choose the smaller value, or to find the volume bought for 1 dollar (or cent) and choose the larger.

A few candidates who used different, but convincing, methods were able to gain the available marks.

(e) The stronger candidates realised that they had only to cube the ratios of sides given to them in part **(b)**, but many candidates earned the follow-through mark by cubing their answers to part **(c)**, although this mark was only available if they then gave the ratio in the simplest possible form.

Question 8

(a) There were a variety of wrong answers given in this part. Even when candidates drew a line from −2 to the right, they frequently omitted the hollow circle above the starting point or filled it in to represent $x \geqslant 2$.

(b) (i) This answer was nearly always correct.

(ii) A large majority of the candidates were able to solve this simple linear equation. The mistake made by some weaker candidates was to forget to change the sign when moving the 9 and to write down $11x = 13 - 9$.

(c) The majority of candidates expanded the brackets correctly although $2x^2$ was sometimes worked out as $3x$ and the terms $-6x + 7x$ were occasionally gathered together as $-13x$.

(d) Most candidates factorised the expression correctly.

(e) Many correct answers were seen, but some candidates offered $11x^8$ or $28x^{15}$ or even 28^8. Some attempts were seen at factorising and a few candidates answered their own misreading of the question as $4x^5 \div 7x^3$.

Question 9

(a) Most candidates were able to plot the points correctly, although the scale proved to be a challenge for some.

(b) The word negative was all that was required here. Candidates were not penalised for adding extra details such as weak, or strong, but those who used these terms instead of the word negative could not earn the mark.

(c) (i) Most candidates were able to calculate the mean mass accurately and to give the exact answer, although answers corrected to 3 or 4 significant figures were not penalised here.

(ii) Again, most candidates were able to calculate the mean time, but in this case many chose to write an answer of 7.3 and thus gained no credit.

(iii) Having worked out the mean values, the better candidates plotted the mean point and ruled a line of best fit through it, with a negative gradient. However, one mark could be earned for a suitable line with negative gradient even when the mean point was not plotted.

(d) Most candidates were able to read the value correctly from the graph, although a number did so at a mass of 1500 and not 1550 as required.

Question 10

(a) Many candidates earned only one mark for putting the value 6 in the intersection of the sets but the wrong values in the outer part of each set.

(b) The wrong answer of 7 was very common, arising from the wrong values (17, 6, 14) in the Venn diagram. Candidates should have been alerted by the fact that their total number of candidates was greater than the total number stated in the question.

(c) Most candidates were able to state a probability correctly using the value shown in their Venn diagram.

(d) Although most candidates were able to shade the correct region of the diagram, there were a number of incorrect interpretations of the set notation $(T \cup B)'$.

Question 11

In all parts, candidates had to be aware that there were five points of the original shape which needed to be plotted correctly. Full marks could not be earned if the central point of the K was not in the correct position in their image.

(a) There were some good diagrams illustrating the rotation, but some candidates used an incorrect centre of rotation, and a few used 90° and not 180°.

(b) There were candidates who confused the *x* and *y* co-ordinates, and thus a considerable number of candidates drew an image after translation by the vector $\begin{pmatrix} -3 \\ 1 \end{pmatrix}$ rather than the given vector $\begin{pmatrix} 1 \\ -3 \end{pmatrix}$.

(c) This part was frequently omitted and the solutions that were offered were often in a wrong position or with only the vertical part of the original shape correctly enlarged.

Question 12

(a) Most candidates were able to draw Pattern 4 correctly.

(b) The table was nearly always completed correctly.

(c) A few candidates gave the *n*th term as their answer here, but most correctly indicated in some way that 3 must be added each time to the previous term.

(d) There were many correct answers here.

(e) The answer 'Yes' had to be supported by clear working to gain credit here. The best method was to put $3n - 1 = 134$ and solve the equation to show that *n* was an integer. This was done by many, but some preferred to choose a value for *n* and to verify that this value gave 134 when used as the *n*th term. A long and time-wasting method, which candidates should avoid, was to continue to list the number of dots until 134 was reached.

Question 13

(a) Most of the candidates knew the shape of the graph they must sketch but the drawings were often of very poor quality, with a noticeable corner and the ends curving away from the axes instead of getting closer.

(b) There were many wrong answers of $y = 0$ here.

(c) This straight line with a positive gradient was generally well drawn. Marks were lost if the line was not ruled, or if it did not pass through the origin.

(d) Many candidates gave the correct answers here even if they had not been able to deal with the other parts of the question.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/33
Paper 33 (Core)

Key messages

To succeed in this paper, it is essential for candidates to have completed the full syllabus coverage. Sufficient working must be shown and full use made of all the functions of the graphics calculator that are listed in the syllabus.

General comments

Candidates continue to perform quite well on this paper. They were well prepared and, in general, showed a sound understanding of the syllabus content. Presentation of work continues to improve although some candidates are still reluctant to show their working and just write down answers. Calculators were used with confidence although it does appear that some do not have a graphics calculator as the syllabus requires. Candidates had sufficient time to complete the paper. Few did not attempt every question.

Although work on the more difficult topics in the syllabus has improved, it appears to be that this is at the expense of knowledge of the more basic content and techniques. Further instruction is needed so that candidates recognise key words in a question. More complex, multi-step questions need thought before candidates start their solution. This could avoid false starts and the using of incorrect formulae. The standard of algebra work produced is improving.

Comments on specific questions

Question 1

In general, candidates answered each part of this question well. Their knowledge of number work was very good.

Errors that did occur were few. In part **(b)(iv)**, some gave an answer of 9%. In part **(c)**, 6.6 was seen where candidates did not round or 6.67 where they rounded to 2 decimal places. In part **(d)**, 6.32 was sometimes given where significant figures and decimal places were confused. Also $2\sqrt{10}$ was seen here where candidates did not follow the instructions in the question.

Question 2

(a) It was clear that some candidates did not have a protractor available to them. Some read the wrong scale on the protractor when measuring the angles.

(b) (i) Reflex was not widely known in connection with angle measure.

(ii) The number of degrees in a right angle, on a straight line and around a point were all well known.

Question 3

(a) (i) and (ii) These parts were answered correctly by nearly all candidates.

(b) Most could find 4% of $7.50 correctly. However, few realised this was the answer and many went on to find the reduced price of a jar of coffee.

(c) There were many correct answers here. Candidates showed their working clearly and drew a correct conclusion.

Question 4

(a) (i) Although many candidates could reflect the rectangle in the *y*-axis, some reflected in another vertical mirror line or reflected in the *x*-axis.

(ii) This part confused some candidates who could not visualise the diagonal line that needed to be drawn.

(b) It is of concern that many candidates still do not realise that they must refer to one transformation only in their description. If more than one transformation is referred to then the marks are lost.

(i) Many realised that this was a rotation but often did not give a full description.

(ii) The term 'translation' was not well known. Often, candidates did score for a correct description of the move.

Question 5

(a) All sections of part **(a)** were answered well.

(i) A few candidates did not plot points correctly as they did not interpret the scale correctly.

(ii) Most correctly worked out the two mean values.

(iii) Many candidates still do not realise that their line of best fit must go through the mean point. A common error was to make their line of best fit go through (20, 0) or (80, 10) or both.

(iv) Invariably, where a line of best fit existed, candidates could use it correctly to find an estimate of the amount invested.

(b) (i) Candidates usually selected the correct interval for the modal group.

(ii) Finding an estimate of the mean was not well done. Few realised they needed to use mid-interval values in a calculation. Fewer still knew to divide by 100. It is important to remember that some working needs to be shown even when the calculation can be completed wholly on the calculator in order that method marks can be awarded if the final answer is incorrect.

Question 6

All parts of this question were answered well. Although some slips were made by candidates, there appeared to be a general improvement in knowledge and understanding of the algebra techniques involved.

Question 7

This was another question that was answered well although there were some errors when adding values. In part **(b)(i)**, many candidates thought the question wanted the number of students with 3 cats and 0 rabbits whereas it wanted the number of students with 3 cats and any number of rabbits. Part **(b)(iii)** was less well done than the other parts. Once again, perhaps this was due to mis-interpretation of the question.

Question 8

(a) (i) and (ii) Most added the lengths correctly to find the perimeter and knew the formula needed to find the area of the triangle.

(iii) Very few saw to find the area of the triangle using 20 cm as the base and *x* as the height and link this to the answer in part **(a)(ii)** to find *x*. A few candidates tried to use trigonometry to find angle *B* and then use this to find *x*. These attempts were never successful and did not, as the question required, use their answer to part **(ii)**.

(b) There was a mixed response to this question. The term 'mathematically similar' was not understood by many. Most assumed that there was a +6 factor between the two triangles, giving an incorrect answer of $y = 22$, instead of a · 1.5 factor.

Question 9

(a) (i) Many candidates did not understand that they needed to find the number of elements in *S* and just listed the elements of *S*.

(ii) and (iii) Some confused the union and the intersection of sets. Others, in part **(iii)**, listed some elements twice.

(iv) There was less confusion when finding the complement of *S*.

(b) (i) Finding the probability was well done, with answers as fractions, decimals and percentages.

(ii) In this part, most knew to multiply their probability by 60.

Question 10

This question was not done well. Many candidates used wrong formulae or did not substitute correctly. It was common to see the volume of a sphere used but not halved. Even when a correct formula was used, the evaluation of the calculation was often done incorrectly. It was rare to see a correct change of units from cm^3 to litres.

Question 11

(a) The co-ordinates of the midpoint of the line were often found correctly.

(b) Many candidates used a formula to find the gradient of the line. Unfortunately, this was often not used correctly, with wrong values substituted.

(c) As in part **(b)**, although the method was known, many used wrong values. Usually this meant using 9 and 2 for the lengths instead of 8 and 2.

Question 12

(a) (i) 18 or 17 were common wrong answers although a good number correctly gave 16.

(ii) There were 'incomplete' answers here such as $0.55 \cdot 10^{-4}$ or incorrect answers such as $5.5 \cdot 10^{-4}$.

(b)(i) A significant number of candidates could not change kilometres into centimetres.

(ii) Many candidates could work out how many seconds there were in one day and most of these went on to multiply their answer by 8.

Question 13

It was evident that many candidates did not have access to a graphics calculator. There was a significant number who plotted points to help find the shape of the graphs. This led to errors when there was no scale to use on the axes.

(a) (i) Many had the correct shape of the curve although some did not have it going through (0, 0).

(ii) Those with access to a graphics calculator went on to find the co-ordinates of the local maximum.

(b) Plotting points often led to a non-straight line.

(c) This was rarely found from the graphs. Often candidates used trial and error to locate values of *x*. Rarely were both values obtained.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/41
Paper 41 (Extended)

Key messages

To succeed in this paper, candidates need to be able to apply formulae, and show clearly all necessary working so that they may gain method marks if errors are made in calculations. In order to avoid losing accuracy marks, candidates are strongly advised not to round off in the middle of a two-step calculation but to work to a minimum of four significant figures throughout.

Most candidates were familiar with the use of the graphics display calculator in the curve sketching question but many did not use it for statistical questions and/or for solving equations.

Candidates should use the mark value indicated in the question as an indicator of how much work is required for a question.

When a question states ‘show that’, candidates should not start with the answer and try to verify it. They should start with what is given and work towards the answer.

General comments

In **Questions 1, 5, 8 and 9** some candidates did not show enough working and some who did lacked organisation so that their method was not clear. For certain questions, such as **Question 9**, working is required in order to score full marks; in other questions candidates may gain full marks with no working shown but, if errors are made, then method marks are not available. Sometimes a lack of attention to detail cost marks, for example in **Question 7**. In **Question 8** some candidates lost accuracy marks because of premature rounding.

