# CAMBRIDGE INTERNATIONAL MATHEMATICS

**Paper 0607/11**
**Paper 1 (Core)**

## Key messages

To succeed with this paper, candidates

- need to have completed the full Core syllabus
- must be able to apply formulae and clearly show all necessary workings
- are reminded of the need to read the questions carefully, focussing on key words and instructions
- should check their answers for sense and accuracy.

## General comments

Candidates should pay attention to how a question is phrased, for example **Question 9** requires the answer in its simplest form and **Question 21** asks for a time in minutes not hours. Workings are vital in questions with more than one mark, particularly those with no scaffolding such as **Questions 9**, **16** and **21**. This is particularly important with problem-solving questions – **Questions 11**, **15** and **23**. Candidates must make sure that they do not make numerical errors especially in questions that are only worth one mark when any good working will not get the mark if the answer is inaccurate.

The questions that presented least difficulty were **Questions 2**, **3(a)**, **5**, **6(b)** and **8**. Those that proved to be the most challenging were **Question 7** order of operations, **Question 9** writing a map scale as a ratio, **Question 18** re-arranging a formula and **Question 19** listing elements of a set. In general, candidates attempted the vast majority of questions. Those that were occasionally left blank were **Questions 14**, **17**, **22** and **23**.

## Comments on specific questions

### Question 1

This opening question was accessible to nearly all candidates. A few gave factors instead of multiples. Occasionally the answers included numbers not from the list. Others appear to miss the word, all, and gave only one multiple.

### Question 2

Common wrong answers included 9 followed by various number of zeros, with 90 being the most frequent wrong answer.

### Question 3

In both parts, a small number of candidates ignored the diagram and attempted to answer on the grid provided for **Question 4**.

**(a)** Some candidates gave excellent answers using the correct mathematical notation. Many did not understand what was expected and drew arrows pointing at parallel lines, rather than using the correct symbols on the parallel lines. Some indicated more than one set of lines using the same arrow symbols for each set.

**(b)** Most were able to identify an acute angle. However, some indicated a right angle in the rectangular part or the angle at the tip of the arrow which was obtuse.

**Question 4**

**(a)** This was answered well by many candidates. Some did not understand the scale assuming that one square represents 0.1 instead of the correct 0.2. Others reversed the coordinates.

**(b)** Often the same candidates showed the same misunderstandings when trying to plot the point (1.2, 1).

**Question 5**

This was the best answered question on the paper with most being awarded at least 1 mark. A common error, for a small number of candidates, was to confuse east and west. Some did not draw a continuous walk as they started each part back at point *P*.

**Question 6**

Candidates should be aware of the terminology used in statistics and how to find the mean, mode, median and range.

**(a)** Some candidates did not order the values so gave 32 (the $6^{th}$ in the list) as their answer. Some ordered the distances correctly then had difficulty working out where the median was as answers of 18, 18.5, 20 or 21 showed. A few attempted to work out the mean distance.

**(b)** Those that ordered the data in **part (a)** had an easy job to subtract the smallest distance from the greatest. Some made arithmetic slips which meant they got zero marks as there were no method marks available here. Others left the range as 36 – 10 or even 10 – 36, neither of which got any marks. Some gave the greatest distance (36) as the range or added the smallest and greatest distances (46). Others used the first and last from the unordered list (21 – 13 = 8).

**Question 7**

The main misunderstanding here was the placement of the decimal point. Many answers of 3.6 were given. Quite a large number of candidates gave 0.6 so that it appeared from their workings, that 3 × 1 is zero. A few added the two values instead of multiplying. Some answers were seen where the value was 6.3 from putting the figures in the wrong columns during long multiplication.

**Question 8**

This was done well by most candidates. Some recognised the need to evaluate the division first, but then incorrectly reversed the resulting subtraction, finding 7 – 6 and not 6 – 7. A few others ignored the order of operations and worked out (6 – 14) ÷ 2 giving –4 or 4.

**Question 9**

This was the first problem solving question. There were a few correct answers. Some stopped after converting 5km into cm and did not divide each part by 2 to give the ratio in the required form. Others gave 2 : 5 or 1 : 2.5 without any conversion to common units.

**Question 10**

There were many correct answers here. Of those that gained a single mark it was more often for the 3*f* term. Other candidates made errors with the directed numbers – most of the problems stemmed from not understanding that subtraction signs only applies to the number that immediately follows. Some got to the correct expression but then combined the separate terms into one. Occasionally, some candidates treated this as two brackets to be multiplied.

**Question 11**

Most candidates were able to calculate the correct time for at least one of the ferries, thus gaining one mark, but many made arithmetical slips in one or more of their calculations and so did not reach the correct final answer. Some candidates did not appear to understand how to read, then use, a timetable to calculate the length of time of a journey, by reading down a single column.