The questions that presented least difficulty were **Questions 2(a)** and **(b), 4, 5(a)** and **(b), 10(a)** and **12**. Those that proved to be the most challenging were **Question 2(c)**, a transformation by rotation and enlargement, **5(c)**, combining probabilities, and **11(d)(ii)**, inequalities solved graphically.

Candidates appeared to have sufficient time to complete the paper. Most candidates attempted all of the questions, but **Questions 2(c)** and **11(d)(ii)** were most likely to be left blank. There was some very impressive work shown by the most able candidates.

Comments on specific questions

Question 1

(a) Most candidates were successful but a common error was adding 15%. Rounding 535.5 to 536 for the final answer was also fairly common.

(b) Again, most got the right answer but 952×1.15 was frequently seen.

(c) There was some impressive log work by the better candidates here although it was sometimes spoilt by rounding 10.34 to 10 and/or forgetting to add the initial week. Using 630 instead of 535.5, and 15% or 20% instead of 5% were fairly common. Perhaps more unfortunate were those who aimed for $\frac{1}{2}(535.5)$ instead of $\frac{1}{2}(630)$. Repeated trials was a common method, but using this technique requires values either side of the target value, and many candidates omitted one of these. Weaker candidates often used successive reductions of $26.775 (5% of $535.50).

Question 2

(a) Almost all candidates gave the word reflection and most gave $y = -1$; however, $x = -1$ was fairly common. Just a few gave a combination of transformations, usually a reflection and a translation, but this was very rare. Candidates should be aware that giving more than one transformation will score no marks.

(b) This was almost always correct, with just a few only getting the movement in one direction correct or the top vertex incorrect.

(c) Better candidates did this well but many others ignored the need for trigonometry. Many of those who did use trigonometry used a correct method to reach 26.6° but then calculated 90° – 2(26.6°). Weaker candidates often measured the angle or gave the answer 90° or 270°.

(d) This was not done well. Most candidates did not use correct Pythagoras calculations and even those who did often used decimals instead of surds.

Question 3

Most candidates did well on both parts. Just a few omitted one or two factors in part **(a)** or simply used the rule and did not list the factors. Some worked out the prime factors again for themselves. Weaker candidates struggled with the prime factors in part **(b)** and some listed all the factors of 360, but most were successful in finding the prime factors and then applied the rule correctly. Basic mistakes like 1 + 1 = 1 were seen more than once.

Question 4

(a) Most candidates reached the correct answer but some made errors like adding the mid-interval values and dividing by 7 or using the width of the interval instead of the mid-value. A number clearly entered the information into their GDC as intended, but most used a long mechanical method.

(b) The cumulative frequencies were usually plotted at the right heights but many used the mid-interval values. It is wise to write down the cumulative frequencies in order to gain credit in the event of incorrect plots. Some lost a mark by joining to (0, 0) instead of (10, 0). Frequency diagrams were rare.

(**c)** All parts were done well and candidates with incorrect graphs still gained credit by reading off values correctly from their graphs, so long as their graph was increasing.

(d) Middle and high ability candidates did well, calculating correct frequency densities and drawing good histograms. Weaker candidates consistently divided by 10 rather than the width of the interval but still gained some credit for the diagram.

Question 5

(**a)** This was usually well done but a significant number found the percentage 20 rather than the angle 72°.

(b) This was almost always correct.

(c) Most candidates used $\frac{12}{60} \times \frac{10}{59}$ but many did not add the reverse order. A number, however, did not understand that these were probabilities without replacement, and used 60 for the second denominator instead of 59, and, as a result, gained no further marks. Some candidates added probabilities.

(d) Many gained some credit by finding the probability of one or two of the possibilities but only the best found all three possibilities. Very few used the quicker method of subtracting from one the probability of both not saying sport. Here also a number of candidates did not recognise that the second selection was out of 59 not 60.

Question 6

(a) The majority of candidates, who were able to deal correctly with inverse proportion, gave some very good responses. Most were successful with the first part starting off with the correct variation and finding the constant 18. Just a few did not evaluate the constant and some did not include the value in their answer. Weaker candidates often started with $y = k\sqrt{x}$ and hence made no progress in any part. Those who got part **(i)** right were usually correct with part **(ii)** also. Part **(iii)** proved somewhat more difficult. Many reached $\sqrt{x} = \frac{18}{15}$ but then went on to find the square root instead of squaring.

(b) Only the best were successful here, with most candidates not making the first step of setting up an equation involving *z* and (y + 5) involving a different constant. Some did write $z = k(y + 5)$ but were then unable to evaluate the constant and substitute the answer to part **(a)(i)**.

Question 7

(a) This question did not prove to be too difficult for most candidates, but marks were lost by simple errors. Most gained the mark for 2**b.** For the other two parts, although many candidates had the right idea, they often drew the two vectors that made up the addition but not the resulting vector. So for 2**a** + **b**, for example, they drew the vector 2**a** and from the end of it the vector **b** but not the vector from the start of one to the end of the other. A few who drew the correct lines omitted the arrow.

(b) This was done better. Middle and high ability candidates usually had all three correct but weaker candidates often found it difficult.

Question 8

(a) Most candidates used Pythagoras but a number chose longer methods, first finding angle *BDC* or angle *BCD*. A very common error for either method was to work too inaccurately. An angle given to only two significant figures is not going to give the required degree of accuracy for the final answer. Candidates appeared not to realise that, in order to show that the answer was correct to 3 significant figures, it was necessary to show it to at least four significant figures first.

(b) Many candidates were successful here, showing good technique in applying the cosine rule. Some started by quoting the cosine rule starting 9^2 = and some using the version starting with cos *ABD* =. The latter were slightly more successful in general as errors were sometimes made in transforming the former. A number misquoted the cosine rule or used a version for the wrong angle. In this part and in parts **(c)** and **(d)** some candidates assumed angle *ADB* was 90°.

(c) This proved difficult for some. Most were able to find the area of triangle *BCD* but many were unsuccessful with triangle *ABD*. Again, assuming angle *ADB* = 90° was common.

(d) Most candidates used the cosine rule with triangle *ABC* and these were usually correct. If their angle was incorrect in part **(b)** they gained partial credit. Those using triangle *ADC* were less successful. Many again assumed angle *ADB* was 90°. Others used the sine rule to calculate angle *ADB* but did not take into account the fact that angle *ADB* was obtuse.

Question 9

(a) Most candidates realised that they had to express both the length and width of the picture frame in terms of x and then form an equation for the area; these candidates usually simplified correctly to reach the correct equation. Just a few split the shape up into smaller areas. A small number subtracted 900 from $(45 + 4x)(20 + 2x)$ but still equated to 2208. Very few were unable to expand the bracket correctly. Some weaker candidates left this part blank or solved the equation here.

(b) Most used the formula here and there were many correct solutions. The most common mistakes were sign errors leading to –6 and 27.25. There were also excellent solutions using factorisation or graph sketching. A number of candidates did not show working despite the instruction. Candidates should appreciate that if they are using their graphical calculator to solve equations, then they must show their sketches.

(c) Whilst there were many correct solutions, a significant number did not appreciate that all that was required was to substitute their positive solution to part **(c)** into $(45 + 4x)$ and $(20 + 2x)$.

Question 10

(**a**) Most parts were well done. Part **(i)** was almost always correct. The vast majority were also correct with part **(ii)**. Just a few made numerical errors and some found g(f(4)). Part **(iii)** was very well done. The most common errors were multiplying out $2(3x + 2)$ to $6x + 2$ or making sign errors when isolating terms.

Sign errors also occurred in isolating terms in part **(iv)**. A few forgot to swap x and y and some confused $f^{-1}(x)$ with $(f(x))^{-1}$.

The most common errors in part **(v)** were treating it as $f(x) \times g(x)$, finding $f(g(x))$, and going from $15 - 6x + 2$ to $13 – 6x$. Some also tried to solve an equation using the expression.

There was some impressive algebraic work in part **(vi)** and many candidates were completely successful. The common errors were in expansion of brackets in the numerator and/or denominator. Candidates should realise that it is not necessary to expand the denominator as the factorised form is already simplified. Here, too, simple sign errors were made in simplifying the numerator.

(b) Only the best candidates were able to get this part right. It was hoped that some would spot that the answer was x without doing any manipulation. Others chose a function for $h(x)$ and worked the inverse out and then found the composite function.

Question 11

(a) Most candidates were successful with the sketch but some had branches overlapping across the asymptotes. The best sketches were those where the asymptotes were drawn first. A few candidates entered $(x + 2) \div (x – 1) \times (x – 4)$ into their calculator giving a totally incorrect sketch. Very few candidates tried to plot the curve rather than using their calculator.

(b) Those with a correct sketch usually produced the right answer here. Some lost the marks through inaccuracy and some omitted the negative sign.

(c) Most candidates gave $x = 1$ and $x = 4$ but $y = 0$ was much less common. $y = –1$, $y = –2$ and $y = –1.94$ were all common incorrect answers.

(d) In part **(i)**, there were many correct answers although some only gave the answers to 2 significant figures. This part was omitted by a number of candidates.

In part **(ii)**, only the best candidates were totally successful; many gave $1.34 < x < 2.79$ but most omitted $x < 1$ and/or wrote $x < 5.87$ rather than $4 < x < 5.87$. Some candidates tried an algebraic approach which was not appropriate for this question where they were expected to use their graphical calculator. This part also was left blank by many.

Question 12

(a) Almost all candidates gained at least partial success here and many found all 5 numbers correctly. 24 and 91 were usually correct. 24 instead of 37 for the top two numbers was fairly common.

(b) This was well done by many but also many made errors in substitution to form equations and solving. Some appeared to use trial and error and some of these were successful.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/42
Paper 42 (Extended)

Key message

Candidates are expected to answer all questions on the paper so full coverage of the syllabus is vital.

Communication and suitable accuracy are also important aspects of this examination and candidates should be encouraged to show clear methods, full working and to give answers to 3 significant figures or to the required degree of accuracy specified in the question. Candidates are strongly advised not to round off during their working but to work at a minimum of 4 significant figures to avoid losing accuracy marks.

The graphics calculator is an important aid and candidates are expected to be fully experienced in the appropriate use of such a useful device. It is anticipated that the calculator has been used as a teaching and learning aid throughout the course. In the syllabus, there is a list of functions of the calculator that are expected to be used and candidates should be aware that the more advanced functions will usually remove the opportunity to show working. There are often questions where a graphical approach can replace the need for some complicated algebra and candidates need to be aware of such opportunities.

General comments

The candidates were very well prepared for this paper and there were many excellent scripts, showing all necessary working and a suitable level of accuracy. Candidates were able to attempt all the questions and to complete the paper in the allotted time. The overall standard of work was very good and most candidates showed clear working together with appropriate rounding.

A few candidates needed more awareness of the need to show working, either when answers alone may not earn full marks or when a small error could lose a number of marks in the absence of any method seen. There could be some improvements in the following areas: handwriting, particularly with numbers; taking care in copying values from one line to the next; reading the question carefully.

The sketching of graphs continues to improve although the potential use of the graphics calculators elsewhere is often not realised.

Topics on which questions were well answered include transformations, histograms, reverse percentages, trigonometry, curve sketching and quadratic equations.

Topics which candidates found difficult were bearings, compound functions, combined probability without replacement, scale factor of volume and mensuration.

There were mixed responses in other questions as will be explained in the following comments.

Comments on specific questions

Question 1

(a) This question was almost always correctly carried out with the very occasional circular argument.

(b) Again, this was almost always correctly calculated with many candidates going the extra step to the simplest ratio. There were some errors in subtracting.

(c) This was usually well answered. The challenge was to calculate the fraction of the appropriate amount, which is why 'remaining' was printed in bold.

(d) (i) This was usually well answered with most candidates going directly to 90% of \$6. Many candidates left their answer as 5.4 when 5.40 is more appropriate with money. However, this was allowed.

(ii) Candidates have become very well practised with reverse percentages and this was demonstrated here. A few candidates treated the \$3.69 as 100% and increased it by 10%.

Question 2

(a) This question was answered well with the majority of candidates producing a sketch with the correct shape not crossing the axes of the graph.

(b) Although many candidates identified the asymptotes correctly, a few thought the graph tended towards a value other than zero and a small number did not respond, suggesting they were not familiar with the term 'asymptote'. A few responses had x, y not equal to 0.

(c) & (e) Candidates who knew how to use their calculator to solve these equations were generally successful in finding the correct values. Many lost the marks due to not giving their answer to 3 significant figures with often only 2 digits being seen.

(d) It was unusual to find a candidate who could not draw a straight line through the origin in order to obtain the mark for this question.

(f) A significant number of candidates shaded regions of the graph that were excluded from the required region due to the criteria given in the question. It was reasonably common to see graphs without the line $y = 0.5$ drawn and hence the correct region was not identified.

Question 3

(a) Most candidates completed the tree diagram correctly. The third pair of probabilities was the most challenging and a number of candidates placed 0.5 beside each branch.

(b) (i) This required the sum of two products from the tree diagram and it was clear that the tree diagram made this question more accessible. A few candidates added quotients such as $\frac{0.2}{0.7}+\frac{0.05}{0.95}$ and a few others incorrectly found the product of two sums, i.e. (0.7 + 0.2)   (0.3 + 0.05).

(ii) Most candidates were able to calculate the expectation using their answer to part **(b)(i)**.

Question 4

(a) This part was generally well answered with most candidates spotting that π would cancel out in a correct equation. A large number of candidates did not use the correct formula for a sphere, despite it being given on the formula page, choosing to square rather than cube the radius. By far the most common error was equating the volume of the cylinder to 144π ignoring the two hemispheres. A numerical value for π was often used but, if used correctly, 12 was nearly always obtained.

(b) Although π was occasionally omitted in other parts it was omitted much more often in this part of the question. Multiplying by 1000 rather than dividing was seen a few times; division by 100 rather than 1000 was also seen. A few candidates did not use 144π but tried to calculate the volume of the solid. In this case the answer was outside the acceptable range.

(c) There were numerous different errors when finding the volume of 20 cubes. Most common was using 2.8   2.8 for volume; others were just using 1 cube; 6   2.8 was also seen as the surface area was used instead. Some candidates used π in trying to find the volume of the cube. When the volume of 20 cubes was correct the most common error was in keeping within the required accuracy of 3 significant figures. A few used the volume of the cube rather than 144π as the denominator in the percentage calculation. Others chose to work with percentage mass, rather than percentage volume which, though valid, often gave rise to an incorrect answer at the end.

(d) This part generally well answered by candidates. However, several equated 18π either to the volume of a sphere, cylinder or the solid. For those that used ratios it was most common to find the square root rather than the cube root. $\frac{1}{8}$ was also used as the length ratio rather than the volume ratio. It was encouraging to see how many recognised that the ratio of volumes was required but many were inclined to square root rather than cube root.

Question 5

(a) Although this question was generally well answered, it was an example where some candidates did not read the question carefully as the interest instead of the total amount was often given as the final answer. One mark was awarded for the interest. Another error was to calculate 200   1.5   8 and not divide by 100. A small number of candidates used compound interest.

(b) This was well answered with candidates showing good experience with compound interest and the efficient method of using the multiplier of 1.014 was frequently seen. A few candidates laboured through eight calculations calculating one year at a time. A small number of candidates spoiled their method by subtracting 200 to give the amount of compound interest as their final answer.

(c) The stronger candidates noticed that as the answers to parts **(a)** and **(b)** were close, it would not take many more years for the compound interest amount to become greater than the simple interest amount. They simply did a calculation one year at a time and soon arrived at the correct answer. There were also some very good candidates who set up correct equations, sketched their curves from the graphics calculator with full success. It is also worth mentioning that this method would be more appropriate when the number of years is not obviously small. This question needed to be read carefully and one error was to find when the compound interest amount exceeded the answer to part **(a)**, this answer being 1. This was a good discriminating question which was also dependent on the correct answers to parts **(a)** and **(b)**.

Question 6

(a) Good responses were seen although a few candidates did reflect the shape in the *x*-axis.

(b) A well answered part with very few mistakes seen although some candidates only scored B1 for the correct translation in 1 direction.

(c) There were many good answers. Almost all candidates gave sufficient information, i.e. an angle, direction and centre even though not always correct. A few gave the direction correctly as 270° anti-clockwise but none used -90°.

(d) This was a more demanding part with several incorrect answers, the most common mistake was to place the correct shape one unit too high.

Question 7

A very well answered context question.

(a) This substitution question was nearly always correctly answered.

(b) (i) The sketch of the curve was usually good enough to earn full marks. The loss of one mark was from either crossing the *x*-axis to the right of 4.5, not crossing the *x*-axis, not passing through the origin or by having the maximum point too high. Very few candidates lost both marks by not drawing a parabola with its vertex upwards.

(ii) Almost all candidates understood this part of the context and gained full marks. A few candidates did not give answers to at least three significant figures and a small number gave the answers in reverse.

(iii) Most candidates understood that hitting the ground would be where the graph cut the t-axis. Again, there were a number of candidates who overlooked the rule about three significant figures when reading from the graphics calculator and gave an answer 4.1.

(iv) Using the curve for this context was found to be a little more challenging as it required the difference between two x-values. There were many correct answers and some that would have been correct if more accurate values had been used. The answer 1.34 to 2.74 was quite often seen demonstrating correct readings but a misunderstanding of 'length of time'.

Question 8

(a) This was nearly always correct. Incorrect answers seen included $7n + k$ and $n + 7$.

(b) A well answered part although several candidates used 3 instead of –3.

(c) Most recognised that the next term was the previous term multiplied by 2. For those that recognised a power of 2 the correct answer was usually obtained. Others had $2n$ and n^2. A few thought there was a constant third difference of 8 and attempted to find a cubic.

(d) Most found the constant second difference of 2 and realised that this gave a quadratic expression. Most found the answer by inspection but several used simultaneous equations and some had been taught that the coefficient of n squared was $\frac{2}{2} = 1$.

Question 9

(a) Almost all candidates identified the correct interval.

(b) The mean was usually correctly calculated with a number of candidates not using the function on their graphics calculator, thus doing a lot of work for only two marks. The mark scheme shows that all that is needed for one mark is evidence of mid-values seen. A few candidates did gain from this as they apparently did not input everything into their calculator correctly.

A number of candidates found the mean of the four mid-values, completely overlooking the number of candidates.

(c) There were many fully correct histograms demonstrating a good knowledge of frequency density and how the area represents the data. Apart from the occasional misreading of the scales, the main error was to take the fourth column to the last value on the t-axis instead of stopping at $t = 75$.

(d) (i) Most candidates were able to give the correct probability from the given frequency table.

(ii) This product of two probabilities was a more challenging question with candidates needing to understand that choosing two candidates is a 'without replacement' situation. The other challenge was to interpret the requirement to add two frequencies from the table and not use the value used in part **(b)(i)**. The errors seen were usually one of $\frac{150}{240} \quad \frac{150}{240}$, $\frac{30}{240} \quad \frac{29}{239}$ or $\frac{120}{240} \quad \frac{119}{239}$. A few candidates doubled the answer.

(iii) Another challenging part set to be a discriminating type of question. The stronger candidates showed good working of comparing the denominators 57 360 and the 1912 given in the question to lead towards the product of the numerators being 30   161 (4830). This led them to 70   69 and to the correct interval. There were many answers without any supporting working which suggested that there may have been some fortunate guesses.

Question 10

(a) This simultaneous equations question was very well answered with the majority of candidates gaining full marks. A few did not write two equations and did not show all working as requested in the question. Most could solve algebraically but a few numerical errors were seen.

(b) (i) This was one of the trickier parts of the paper, but most candidates responded well to this question and demonstrated sound algebraic skills to achieve full marks. The most common error seen was to omit brackets when multiplying together two dimensions of the triangle and/or rectangle in order to form an equation by equating their areas. Some candidates dealt skillfully with the fractions involved and although others laboured over several lines of working to eliminate the fractions, many were successful in the end. A few candidates thought 'show' meant solve the equation and used either factorisation or the quadratic formula.

(ii) Although there were a lot of successful answers here, some candidates appeared confused about the difference between factorising a quadratic expression and solving a quadratic equation. As a result a number of candidates looked at this as an equation to solve and used the quadratic formula as their default method, thus gaining no marks. For those that did factorise the most common error was to reverse the signs. A few had both x coefficients as 1 and a decimal as one of the numbers having possibly used the calculator to solve.

(iii) Most candidates recognised that they had to use the positive root from their factorised quadratic in the previous part and correctly substituted into the expression they had written down for the area of the triangle in part **(b)(i)**. Many of the candidates who had solved a quadratic equation in the previous part were able to use their answer to gain the marks here. Nearly all realised that their positive value had to be used. Quite a few just expanded the area of triangle formula and used no numerical values gaining no marks.

Question 11

This proved to be a question that resulted in a wide range of marks.

(a) This was usually correctly answered, although often by using the sine rule in a right-angled triangle. Several candidates found BC instead of DC. A few candidates calculated for example $102\cos 30$ instead of $\dfrac{102}{\cos 30}$. It should be pointed out that context questions require decimal answers and so $68\sqrt{3}$ only scored two marks.

(b) Most candidates realised that this was not a right-angled triangle and the cosine rule was required. There were many fully correct answers. Even though the formula is on the formula page, some candidates put sine in the place of cosine. The only real challenge with the cosine rule is to ensure that (2 110 102 cos 60) is a product that needs to be calculated before being subtracted from the two squares. Candidates should be aware that a scientific calculator does this and the efficient approach is to write down $110^2 + 102^2 - 2\ \ 110\ \ 102\ \ \cos 60$ and nothing more. The candidates who go to $12100 + 10404 - 22440\cos 60$ run the risk of going on to reach $64\cos 60$.

(c) The area of the quadrilateral proved to be more challenging as candidates needed to look carefully at the values they had in parts **(a)** and **(b)**. Most candidates found the area of triangle ABD the easier of the two triangles as given values on the diagram led them to the efficient use of $\frac{1}{2}ab\sin C$. Triangle BCD was a little less obvious although the stronger candidates used $\frac{1}{2}ab\sin C$ again with their answer to part **(a)**. The other method frequently seen was to calculate BC and then use $\frac{1}{2}$ base height.

Most candidates found one correct area. A small number of candidates treated triangle ABD as equilateral or isosceles and attempted to calculate perpendicular heights. A few did correctly calculate a perpendicular height in triangle ABD and usually reached the correct area.