**Question 12**

There were many good answers, and also many cases where candidates made both arithmetic or method errors. The simplest approach was to write $\frac{15}{60}$ and then cancel this to $\frac{1}{4}$ before writing this as a percentage. Many candidates attempted a division calculation and made errors when trying to evaluate $15 \div 60 \times 100$. Others worked out 15% of 60 and ignored the % sign on the answer line. Candidates should be aware of the difference between work out ‘15 as a percentage of… and ‘15% of…’.

**Question 13**

There were some excellent answers to this question. Some candidates were able to find the first term in the expansion but were unable to simplify $x^2 \times x$, with many putting $x^2$ for the final term in their expansion. Some were unable to start this question. Some seemed to be trying to simplify the given expression to a single term whilst others seemed unclear what was meant by expand in a mathematical context, for example writing $x^2(3 - x)$ as $(x \cdot x)(3 - x)$. Some tried to solve this as if the expression was an equation.

**Question 14**

This question needed the opposite algebraic skill to the question before, that of factorisation. It was done slightly less well with some making no progress towards the correct answer. Common misunderstandings include candidates combining the terms together ($50q$) or giving an answer such as $\frac{35}{15}$ that showed they had tried to solve the expression.

**Question 15**

Many showed clear workings so were able to gain method marks if they were not completely correct. There were a variety of errors seen, including arithmetic slips, omitting the division by 2 when finding the area of the cross-section, attempting surface area and not volume, and using incorrect formulae for volume such as $\frac{1}{3} \times \text{base} \times \text{height}$.

**Question 16**

Candidates had to start by identifying the number of candidates who took 3 minutes or less from the table and show the probability as a fraction in its simplest form. Most were able to identify a numerator of 12 or a denominator of 28; those who found both usually went on to arrive at the correctly simplified final answer.

**Question 17**

Of those that used set notation, most identified $M \cup C$. Of candidates who used set notation, the most common error was $M \cap C$. Others tried to answer with a phrase such as, ‘all included’ – this did not get a mark. Candidates should be careful that they use the correct set names, here, it is sets *M* and *C*. The universal set, U, was not involved in the answer; occasionally U = $M \cup C$ was seen – again, this did not get the mark.

**Question 18**

Those candidates that showed the algebra in stages were more successful than those who went straight to their answer. A wide variety of wrong answers were seen. The most common incorrect first stage included writing $4y = x + 5$. Candidates were more successful if their first stage was $y - 5 = \frac{x}{4}$. This question caused real difficulty for many.

**Question 19**

The most common error was to list the elements of $P$ and not of $P'$. Some wrote lists of prime numbers that were not part of the universal set. Others attempted to list the elements of $P'$ but made errors. The most frequent error was that 15 was thought to be a prime number.

**Question 20**

There were some clear, well laid out workings for this question. This was a challenging question for some who had some idea where to start but did not finish the process. Many found the common difference and then did not appear to know what to do then. Some tried to substitute this into the expression for the $n^{\text{th}}$ term and had difficulties as the difference is negative. Many seemed to be thinking of the term-to-term rule as their answers were $n^{\text{th}} - 5$ or $n - 5$. Some appeared to think that the $n^{\text{th}}$ term meant the $9^{\text{th}}$ term so the answer of 5 was seen.

**Question 21**

There were some excellent answers here, with a number doing this mentally and arriving at the correct answer without showing any working. Some reached the stage of writing $\frac{10}{15}$ but did not make any further progress. Many attempted to do calculations, such as dividing 10 by 15, rather than simplifying the fraction and multiplying by 60, as the answer is required in minutes. An alternative method was to work out a pair of values to move towards finding the distance in 10 minutes, for example, starting with 5 km in 20 minutes or 30 km in 120 minutes. Some saw that this involved speed and attempted to use speed = distance ÷ time, which is not a sensible method here.

**Question 22**

Candidates either did very well or very poorly here as often some candidates find this syllabus content challenging as the information is presented in a sentence rather than on a diagram. Those who identified the key information in the question were able to reach the correct answer of $y = 5x - 2$. Some attempted various calculations or algebraic work, often making errors, although this was not required to reach the correct answer. Although it is not necessary with this question, candidates could have drawn a set of axes with the given line to help them understand what they have been given and what they must head towards. Some gained partial credit for giving a line with either a correct gradient or a correct intercept.

**Question 23**

Often questions about proportionality are given with two triangles in the same orientation so that the paired sides and angles are obvious. This was conceptually difficult as candidates had to navigate the diagram to find the pairings. It would have been sensible to re-draw the diagram as two separate triangles – this was not done very often. Those that did, were nearly always correct as once the similar triangles were identified the calculation was very simple. A few multiplied 10 by 2 instead of dividing. A significant number made this question far more difficult by attempting to use Pythagoras to calculate the missing sides as part of a far longer method. This method results in surds for *BC*, and so many candidates who attempted this did not carry on and thus were not successful at getting a mark for the scale factor or the implicit equation involving *AD*.