(d) Bearings traditionally prove to be a real challenge to many candidates and this question had the added difficulty of choosing an appropriate strategy. The most straightforward method was to realise that the bearing of *A* from *B* is 180 plus the bearing of *B* from *A*. This would then lead to use of the sine rule (or the cosine rule) to find angle *DAB*. The stronger candidates did use this method whilst a few other strong candidates found angle *ABD* in the same triangle. In this case, very few were able to go further to find the correct bearing. The question proved to be difficult for many candidates with attempts at combining 30 and 60 degrees in some way without finding any other relevant angles.

Question 12

(a) (b) Almost all candidates got the correct answers to these two parts.

(c) Nearly all the candidates formed the composite function correctly and the majority went on to square the bracket and arrive at the answer in the quadratic form requested. There were some errors seen when squaring the bracket, usually incorrect signs. The most common mistake was to forget to add on the 1 on after multiplying the brackets out correctly, giving an answer of 100 rather than 101.

(d) The number of correct answers suggested that many candidates were familiar with the concept of a 'self inverse' and had not simply guessed the answers. This is an example of where candidates needed to be more careful with their handwriting as f and j were sometimes hard to distinguish apart.

(e) Most candidates managed to successfully process the algebra required to produce a correct answer in this part. Some candidates initially took the correct steps in using a common denominator to combine the algebraic fractions and arrived at a correct answer. However, they then attempted further simplification where none was needed, sometimes incorrectly trying to cancel parts of the numerator with the denominator.

(f) (i) Most candidates answered this part correctly.

(ii) There were many correct answers here, given either as a decimal value or as a power of 3. The answer 0.369… was sometimes seen which arises from log1.5 divided by log 3. Several lost the mark by incorrectly truncating their answer to 5.19. It was not unusual to see candidates correctly write $x = \log_3 y$ but then omit to obtain the inverse function by making y the subject of the equation to arrive at $y = 3^x$. The most common mistake was to write $y = \dfrac{x}{\log 3}$.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/43
Paper 43 (Extended)

Key messages

The use of graphics calculators should be based on the list given in the syllabus.

All questions in this paper are to be answered so full syllabus coverage is essential.

The rubric on the front cover of the paper indicates that all answers should be exact or to three significant figures and candidates should be well practised to do this. This involves working to more than three significant figures without rounding during the working. Answers from graphics calculators must use the same rule about accuracy.

Working should be clearly shown at all times and marks may be lost as a result of only giving answers.

General comments

There were many excellent scripts showing full methods and accurate working. A number of candidates found parts of the paper challenging. All candidates were able to complete the paper in the allowed time.

In recent years there has been the comment about using the graphics calculator in more areas than graphs and statistics. Some candidates in this session used some functions on the graphics calculator which are not in the syllabus. In many cases this was a risk not worth taking as any incorrect answers were not supported by any methods to earn partial credit.

Comments on specific questions

Question 1

(a) Almost all candidates succeeded in finding the height of the cuboid.

(b) The calculation of the volume of the pyramid was found to be very straightforward.

Question 2

(a) The two mean marks from the lists of values were usually correctly found.

(b) Most candidates were able to give a correct equation of the line of regression. A few candidates did not give coefficients to at least three significant figures and some other candidates chose two points and worked out the equation of the line passing through them, not recognising that the graphics calculator should be used.

(c) Most candidates were able to use their answer to part **(b)** to calculate the two required estimates.

(d) Interpreting statistics is usually more challenging but this question was usually well answered, by explaining that either one value was close to all the data or that the other value was an outlier.

Question 3

(a) (i) Most candidates gave a correct probability from the information in the table.

(ii) Again, most candidates gave a correct probability from the information in the table.

(b) Most candidates recognised which part of the table to use and gave the correct probability.

(c) This part was more challenging as it required the product of three probabilities in a without replacement situation. The stronger candidates demonstrated their ability, showing both their working and the correct answer. Some candidates treated it as a with replacement situation and there were also some single fraction answers.

Question 4

(a) Candidates continue to improve with curve sketching and this particular sketch was not straightforward. Most candidates were able to set a correct domain and range and gained full marks.

There were a few candidates who did not attempt this part suggesting that the graphics calculator was not in regular use in class.

(b) Giving the range of this function proved to be more challenging as it required candidates to find the y co-ordinates of the turning points as well not confusing range with domain. There was limited success with this question.

(c) (i) This part involved adding another sketch to the one in part **(a)**. As this was an algebraic function candidates usually drew a curve that earned full marks.

(ii) This part depended on two correct sketches to find the x co-ordinates of three points of intersection. Candidates who had these sketches found this question very straightforward.

(iii) Most candidates correctly gave $x = 0$ as one asymptote but the other asymptote proved to be more difficult to recognise with many candidates giving the answers $y = 0$ or $y = 1$.

Question 5

(a) The list of prime numbers was usually correctly given. There were some careless slips by omitting one value or including 9 as a prime number.

(b) The Venn diagram was often completed correctly with most candidates demonstrating a full understanding of primes, factors, multiples, sets and intersecting sets. A number of candidates omitted the two numbers, 8 and 10, that should have been written outside the union of the three sets. Again, occasional careless slips were seen where one or two numbers were incorrectly placed.

(c) Set notation is often more challenging but this listing of the members of the complement of the union was often correctly carried out and was marked as a follow through from the candidate's Venn diagram.

(d) The notation for the number of members in a set proved to be a less familiar with many candidates listing the members of this set instead of the required number. Although this carried only one mark, it was a discriminating question.

Question 6

This was a rather different transformation question and many candidates found it challenging compared to the more straightforward questions seen in recent papers.

(a) (i) This part asked for the co-ordinates of the image of a point, rather than draw a reflection. Most candidates did give a correct answer but for many this was the only mark awarded in the whole of this question.

(ii) This also asked for the co-ordinates of the image of a point following a combination of two transformations. As the first of these transformations was the reflection in part **(a)(i)**, many candidates used the numerical co-ordinates in that part, instead of starting with the coordinates (x, y).

This part allowed stronger candidates to demonstrate their ability to apply their knowledge in a slightly different situation.

(iii) This part usually depended on a correct answer to part **(a)(ii)** to give the equivalent single transformation although candidates could have used shapes on the grid available to use. Again, this was a challenging question.

(b) This was another part asking for a single transformation equivalent to the combination of two stretches and proved to be another challenging question.

(c) More candidates succeeded in giving the inverse of a given stretch, indicating that the inverse of a transformation is more accessible than the combination of transformations seen in earlier parts. The main challenge of this part was the factor of the inverse, with –2 a common answer instead of $\frac{1}{2}$.

Question 7

(a) (i) This straightforward compound interest question was very well answered.

(ii) This part required candidates to find the number of years required for a compound interest investment to reach a given total. This was generally well answered and candidates seem to be well practised with this type of question.

(b) This was another compound interest calculation but with a monthly, instead of yearly, interest. The stronger candidates correctly applied the given interest rate over the period of 60 months. The common error was to multiply the given rate of interest by 12 and apply this over a period of 5 years.

(c) This was a very challenging part requiring candidates to find a monthly compound interest rate equivalent to a given yearly rate. Many candidates, often those who made the error described in part **(b)**, simply divided by 12. The fact that this part carried 3 marks should have suggested that the problem would be more complicated than a simple division. The candidates who succeeded here showed a good understanding of the method used in part **(b)** and realised that the reverse of a power of 12 would be to take the 12th root of 1.03. This was a very good discriminator.

Question 8

(a) The sketch of an absolute value function was a little more testing than most sketches and a number of candidates appeared to be unfamiliar with this concept as their sketch was that of $y = x^2 - 4$. Although this was a costly error a mark was awarded for the symmetry of this graph and marks were still available in parts **(b)** and **(c)**.

(b) Almost all candidates gave the correct equation of the line of symmetry.

(c) Almost all candidates gave the correct zeroes of this function. A few gave co-ordinates of the two points of intersection with the x-axis, indicating a misunderstanding of the zero of a function.

(d) (i) This part did depend on a correct sketch and so quite a number of candidates were unable to give the value of k when the line $y = k$ met the graph three times.

(ii) This part was more searching as a range of k was asked for when the line $y = k$ met the graph four times. Again, this part depended on a correct sketch of the absolute value function.

Question 9

(a) (i) This straightforward equation was almost always correctly answered.

(ii) This straightforward equation was usually correctly answered. There were a few sign errors in the collection of like terms.

(iii) This quadratic equation was more challenging and the fact that it was not in the form $ax^2 + bx + c = 0$ seemed to cause considerable confusion amongst many candidates. There were many good solutions, usually from rearranging and using the formula. There were some good graphical methods, some from rearranging and some from graphing $y = 8x^2$ and $y = 11 - 2x$.

Some candidates made attempts at trial and improvement but were unable to make any progress.

(b) (i) This inequality was generally well answered with almost all candidates scoring at least one of the two marks. The very common error was to give an answer $x \geqslant -2$ after correctly reaching $-2x \geqslant 4$. Candidates would be perhaps best advised to rearrange an inequality to make the variable term positive before dividing or multiplying.

(ii) This inequality was probably the most searching question of the whole paper. Almost all candidates gained some credit for reaching an answer including $2\frac{1}{3}$ after multiplying throughout by $x - 2$. The challenge was to realise that the inequality changed when $x < 2$. The most efficient method in this question was to graph $y = \dfrac{1}{x-2}$ and look for when $y > 3$.

(c) This simultaneous equations question was generally very well answered. The equations were given in the form best suited to the method most commonly seen in these papers. Candidates usually recognised that two simple multiplications brought about the easy elimination of one of the variables.

Some candidates rearranged one equation and substituted this into the other equation. This method was less successful as fractions were brought into the working.

The question asked for candidates to show their working so correct answers alone only carried two of the four marks.

(d) This equation involving logarithms was more discriminating. Many candidates earned at least one mark by demonstrating one rule of logarithms. The most accessible of these rules was to write $4\log 2$ as $\log 2^4$. The stronger candidates used this, rearranged and then correctly used $\log 13 - \log 16 = \log\dfrac{13}{16}$. A number of candidates tried to convert the logarithms into index equivalents, occasionally with success but this approach usually led to an incorrect equation.

Question 10

(a) Almost all candidates gave the correct column vector.

(b) The length of the line connecting two points was also usually correctly answered, either by using a formula or by using the given diagram.

(c) This show that question was more challenging as candidates were required to choose a suitable strategy without using the given value that had to be shown.

As part **(b)** used the length of a line, many candidates successfully used the same approach to obtain a quadratic equation in k. Some candidates reduced this easily to $k - 5 = \pm 6$ together with $k > 0$ and some rearranged the equation to $k^2 - 10k - 11 = 0$ and correctly solved it together with $k > 0$. Many candidates used vectors, some very carefully by stating that the vector from A to B is $\begin{pmatrix} 6 \\ 3 \end{pmatrix}$ and the vector from B to C is $\begin{pmatrix} 10-7 \\ k \quad 5 \end{pmatrix}$ and as 10 – 7 = 3, then k – 5 must equal 6 for the lengths to be the same. Unfortunately, candidates who used this approach often assumed that k = 11.

(d) The equation of a perpendicular line was quite well answered as this appears to be a well practised topic. Most candidates successfully found the perpendicular gradient and many correctly used the midpoint. Some candidates overlooked the midpoint and used the co-ordinates of *A* or *C*.

(e) The best strategy for this part was to use vectors and many candidates found this very challenging, following a question which had been using co-ordinates and equations. The stronger candidates sketched the rhombus on the given diagram, which made the appropriate vectors or components much more accessible.

Question 11

(a) Although this question involved a three-dimensional situation, most candidates found this part straightforward as a right-angled triangle was quite easily identified. Most candidates used the tangent ratio whilst some used the sine rule. Many candidates only earned the method mark as they did not show an answer with more accuracy than the value to be shown.

(b) This right-angled triangle was also found to be accessible and this part was usually correctly answered.

(c) This was another "show that" question and again, many candidates did not show an answer to greater accuracy than the one to be derived. There were several methods to decide upon, with many candidates choosing triangle *CDF* with the sine rule. The value of *CD* was widened to allow candidates who had used answers to earlier parts. The more efficient method of using the tangent ratio in triangle *DBF*, finding *BD* and then subtracting 6.2 was less popular.

(d) This cosine rule question was generally well answered and many candidates who had struggled in parts **(b)** and **(c)** succeeded here.

(e) The area of the triangle was also found to be more accessible than earlier parts. The use of $\frac{1}{2}ab\sin C$ was straightforward.

Question 12

(a) (i) This variation answer was quite well answered with most candidates showing good knowledge of the topic. The errors seen were not really to do with not understanding the topic but more to do with the reading of the question. Some candidates took the square root as the square and others changed directly to inversely. The candidates who set the equation correctly usually succeeded.

(ii) This part was to solve an equation using the answer to part **(i)** but it did depend on part **(i)** having the correct type of variation. Most candidates who had a correct answer to part **(i)** also succeeded in this part.

(b) This part asked for the next term in each of four sequences and most candidates found the question straightforward. A large number of candidates found the *n*th term of each sequence, presumably anticipating that the final question on this paper would ask for *n*th term rather than the next term. The outcome for these candidates was the loss of several marks on a straightforward topic.

(i) This part was almost always correct apart from the misreading described above.

(ii) This part was almost always correct apart from the misreading described above.

(iii) This part was more challenging as some candidates did not continue to divide by –10. This was probably due to the last of the given terms being 1 and these candidates gave the answer –10 as though the sequence would go back after reaching 1.

(iv) This was a good discriminating final part of the last question on the whole paper. Most candidates used the differences approach but the first differences were not so helpful as they are 0, 0, 6, 18, 36.

The candidates who went to the second or third differences usually saw the pattern and usually gave the correct answer.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/51
Paper 51 (Core)

Key messages

To do well on this paper a candidate needed to be familiar with work on sequences especially triangle numbers. They needed to read very carefully each situation provided in the stems of the two questions and to know exactly what was asked for in each question, i.e. the difference between an expression and a value.

General comments

Familiarity with sequences would have enabled candidates to use a logical method to list the combinations of games and to use the method of differences to find further terms in the sequence. By reading carefully and understanding what is asked for the candidate would know what is meant by value and would not give an expression or formula as an answer. They would also have noted that AB is the same as BA so they would not have allowed overlaps in their lists of games.

Comments on specific questions

Question 1

(a) (i) With the example given, most candidates were able to list the six different combinations of two teams. The organisation of this list was much more random than in part **(ii)**. The answers showed that the candidates had read and understood the information given at the beginning of this investigation.

(ii) Some candidates found it more difficult to complete this longer list of ten combinations. Those who thought and wrote it more logically (starting with all the A combinations, then the Bs etc.) usually managed to complete the list without fault. Candidates were good at not repeating any combinations. Unordered lists were often missing one combination.

(b) There were several methods that the candidates could use to find the missing numbers of games. Their answer for five teams should have come from part **(a)**. Some candidates who had 9 as this answer followed this through to 12 and 15. Many of those who had 10 saw the correct pattern and completed the 15 and 21 successfully. There were also many candidates who went back to first principals and listed the six teams and seven teams. Candidates should be encouraged to use two methods, one for checking, if such an opportunity arises.

There was a communication opportunity in this question which many candidates achieved, mainly for showing the differences in the first part of the table or for listing the outcomes.

(c) (i) Most candidates did not know the name of this sequence. A popular answer was 'Quadratic'. Candidates should be familiar with the names of sets and sequences of numbers.

(ii) There are several ways of finding further terms. Some were easier to explain. Candidates should write out an explanation in rough first, (there was room underneath the answer lines), in an effort to make sure that what they have written is easy to understand, makes sense and is clearly accurate.

(d) Candidates needed to substitute a pair of values for *g* and *n* from the table in part **(b)**. As they have calculators they did not need to choose simple values like $g = 1$ and $n = 2$ but it made sense to choose a pair that they had been given rather than one that they had calculated. Candidates need to work on finding a value where the unknown is embedded in the equation. It is much easier to manipulate numbers after substitution rather than rearranging to make *k* the subject first. Also, many candidates never did a substitution to find the value of *k* but gave their answer as a rearrangement for *k* in terms of *n* and *g*.

(e) **C**andidates needed to show the value of 28 was correct for 8 teams in two different ways. Most of those who had a formula for *k* in terms of *n* and *g* as their answer to part **(d)** were unable to do anything worthwhile. The majority of those who had a value, whether correct or not, made enough progress to work through the formula with their value. Many candidates did not find the 28 games in another way in order to verify the answer for their formula. The long method was to list the games and the better, quicker method was to extend the table in part **(b)** as far as 8 teams.

(f) Some candidates chose to continue their table. This was especially sensible for those who had not found a value for *k*. Most chose to substitute, which was not sensible for all those who had an expression in terms of *g* and *n* for *k* and no value. Many candidates achieved the communication mark for the continuation of the table to at least 15 and 105, whilst others did a correct substitution of $n = 20$.

Question 2

(a) Most candidates understood what to do and EF for week 1, Game 3 was usually given. Weeks 2 and 3 could be made up of a variety of different correct combinations and if there were overlaps they were often spotted by the candidates themselves and corrected.

(b) The correct answer was easy to establish for all candidates who had understood how these matches were arranged.

(c) **(i) (ii)** These two questions were very well answered. Misreading or misunderstanding led to a few incorrect answers. Checking that an answer makes sense should be encouraged for even what appears to be the simplest question.

(iii) The answers for this part were also mostly correct. There was a communication opportunity here as well which many candidates gained for showing how they worked this out.

(iv) Some candidates thought that this team referred to the team in part **(iii)** and not to the team in the stem that played all 7 games. Apart from these, the remaining candidates were able to show a way of getting 21 points and a way of getting 19 points with no possible ways in between. Their working was set out well and they remembered to answer the question with a ‘No’ as well as explaining their working out.

(v) The majority of candidates managed to follow through and to answer this last question well. The main mistake, if any was made, was to forget that the team played 7 games. There were only two further ways apart from the one given and they were calculated and explained well.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/52
Paper 52 (Core)

Key messages

In order to succeed in this investigation, candidates needed to be able to use their calculators efficiently to complete sequences of square roots within square roots. The candidates needed to be able to name the limit (as an integer) initially by experiment and then to investigate formulae associated with the sequences working towards finding them using algebra.

General comments

The basic aim of the investigation was to explore the idea that 'Square roots within Square roots' when continued as a sequence, tend towards a particular limit whose value is dependent on the figures used. Candidates made attempts at most questions, with many of them realising that even if they could not always complete the first parts, the latter part of the paper had independently attainable marks. However, some seemed to simply not answer the latter part. Candidates should be encouraged to keep going, even if they seem are finding it difficult as they may find more accessible parts later in the paper.

It was very important for candidates to use algebra effectively, especially expanding brackets correctly (a common example was 42 = 7(7 – a) becoming 42 = 49 – a), this could result in poor communication marks as well as not gaining the correct answer.

Quite a few candidates did not understand what an integer was, and some did not round effectively or did not give answers to the correct degree of accuracy.

Comments on specific questions

Question 1

(a) Those candidates that followed the instruction exactly gained all the marks. Those who did not follow the instructions carefully could still gain some follow through marks.

(b) Most candidates had the correct answer of 3 but there were variations such as 3000 or 3.000.

Question 2

(a) Many had the correct answers, but candidates need to be aware that where a line is provided, the answer should be placed there. There were also candidates who ignored the instruction to give their answers to four decimal places.

(b) As with **Question 1(b),** this was usually answered well if part **(a)** was correct.

Question 3

(a) This part was usually well answered but a significant number put 1 instead of 2 in the top row of the table and many did not avail themselves of the opportunity not only to discover the sequence 2, 6, 12, 20, 30, 42, (56)…, but also to show those workings

(b)(i) Many candidates did not notice that the term needed to be a root, not the value of the root.

(ii) In this part the decimal was required so many redeemed themselves here, although not all candidates gave the required number of figures.

Question 4

(a) Here substitution in algebra was a great help, those who used it began to realise its value and at this point it was clear that candidates with better algebra were likely to be more successful.

(b) Those who realised that using the formula 90 = 10(10 – 1) gave 90 = 90 scored the mark. Others, who did not, tried to show that $\sqrt{90}$ was nearly equal to 10 rather than approaching from the other direction using 90 = 10(10 – *a*) leading to *a* = 1 or 90 = *N*(*N* – 1) leading to *N* = 10.

(c) Here the instruction to give the root was in bold, but marks were awarded if both forms were given. A mark was awarded to those candidates who could only get as far as *k* = 650.

Question 5

(a) Again, those who could substitute correctly were awarded the mark.

(b) (i) As in part **(a)**, those who could substitute did well.

(ii) Many candidates gained the mark here if they had completed parts **(a)** and **(b)(i)** correctly. There was a follow through mark for those who used their incorrect value of *k* from part **(i)** correctly.

(iii) Those who achieved the mark in part **(ii)** mostly gained this mark as well.

Question 6

Those candidates that could substitute and expand successfully, were able to earn the mark, but a significant number went from 14 = 7(7 – *a*) to 14 = 49 – *a*, and thus were unable to find the correct answer of 5.

Question 7

(a) (i) Those candidates who had answers previously, found this easy and thus were able to answer part **(ii)** successfully as well. Quite a few candidates left both parts blank.

(ii) As noted above, success in part **(i)** often meant success in part **(ii)**. Many candidates wrote the equation *k* = *N*(*N* – *x*), even though they were asked for an expression, but this was allowed on this occasion. It is important for candidates to realise the difference between an expression and an equation. A significant number wrote *k* = *N*(*N* – *a*) which did not gain a mark as their answer still contained *a*.

(b) Those candidates who could solve a quadratic equation saved themselves time, whilst others worked out some values in the sequence and deduced the answer. Again, this question was achievable without previous answers being found.

Communication

There were nine opportunities for gaining communication marks, and if candidates showed three of them, they gained one mark, whilst those who showed five or more gained both marks. It cannot be stressed enough that candidates should explain their thinking by writing their method in the appropriate spaces. The majority of candidates scored at least 1 mark, although a significant number of candidates left blanks in the spaces for working and thus scored 0 having scored quite well in their answers.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/53
Paper 53 (Core)

Key messages

To do well on this paper candidates needed to be prepared to look for patterns both in sequences and in tables. They needed to look back at previous questions and to compare results across several questions. The knowledge that sequences are not always built on common differences was also key. It was important to check ideas for several terms or values and not to rush onto the next question without having established and confirmed answers were correct.

General comments

The answers to all the questions about finding the rule to find further terms in a sequence were based on adding previous terms. They followed a pattern and by looking back at previous questions candidates should have seen this pattern forming and been able to continue it. If candidates checked their rule for the next few terms they would see that often their rule did not work past the next term. This would give them the opportunity to rethink their answer and possibly enable them to make much more progress through the paper.

Comments on Specific Questions

Question 1

(a) This part was answered correctly almost without exception. Candidates read and understood the introduction and were able to work out the remaining ways. As with all the following questions that involve drawing, candidates should use a pencil so that errors can be erased.