# CAMBRIDGE INTERNATIONAL MATHEMATICS

**Paper 0607/12**
**Paper 1 (Core)**

## Key messages

To succeed with this paper, candidates need to have completed the full Core syllabus.

Calculators are not permitted on this paper, so candidates need to be able to perform calculations using a range of non-calculator methods. It is important that candidates work accurately, avoiding arithmetical errors; they should also show their working clearly. Candidates need to be able to deal with place values when multiplying pairs of decimals **(Question 5)**. They should calculate with fractions where appropriate; using non-exact decimals introduces errors and leads to a loss of marks.

Candidates are expected to understand and use appropriate mathematical vocabulary, including types of correlation **(Question 11(b))**, integer **(Question 12(b))** and mean **(Question 16)**.

## General comments

The paper was accessible to all candidates, the majority of whom attempted every question and reached the end of the paper. Candidates sometimes omitted **Question 11(b)** (describing correlation), **Question 12(a)** (showing an inequality on a number line), **Question 17** (finding a translation vector) or **Question 21** (range of a function).

The questions that presented the least difficulty were **Questions 1**, **4**, **6**, **7**, **8** and **9**. Those that proved to be the most challenging were **Question 10** (find length of a square and surface area of a cuboid), **Question 16** (mean from a table of data), **Question 21** (range of a function), **Question 22** (finding a length in a pair of similar triangles) and **Question 23** (probability of combined events).

Most candidates showed their working. The stronger candidates set their work out clearly with steps in a logical order. Weaker candidates often had working that was not in any order, with calculations placed randomly within the working space.

It is important that calculations are evaluated correctly, and candidates need to be able to draw on a range of non-calculator methods. Some candidates avoided working with fractions, instead opting to work with decimals. This led to rounding errors and inaccurate final answers. Numerous candidates lost marks because of basic arithmetic errors in their calculations, including with addition and multiplication of single digit numbers.

## Comments on specific questions

### Question 1

This was done well, and most candidates gave the correct answer. A small number made arithmetic errors, leading to answers such as 6 or 8; some attempted to evaluate the square root by dividing 49 by 2.

### Question 2

Most candidates showed good understanding and the majority gained at least one mark. Weaker candidates often omitted one or two factors.

**Question 3**

The majority gave the correct answer, but very few candidates showed any working here. Those who showed some working, for example highlighting the even numbers, or writing how many even numbers were on each spinner, usually went on to reach the correct answer.

**Question 4**

This was a straightforward question, and most candidates gave the correct answer in both parts.

**(a)** Some did not realise that they simply had to read the total from the table, instead they added all the numbers in the first column, including the given total of 25, reaching the answer 50. Some read the total number of fruits and vegetables, 45, instead of the total number of fruits.

**(b)** The most common incorrect answer was 16, which is the number of green fruit and vegetables, as shown in the final column of the table.

**Question 5**

Most of the higher achieving candidates did well here, but the weaker candidates found this challenging and were often unable to reach the correct answer. The most common error was to give the answer 0.5. Some aligned their numbers in a column multiplication, then lined up the decimal point in the answer with those in their working. Candidates need to be able to multiply pairs of decimals using an appropriate non-calculator method that deals with place values correctly.

**Question 6**

This was done well, with most candidates shading one of the two possible sections to give a symmetrical pattern. A small number shaded more than one section, so no mark could be awarded.

**Question 7**

Most gave the correct answer here, with the higher achieving candidates performing significantly better overall on this question. Several weaker candidates put brackets around $16 \times 2$, which would have been calculated as a first step without the brackets.

**Question 8**

The majority were able to substitute 9, gaining one mark, and most went on to evaluate $y$ correctly, however a number of candidates made arithmetical errors. A small number did not seem to know what operation was implied by the 5 outside the bracket, with some adding 5, others dividing and some stopping once they had substituted 9 or reached 5 (12).

**Question 9**

Most candidates gave the correct answer. Some wrote $8^4$, suggesting that they had counted the multiplication symbols rather than the number of 8s in the multiplication. A few gave answers where 8 was the power.

**Question 10**

This was the first problem-solving question on the paper, and it proved to be challenging for many. The highest achieving candidates did well, but the weakest often made no progress and gained no marks.

Some candidates treated 25 $cm^2$ as the length of an edge, others assumed that the upright faces of the cuboid measured 6 cm by 6 cm. Some candidates were able to use the given area to deduce that the base measured 5 cm, but many of these were unable to go on to find the surface area. Some found the volume; others found the areas of one or two faces but were unable to make any further progress.

**Question 11**

All candidates attempted this question, and most were successful, with many gaining 2 or 3 marks.