(b) Again, most candidates found the four remaining ways that this frog could jump between five stones. Many followed a methodical order which meant they did not make mistakes and covered all the possibilities.

(c) (i) There were several different ways of finding further terms in this sequence. Most of them were quite difficult to explain except for what should have been the most obvious one, adding the two previous terms. Candidates need to learn and appreciate that there are other ways of creating sequences and that these are not necessarily found by finding first and possibly second differences.

(ii) Many candidates were able to find an answer by continuing the table given in the stem of part **(c)**. Those who used differences, however, were unlikely to find the correct answer. Very few actually used their rule from part **(i)** as they had been directed to.

Question 2

(a) Candidates had no difficulty in drawing the single jump which was the answer to this question. The progression to a jump length of 3 units was well understood.

(b) In order to answer this question correctly the candidates needed to check back to **Question 1(b)** to make sure which different jumps were recorded there. The reason for mistakes here was probably due to not looking back, despite the advice in the question.

(c) **(i)** Following the pattern of **Question 1**, candidates were again looking for a pattern in the sequence as given in the table. Even some candidates who managed to answer **Question 1(c)(i)** correctly were unable to see the follow through pattern to help them answer this part. Those who had not seen the pattern in **Question 1** were unlikely to see it in this question.

(ii) Just as in **Question 1**, this was simple to answer if the straightforward rule had been realised in part **(i)**. Candidates who had not found the simple pattern had great difficulty in finding this answer. There was a communication opportunity in this question which enabled those candidates who had followed the pattern of the sequence to get an extra mark by showing the addition of 7, 13 and 24.

Question 3

(a) To complete this table, candidates had to be aware of the pattern that followed through in each of the unit columns. Most candidates had not seen the connections in the sequences of units and so were not able to complete the columns correctly. Candidates should be advised that where a table brings together information from previous questions it is for a reason such as there is a common thread and this will help them to find answers.

(b) and (c) The pattern in the maximum jump length of 2 and 3 units needed to be followed in terms of the jump lengths of 4 and 5 units. Most candidates did not see the earlier patterns, not even when the table was constructed in part **(a)** so there were few correct answers to parts **(b)** and **(c)**.

Question 4

(a) Most candidates followed the new arrangement of this table and managed to complete the empty cells with the correct powers of 2. Following the pattern as it was presented was necessary to find the correct powers.

(b) Just following patterns was not enough to be able to answer this question correctly. Candidates had to use the information in the table to find a connection between the number of stones, the maximum jump length and the power of 2. This required good powers of concentration and focus.

(c) Candidates again needed to compare some examples in the table to find the difference with 30 stones between a maximum jump length of 29 units and a maximum jump length of 28 units. Very few candidates found the connection.

(d) If the candidates could see the connection between 3 stones and the largest number of ways of jumping being 2^1, then the answers to all three parts were straightforward. Not many candidates were able to see this connection.

(e) **(i)** Some candidates realised that they needed to look in the table for 2^3 which, on the 5 stone row, is in the column for the maximum jump length of 4. The correct answer also relied on the correct answers to part **(d)(i)** and the table in part **(a)**.

(ii) This final question asked for the answer as an algebraic expression. Candidates should know the difference between a value and an expression. They also needed to be able to see a further pattern and to have part **(d)(iii)** correct.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/61
Paper 61 (Extended)

Key messages

In order to do well in this examination, candidates need to give clear and logical answers to questions, showing sufficient method so that marks, particularly communication marks, can be awarded. Candidates are expected to have access to and to be able to use a graphics calculator efficiently to draw and interpret graphs, for example. This includes setting the scale on each axis so that the overall shape of a graph over the domain given is clear. Explanations, when required, need to be clear and not contradictory. When candidates are asked to 'show that' a result is valid, they should produce a clear and accurate mathematical justification.

General comments

Many candidates were well prepared for this examination and gave good, clearly presented and well explained answers. The level of communication was reasonable in the investigation and good in the modelling. Few candidates earned all the communication marks available. A good number of candidates scored reasonably well and found both parts accessible. Some candidates performed well in the first three questions of the investigation and the first two questions of the modelling. The later questions in each part proved challenging, particularly in the modelling, with many candidates making no attempt to answer any part of **Question 8**. Many candidates presented their work neatly, clearly and with correct mathematical form. In order to improve, other candidates need to understand that their working must be clear and detailed enough to show their understanding. Diagrams used to communicate method need to be clear and labelled, not just a series of marks on the page.

Comments on specific questions

Part A: Investigation – Games in a competition

Question 1

This question introduced the idea of a *knock-out* competition. Candidates needed to understand the terms 'round' and 'team', which most did without difficulty.

(a) This was designed to be a simple introduction into the structure of a *knock-out* competition. Candidates were asked to find particular numbers of rounds or teams in each part. Most candidates earned all the marks available in this part of the question. There were opportunities to communicate method in part **(ii)** by listing the number of teams in each round or by indicating that the 32 was 2^5, for example. Many candidates did this. Similarly, in part **(iii)** many candidates listed the extra numbers of teams as 32, 64, 128 or stated 2^7 which counted towards the communication mark in this part.

(b) Candidates were given a table to complete in order to assist them in observing the relationship between the number of rounds and the number of teams. Many candidates answered this very well and few errors were seen.

(c) (i) This was the first algebraic part of the investigation. A good number of candidates stated the complete formula with the subject being *t*, which counted towards communication. Many candidates stated $t = 2^r$. Some candidates have clearly studied geometric progressions more formally and these tended to offer $t = 2 \times 2^{r-1}$ which was acceptable. It was necessary for the formula to be in *r* and not *n*. Some candidates needed to take more care with this as $t = 2^n$ was not accepted. Some candidates gained credit for communication by checking that their formula satisfied at least two (*r*, *t*) pairs or for stating the sequence was geometric and identifying its first term and common ratio. Many candidates tried finding differences which was inappropriate for a geometric sequence. Some candidates used their calculator to attempt a cubic regression, which also was not appropriate here and is not a built-in application which candidates should be using; this is clearly stated in the syllabus.

(ii) Many candidates found the correct number of teams using their formula as required. Some candidates were able to find the correct number by continuing the sequence. This was also accepted. A few candidates attempted to use their formula. Most often this resulted in a value less than 256 and was not accepted as it was not a reasonable value given the data in the table in part **(b)**.

Question 2

This question built upon the ideas in **Question 1**. Candidates were still working with a *knock-out* competition but the initial number of teams was not a power of 2. An example was given at the start of the question. Some candidates did not seem to realise that the method used in the example needed to be applied each time the initial number of teams was not a power of 2.

(a) In this part of the question candidates needed to understand how to reduce the number of teams from 25 to the nearest power of 2 below 25, i.e. 16.

In part **(i)**, many candidates were able to determine that 5 rounds would be needed. Candidates sometimes indicated in their method that they were not playing 9 matches in the first round, as expected. Usually one team was brought in to a later round. This was condoned. For communication, however, it was necessary for the correct thinking to be seen.

In part **(ii)** many candidates gave the correct answer 24. A few candidates gave the answer 23, omitting the final game. Weaker candidates gave random answers which seemed to arise from their answer to part **(c)**.

A good number of candidates communicated their method successfully in either part **(i)** or part **(ii)**. In part **(i)** they could do so by stating 4 previous rounds plus one or by listing a valid sequence of teams or teams who played in each round, starting with 25 or 18. Some candidates attempted to draw diagrams. Whilst this could have been a successful strategy, diagrams were often poorly presented and difficult to follow. Tree diagrams were the most successful. In part **(ii)** they were able to gain credit for communication if they listed the number of games in each of the 5 rounds. Again, a diagram would have been acceptable if it produced a sequence of games played that was equivalent to one of those stated in the mark scheme.

(b) This part was fairly well answered. Many candidates understood that the number of games was one less than the number of teams. Several candidates simply wrote the answer down without any communication of method. Some candidates did not reduce the number of teams to 32 at the end of the first round. Usually, these candidates played 18 and 9 games in rounds 1 and 2 and then played a single game in round 3. This was condoned and allowed to count towards communication if it was clearly stated. A good number of candidates did communicate their method clearly, listing the number of teams or games played in each round, which gained credit. Again, a clear diagram which gave a list equivalent to that in the mark scheme was also credited for communication. Candidates attempting diagrams were often less successful as the diagrams were unclear or incorrect. This was particularly the case if the number of teams was not reduced in the first round.

(c) Many candidates were able to correctly state the connection between the number of teams and number of games, usually in words rather than using an algebraic form. Candidates who had not determined that the number of games was one less than the number of teams made various suggestions, such as the number of games was the square root of the number of teams or the number of games was half the number of teams. Other candidates made more general statements such as 'as one increases the other increases' or stated 'positive' or 'negative', possibly thinking of correlation. These comments were not specific and therefore not credited. Some candidates made no attempt to answer this part.

Question 3

In this question, candidates were introduced to the idea of a *league* competition for the first time.

(a) Many candidates observed that the number of games was the sequence of triangle numbers. It was rare to see a set of completely incorrect values, although arithmetic slips were sometimes made. A good number of candidates listed pairs of teams for an appropriate number of games or gave at least three correct first differences or an appropriate connected diagram with labelled vertices. These counted towards communication in this part.

(b) Those who recognised the sequence as being triangle numbers often simply stated the correct formula without any working to derive it. This gained full marks. The formula had to be in terms of n for both marks to be awarded and it also had to have the correct subject. Evidence of a correct method used to find a and b counted towards communication in this part. A few candidates formed and solved equations. Those who substituted the given (n, g) pairs from the table were the most successful here. Those who were using algebraic forms from the difference table for a quadratic expression often omitted to take note that the first value of n in the table in part **(b)** was 2 not 1 and the incorrect equation $3a + b = 2$ was commonly quoted. A few candidates used differences to find the value of a and then used an equation or further differences to find the value of b.

(c) Many candidates understood the need to substitute 8 into their formula from part **(b)**, as indicated. Some candidates, initially having $\frac{1}{2}n^2 + \frac{1}{2}n$ in part **(b)**, realised their error and corrected their formula but not their working. A few candidates did unnecessary work verifying the result worked for all the (n, g) pairs from the table. This was not penalised but wasted time.

Question 4

There were many possible ways to complete the table once the first row had been completed. A good number of candidates earned both marks and had clearly understood what was needed. Candidates who wrote out ABCDEFGH underneath the table and ticked off each letter as they used it were less likely to repeat letters in a row, which was not allowed. Candidates also needed to take care that they were not repeating a pairing. Some candidates lost one or both marks for infringing these rules. Weaker candidates tended to repeat a letter several times in weeks 2 and 3, thereby indicating that they had not understood the structure of the competition and had not noted the information 'Every team plays one game each week.' which was clearly stated in the question.

Question 5

(a) The information needed to answer this part of the question could be found by looking back at the table in **Question 3(a)** and using the formula derived in **Question 2(c)**. Many candidates did this and offered a correct set of three values. A common incorrect answer was 1, 2, 2. This was not accepted as it had clearly been stated at the start of the question that there were more than 2 teams in each competition. Weaker candidates often made no attempt to answer.

(b) This was only correctly answered by very good candidates. Some formed and solved a quadratic equation whilst others constructed a table of values including the number of teams and games from both types of competition. This contributed to the communication for this part. Some candidates became confused here at the structure of the question differing slightly from part **(a)**. Many candidates made no attempt to answer.

Part B: Modelling – Throwing stones

Question 6

(a) This was very well answered by the majority of candidates. A few candidates omitted h = ... which was not condoned. A few had H = ... which also was not condoned here as H had already been defined in the question and was not appropriate. Some candidates spoilt their answer by combining terms, for example $h = 117.6t^2$ was seen several times.

(b) A good number of correct answers were seen to this part. Often candidates demonstrated that they were able to use their graphic display calculator to view the relevant section of the model and drew it sufficiently accurately for the mark to be awarded. Some candidates clearly needed to adjust their viewing window as the graph they drew did not reach the y-axis on their sketch indicating the setting for the h values needed to be adjusted. A few candidates drew discontinuous, dashed graphs, copying the diagram given at the start indicating the path of the stone. This was not condoned as the graph should have been continuous. A few graphs were penalised for incorrect curvature. Candidates who had produced a reasonable graph also communicated well here, very commonly stating or implying by scale the correct position of the h-intercept.

(c) In this part, candidates needed to interpret their sketch in part **(b)** and show that they understood that the stone was on the ground when h was 0, i.e. when t was 5. Many candidates were able to do this successfully. Occasional answers of 4.9 or 5.1 were seen. Weaker candidates tended to try to use a relationship between time, distance and speed rather than simply interpreting the sketch.

(d) In part **(i)**, candidates were required to interpret the information given to deduce the unit of speed for a distance measured in metres and a time in seconds. This was very well answered with a high proportion of candidates earning the mark.

In part **(ii)**, candidates needed to use their answer to part **(c)** along with the information given in this part of the question to find the horizontal distance. Many candidates were able to do this and found the correct answer or a correct value which followed their answer to part **(c)**. A few candidates stated an algebraic answer, not making the link to part **(c)**.

(e) (i) Many candidates found this part of the question to be very challenging and answers earning both marks were not commonly seen. The most successful solutions started with the model from part **(a)**, rearranged the model from part **(d)** and substituted. These candidates arrived at the correct result efficiently and neatly in most cases. Some candidates found either $t = \frac{x}{20}$ or $x^2 = (20t)^2$ but made no real progress beyond that. Sometimes this was because they were unable to make the connections between the models. Other times it was because they lacked the necessary algebraic skills. Some candidates tried to verify the result using numerical values. This was not credited.

(ii) Candidates who had drawn an acceptable sketch in part **(b)** usually were able to do so in this part. Some candidates drew straight lines here and in **Question 7(b)**, indicating that they should have adjusted their viewing window to have seen the correct shape of the graph. Again, those who communicated the correct position of the h-intercept by stating it or implying it by scale in part **(b)** often did so again here. Either indication counted towards communication.

Question 7

(a) A good proportion of candidates interpreted the new model correctly and simply wrote down that Belinda threw her stone from 61.25 m. Many also remembered to quote the correct unit which gave them credit towards the communication mark. A good number of candidates gave various other numerical answers, such as 61.25 – 4.9 = 56.35, suggesting that they had not understood that, as x was the horizontal distance from the cliff, it was initially 0.

(b) Again, some excellent sketches were seen. Occasionally the x-intercept was not 100 or the sketch was not sufficiently close to the vertical axis. Some candidates drew straight lines here, indicating that they should have adjusted their viewing window to have seen the correct shape of the graph. A few candidates made no attempt to answer this part.

(c) Candidates needed to interpret how to use the information given in this part and the graph they had sketched in part **(b)** with the model for the horizontal distance in **Question 6(d)**. A good number of candidates were able to do this and find the correct value. Weaker candidates tended to try to find (*their* 61.25) ÷ 28.3, misunderstanding what was needed.

Question 8

This question required interpretation skills that many candidates lacked. Few candidates made any real progress with any part and only the very best gained any marks in part **(c)** and part **(d)**.

(a) Candidates often were able to deduce that x had to be 50, but they were frequently unable to determine that h had to be 0. Many candidates substituted $h = 50$. Other candidates correctly used $x = 50$ but then calculated and used a spurious value for h. This was found by a variety of incorrect methods. Answers, when they were seen, were often still in terms of x and/or h. Few candidates were able to earn credit for communication in this part as it was rare to see further correct work after the initial substitution and it was also uncommon to see a correct step in the rearrangement of the given model.

(b) In this part, candidates needed to understand that the models for Jayden's stone and Belinda's stone needed to be equated. If they had a numerical value of k this could be followed provided it was of reasonable size. Some candidates drew sketches to show they had understood what was required and this was credited. Other candidates equated the models they had and this was also credited. Few candidates were able to earn credit for communication here which could have been achieved by labelling the crossing point of their sketch and indicating that the solution came from the x co-ordinate or by sight of a correct step in the working after the models had been equated.

(c) Only the very best candidates earned marks in this part. Those that did make an attempt often misinterpreted the value of h that came from $h = 61.25 - \frac{4.9(50)^2}{800}$ as being the height at which she should be standing rather than the height she needed to move down the cliff. These candidates commonly stated the answer as 15.3. Fully correct answers, although rare, were seen and these came from interpreting $h = 45.9$ correctly or by finding $H = 15.3$ from $0 = H - \frac{4.9(50)^2}{800}$ and interpreting that correctly.

(d) Correct answers to this part were very rare. Those that did find a correct value usually found it by dividing 50 by 3.53 rather than using $0 = 61.25 - 4.9t^2$ to find $t = \frac{5\sqrt{2}}{2}$ and using that with $x = 50$ in $v = \frac{x}{t}$.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/62
Paper 62 (Extended)

Key messages

The difference between the words *formula* and *expression* was not always understood: an expression does not have an equals sign; a formula requires an equals sign with the subject on the left.

Scales are necessary to gain full marks in graphing questions, and candidates should learn how to choose a suitable window on their graphics display calculator.

An instruction to use a previous part should always be followed. Either it is a requirement for gaining the marks or it is a helpful hint in solving the question.

Show that … or *Check that …* requires full details, even if some appear obvious.

General comments

To do well in this paper, candidates needed to distinguish between a square root answer and its decimal approximation: the first is exact while the second is not.

Candidates exhibited accurate work in evaluating nested square roots and the concept of a limit, as introduced in this paper, was understood well.

Many candidates displayed very strong algebraic skills.

It is now much less common to see answers without working on this paper and most candidates understand the need to communicate effectively.

Most candidates showed good use of their graphics display calculator for sketching graphs, a skill for which improvement has been seen.

Comments on specific questions

Part A: Investigation – Square roots within square roots

Question 1

(a) Nearly all candidates gave an accurate answer. A few thought that every decimal should end with some dots and this was condoned. Nearly every candidate gained credit for showing how the answer was found, either by writing out the term in nested square root form or showing how the subsequent term was found using the previous decimal approximation. Most candidates chose to round to 4 decimal places rather than truncating with both answers being accepted.

(b) Almost every candidate could deduce the limit of the sequence as an integer.

Question 2

(a) This question, which required forming a sequence of nested square roots and evaluating them, was very well done. Many candidates preferred rounding to four decimal places rather than just writing the decimal as far as the fourth decimal place. This was allowed as were extra dots beyond the fourth decimal place.

(b) Candidates generally had no difficulty in deducing the integer limit of this sequence.

Question 3

(a) Nearly all candidates spotted that the integer limits increased by 1 each time and so correctly completed the table. A few gave the first term as 1.

(b) (i) Finding the first term of the sequence that gave an integer limit of 8 required extending the table by one row. Most noticed that the numbers in the table under the square root signs increased by 4, 6, 8, etc. and were rewarded with communication. Others spotted that those numbers were 1×2, 2×3, 3×4, etc. or even $1^2 + 1$, $2^2 + 2$, $3^2 + 3$, etc. All this showed good communication and understanding in getting the answer and most candidates were successful in this question. An exact square root was required for the answer, so decimal answers were not allowed. A few candidates omitted the square root sign or gave a decimal answer.

(ii) Candidates showed good work in calculating the nested square roots, with a large number able to enter the calculation in one go into their calculators. In doing so, candidates were able to confirm their answer to part **(i)**. Some did not round up to the fourth decimal place as required. A few calculated $\sqrt{20}$ because it was the 4th row of the table. Good communication was seen from nearly all candidates, who either wrote out the exact nested square roots for the 4th term or showed how the sequence continued by using decimals.

Question 4

(a) Removing the square roots in the equation was competently done by the large majority of candidates. There were some who spoiled their work by omitting k =, thus writing an expression and not a formula on the answer line.

(b) There was a clear instruction to use part **(a)** here. Any candidate who instead evaluated square roots, could not be given credit. In this paper clear and full communication is vital. Some candidates could see that the result was true for the given sequence but then only re-stated, with numbers, the result in part **(i)**. Successful candidates showed in detail why the equation was satisfied, the most efficient method being to substitute $x = 7$ into the expression in part **(a)** and then show, with an intermediate step, that the result was 42. Some chose to substitute the 42 and solve the resulting quadratic equation. In doing so it was essential to show a method, usually factorisation, for solving the equation.

Question 5

Several candidates evaluated nested square roots to get the answer. But the exact answer can only be found by using the quadratic formula, which was given. Most candidates were able to form the necessary equation and so were rewarded with credit for communication. Many showed good skill in using the formula to get an answer. The large majority, when solving such an equation, wanted to give a decimal answer. But here the exact answer (square root form) was required and so decimal answers did not receive full marks.

Question 6

(a) Although the square roots held a pattern of alternating integers, nearly all candidates deduced the limit of the sequence correctly. There were only a few incorrect answers, usually resulting from candidates being unable to use the calculator in such a complex expression.

(b) As in **Question 4(a)**, the removal of the outer square root by squaring was successfully done by the large majority of candidates, giving the essential intermediate step in deriving the required equation.

(c) (i) To show that the equation in part **(b)** was correct, most candidates substituted the relevant values for *x*, *a* and *b* and demonstrated that each side gave the value 4. The best candidates did this as separate statements. Many assumed the equation was true and worked with that, leading to the statement 4 equals 4. This approach was condoned but not considered good practice in a paper that stresses good communication.

There were some candidates who substituted two of the variables and solved an equation to find the third variable, which then fitted the information given. This approach was often successful. With this method, substituting *a* and *b* results in a quartic, which most solved without explanation. This was insufficient for a 'Show that…' question. A suitable explanation would have been to draw the graph and note an intercept, or substitute 3 and evaluate each term. Candidates should remember that use of the calculator's equation solver is not expected and does not receive credit.

(ii) The last question for the investigation was an open-ended task based on the equation given in part **(b)**. Even candidates who had not scored highly so far were able to show investigative skills in finding the pairs of *a* and *b* that satisfied the equation. There were several good ideas for communication seen, with a large number of candidates demonstrating a clear systematic approach. Some substituted one variable and found the other, showing working for their solution of the resulting equation. Others realised that the key was to make $b + 3$ a square number and wrote a statement to that effect. A sophisticated approach was seen when candidates rearranged the equation to get a formula for *b* in terms of *a*, with *a* then taking the values 1, 2, 3, etc. A number of candidates gave solutions without working, whilst others did not know how to approach this question and lacked a clear plan or made no attempt to respond.

Part B: Modelling – Making cones

Question 7

(a) The start of the modelling task was to find an arc length. With the formula for the circumference of a circle given, nearly all candidates were able to do this. A few candidates either simplified the expression without working or used radian measure without explanation. *Show that...* questions require full working to be shown.

(b) Nearly all candidates found *r* in terms of *x* correctly. Candidates are advised not to leave π in an answer if it cancels out. Communication was awarded to nearly all the candidates for setting up the necessary equation in *r* and *x*.

(c) The successful candidates ensured that they gave all the details in this *Show that …* question.

Many candidates did not say why $\frac{x}{20}$ was necessary for this result and assumed that the first steps of the Pythagoras' theorem were self-evident. Since the starting point for the given result is the theorem of Pythagoras, it should have been clearly stated as an example of good communication.

A few candidates showed good work in drawing a small diagram to illustrate the use of Pythagoras' theorem. Some candidates were too quick in arriving at the given result and skipped over necessary steps.

(d) (i) The large majority of candidates knew that the coefficient of 0.0026 came from working out $\frac{1}{3}\pi\times\frac{1}{400}$ as a decimal. Since 0.0026 is not exact it is necessary to show it rounds to this value by giving further decimal places (0.002618…). Most candidates omitted this check.

(ii) Candidates who recognised that $x = 180$ was required for a semicircle were usually successful substituting into the given formula to get the correct answer. The most common error was to take the 18, given as the radius in the question, and substitute that instead. A few candidates used 360 for the angle.

(e) There were many very good sketches of the given function and the majority of candidates positioned the maximum in approximately the correct place. Some candidates used a window on the calculator that did not allow the full graph to be shown. It is important that, where a graph meets the *x*-axis, this is shown clearly and there were some graphs that either did not reach or missed 360 by a significant amount. A few candidates curled the graph back to meet 360 so that it was no longer a function. At the origin the angle the graph makes with the *x*-axis is quite small and angles over 20° were not justifiable from the graphics calculator.

Credit for communication was given to those candidates who gave an appropriate scale on the *V*-axis. In this several possibilities were shown which corresponded correctly with the maximum but there were a large number of candidates who did not show any scale. Other candidates labelled the maximum with its co-ordinates, thus implying the scale used. Calculator terms do not always show good communication. For instance, 2.33×10^3 as a label should not be written 2.33E + 3.

(f) **(i)** The large majority of candidates could find the angle that gave the maximum volume.

(ii) Candidates, who had found the maximum angle correctly in part **(i)**, could also read off the corresponding volume from the calculator. As in part **(i)** most candidates were successful in this.

(iii) To find the curved surface area of the cone candidates had a choice of calculating the appropriate fraction of the area of the original circle or using the formula provided at the start of the modelling task.

Several candidates were unsure how to proceed as this did not immediately follow from their graph. The most successful candidates used their angle from part **(i)** and $r = \frac{x}{20}$ in the formula for the curved surface area of a cone. A few candidates found *r* by using their answer to the volume in part **(ii)** and the formula for the volume of a cone. This method often lost accuracy through several steps in which there was rounding.

Question 8

(a) Nearly all candidates could write *y* in terms of *x*. The most common error was omitting *y* = in the formula.

(b) The great majority understood how to substitute for *y* in the formula. The words *Write down* indicated that no simplification was expected and candidates who tried to simplify had little success. For a fully correct answer the denominator of 400 had to be clearly within the square root and only under the squared expression. Omitting the power 2 in $\sqrt{324 - \frac{(360 - x)^2}{400}}$ was seen a few times.

(c) This question required careful entering of the equation into the graphics calculator. Most candidates were able to do so and showed a symmetrical graph with two maxima at approximately the correct height. Others had probably mis-typed something or muddled the necessary brackets. Of those that drew an appropriate graph nearly all had a suitable window for the horizontal scale. There were several that used a window going vertically from 0 to 2700, making the shape of the graph difficult to see. Some of those with the correct vertical scale showed it passing through 0 and 360 on the horizontal axis whereas in fact those intercepts were approximately 60 and 300.

If using a vertical window given by the scale on the *V*-axis, then it is evident, from the graphics display calculator, that the graph reaches no more than three-quarters of the height of that window. Many had maxima that reached the full height of that window. Candidates are advised to sketch their graphs with reasonable care regarding the position of intercepts and turning points so that there are no inconsistencies. Credit for communication was given to those who gave a sensible horizontal scale or at least indicated their scale by labelling the *x* co-ordinates of the maxima.

(d) Many candidates, including those who were unsuccessful in sketching the graph, managed to identify the two angles for maximum volume.

Question 9

(a) Because of similarity, doubling the radius of the original circle will multiply the volume by a factor of 8. The best candidates were able to see this connection and were rewarded with credit for communication for saying so. A more popular approach was to work through the task again with 36 replacing 18 where necessary and arriving at an appropriate formula for the volume. A correct final formula for volume also showed good communication. A range of answers was accepted that reflected the different rounding approximations that could be made. A significant number of candidates made no attempt at this question.

(b) Those who realised that the maximum volume did not depend on the radius of the original circle could write down the same angle as in **Question 7(f)(i)**. More common was graphing the new function for the volume and finding the angle from its maximum.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/63
Paper 63 (Extended)

Key messages

When candidates sketch graphs with the aid of the graphic display calculator they should show the important features (for example, scale used and intercepts) to a reasonable level of accuracy.

Candidates should always follow any instruction to use a previous part. Such instructions are intended to aid the candidate or a specific technique. In many cases, ignoring such an instruction will result in no credit being awarded.

General comments

The investigation was answered a little better than the modelling. Centres need to ensure that a variety of types of sequences are covered as many candidates were determined to find a common difference where there was not one. Candidates need to be made aware that the investigation builds and therefore they need to remember and often use what they have discovered earlier on in it in the latter parts of the investigation.

An important skill in modelling is being able to relate the mathematics to the context and keep this in mind throughout the modelling task. In this paper, the fact that there is no material on the base and that customers want to buy tents with a height of at least 1 metre are required to be used again, not just when they are initially written. More practice of 'show that' type questions would be beneficial to candidates, especially where algebraic manipulation and substitution are required. Also interpretation of graphs, what does the maximum or intersection mean within the context. Candidates should also remember to think about units, as correct units are often rewarded under communication. Annotation of sketches can also gain credit for communication.

Comments on specific questions

Part A: Investigation – Jumping Frogs

Question 1

(a) This question required the candidates to show how a frog could jump either one stone or two. Nearly all candidates could do this correctly.

(b) This question developed the idea further and nearly all candidates could do this correctly.

(c) (i) This question required the candidates to realise how to get the next two numbers in the sequence and most found them. Many gained credit for communication for showing differences in the table.

(ii) Most who had found the correct next two numbers in part **(i)** could explain the rule sufficiently well to gain the mark. A concise rule would be 'sum the previous two terms'.

Question 2

(a) This question developed the idea to a frog who could jump a greater maximum length. Nearly all candidates could find the one new way.

(b) Finding two new ways for five stones was also completed correctly by nearly all candidates.

(c) (i) This part required candidates to fill in the table and some could do this. There was an opportunity to gain credit for communication if a method was shown. For example, 7 + 13 + 24 = .

(ii) Candidates who could find the missing values in part **(i)** could explain the rule sufficiently well to gain the mark. A concise answer would be 'sum the previous three terms'.

Question 3

(a) An understanding of how the values in the tables in **Question 1(c)(i)** and **Question 2(c)(i)** were found was essential for success with finding them in this part. There was an opportunity to gain credit for communication if a method was shown. For example, 8 + 15 + 29 + 56 = .

(b) Those able to complete the table correctly in part **(a)** could explain the rule sufficiently well to gain the mark and many candidates could express it more concisely by this point having understood the patterns more fully.

(c) (i) Some candidates were able to recognise the involvement of powers of two in the expression, but fewer got the correct power of two. Candidates need to be aware that if an expression in x is requested then an expression in n should not be given instead.

(ii) To gain this mark, candidates were required to evaluate their expression from part **(i)** to get 256 **and** show that the sum of the previous 8 terms was 255. Very few showed the latter. However, those who evaluated their expression from part **(i)** using $x = 10$ could gain credit for communication.

(d) To be successful with this question, a good understanding of the whole of the investigation was required. Many good candidates did not realise the connection between this question and their previous answers, so lost the marks.

(e) Only a few of the candidates were able to recognise that there was a need to subtract one from their power of two as the frog cannot jump the distance all the way as it is one stone longer than the frog's maximum jump length.

Part B: Modelling – Play Tents

Question 4

(a) Nearly all candidates were able to find the volume of a cuboid.

(b) To gain the mark, candidates needed to explain with words or diagrams that the different parts of the equation came from the top and the sides. It also needed to be clear that they realised that there was no material used to make the bottom of the tent.

(c) Successful candidates used part **(a)** and part **(b)** as instructed and understood that $A = 8$. From there, most could manipulate the algebra correctly to show what was asked. Credit for communication could be gained if they wrote down $8 = x^2 + 4hx$, which most did.

(d) (i) Although most candidates could produce the correct curve on their GDC, many lost the mark by not making sure that their curve went through the origin or crossed the x-axis between 0 and 3. Credit for communication was awarded for an indication of the scale on the y-axis or labelling of the maximum.

(ii) Many candidates gained this mark for correctly identifying the y value at the maximum. Care needs to be taken with accuracy when rounding decimals; 2.177 gained the mark, but 2.17 did not. Credit could be gained for communication if m^3 was included.

(e) (i) Most candidates recognised that they needed to sketch $y = x^2$. For more to have gained the mark the sketches needed to pass through the origin and intersect to the left of the maximum.

(ii) To gain this mark, candidates needed to understand that the required answer was the *y* value of the intersection of the two graphs. Many gave the *y* value of the maximum again. Credit could be gained for communication if m^3 was included.

Question 5

(a) Candidates were only rewarded if they expressed their answer in its simplest form. For example, $\frac{4xy}{2}$ would not get the mark. The expectation was that $S = 2xy$ would be written for a model rather than just $2xy$. If the formula for the area of a triangle was shown, credit for communication could be awarded.

(b) Most candidates knew that this question required the use of Pythagoras' theorem, but some candidates did not make it clear that they knew it was $\left(\frac{1}{2}x\right)^2$ and not $\frac{1}{2}x^2$ and so were not rewarded.

(c) Successful candidates used part **(a)** and part **(b)** as instructed. The majority of those who did were able to do the required algebraic manipulation.

(d) (i) This question required the substitution of x^2 into the formula given for the volume of a pyramid and the substitution of $S = 8$ into the *h* given in part **(c).** A common mistake was not showing where the 16 came from, so that the answer was not convincing.

(ii) Although most candidates could produce the correct curve on their GDC, many lost the mark by not making sure that their curve went through the origin or looked like it would cross the *x*-axis between 0 and 3 or their maximum was not sufficiently to the right of centre. Credit for communication was awarded for an indication of the scale on the *y*-axis or labelling of the maximum.

(iii) Many candidates gained this mark for correctly identifying the *y* value at the maximum. Credit could be gained for communication if m^3 was included.

(iv) Most candidates recognised that they needed to sketch $y = \frac{1}{3}x^2$. In order to gain the mark, the sketches needed to pass through the origin and intersect to the right of the maximum.

(v) One or two candidates were able to correctly identify that the *y* value of the maximum was the required value. Many wrote down the *y* value of the intersection. Credit could be gained for communication if m^3 was included.

Question 6

Some candidates were able to identify for the correct reason that the pyramid tent was what customers would buy because it fulfilled the criteria of having a height of at least 1 m and the cuboid tent did not. Many did not grasp the idea that both the amount of material used and the volume of the tents was the same and therefore only the height could alter. A lot of candidates were using non-mathematical reasoning for their choice, for example, more room to lie down. Those who identified the volume where the two tents were the same as $2.16\,m^3$ or sketched the appropriate graph got credit for communication.