**(a)** Most candidates were able to plot the points that aligned with the values on the scales, but the intermediate points (170, 10) and (230, 15) were not always plotted correctly, with some candidates incorrectly assuming that one small square represented 10 units on the *x*-axis.

**(b)** The higher achieving candidates usually gave the correct answer. ‘Positive’ was a common incorrect answer. Weaker candidates often seemed to be describing the diagram rather than the correlation, giving answers such as scattered, decreasing or descending. Some candidates did not know what to do and left this part blank.

**Question 12**

There were some excellent responses to this question, but it proved to be challenging for many candidates.

**(a)** The highest achieving candidates usually reached the correct answer, but most candidates had difficulty here. A significant number did not attempt this question. Common errors were to show a closed circle or dot at $x = -1$, to draw the arrow in the wrong direction, and to have an additional circle instead of an arrowhead at the end of the line.

**(b)** Some candidates put 1 rather than 0, suggesting that they do not know that 0 is an integer. Other common wrong answers included 5 and −5, which are the integers from the ends of the scale in **part (a)**.

**Question 13**

There were some good answers here, but there was a significant difference in performance between the highest achieving candidates and the weaker candidates. Successful candidates usually showed clear working and calculated accurately. A significant number made arithmetical errors, including with straightforward calculations, such as division by 100. Candidates who took the approach of finding 10% of 120 and 5% of 120 generally made fewer arithmetical errors and were more successful than candidates who attempted to multiply 120 by $\frac{15}{100}$. Some showed a method to find 15% of 120 but did not attempt to add this to 120.

**Question 14**

There were some good responses here, with many candidates realising that $4x + 2x = 180°$. A common approach was to fill in the missing angles and work with $4x + 2x + 4x + 2x = 360°$. The weakest candidates were often unable to start this question, giving answers such as 180, 8 (from $4 \times 2$), 90 (sometimes from $360 \div 4$) and 2 (sometimes showing $4 \div 2$ in working).

**Question 15**

There were some good responses here. Successful candidates usually started by writing 9 as $\frac{9}{1}$, then completed the division using a correct method for dividing fractions, usually $\frac{2}{5} \times \frac{1}{9}$. Some seemed confused about the method for dividing fractions, either cross multiplying values or working with the reciprocal of $\frac{2}{5}$. A few candidates attempted to work with decimals, arriving at a recurring decimal in their first step and not making any further progress.

**Question 16**

There were some excellent solutions with clear working. Some found the correct products but then divided by 4 (the number of entries in the table) not 20 (the number of players). Some candidates got as far as $\frac{38}{20}$ and attempted to cancel or work out 38 ÷ 20, sometimes making errors in the calculation. Candidates who simplified $\frac{38}{20}$ to $\frac{19}{10}$ usually went on to reach the correct answer. A few gave $\frac{38}{20}$ or $\frac{19}{10}$ as their final answer, which is not appropriate in this context. A significant number did not know how to find the mean from a table, many of these added the four frequencies and divided by 4.

**Question 17**

There were some good answers here. A small number made sign errors or reversed the components in the vector, and some made arithmetical errors. Some candidates include 'fraction lines', sometimes spoiling good work by doing this. Weaker candidates usually struggled with this question. Many of these candidates were unable to calculate the differences correctly, often adding rather than subtracting.

**Question 18**

Some candidates were able to write a correct expression for the cost of 5 pencils, but only a minority were able to write a correct expression for the cost of the notepads in cents. Many did not make any conversion and wrote $5y + 3x$; some who attempted to convert dollars to cents divided by 100 instead of multiplying, a few divided by 10.

**Question 19**

Approximately half of the candidates gave the correct answer here. Common wrong answers included 639, (suggesting that candidates had used $10^2$ not $10^{-2}$), 0.00639 (suggesting that candidates were counting zeros) and various other responses containing the digits 639.

**Question 20**

Candidates who attempted to factorise usually did well and most of these gained at least one mark. A significant number showed no understanding of what was required here and these candidates either left this blank or seemed to be attempting to either divide or simplify the given expression, often arriving at answers consisting of a single algebraic term.

**Question 21**

There were some good answers, sometimes with efficient working but often with no working, implying that some candidates had done this mentally. However, most candidates found this challenging, and it was the question with the lowest number of correct responses on this paper. A wide variety of errors were seen. Incorrect numerical answers included 5 and –1 (the upper and lower bounds of the domain), 30 (from candidates who had noticed that –1, the minimum value of the domain, multiplied by 6 was –6, so they assumed that the same pattern applied for the maximum value and calculated $5 \times 6$) and a wide variety of other integer values. A significant number wrote expressions or inequalities in the answer space, suggesting that they did not have any understanding of what was expected here.

**Question 22**

There were some excellent and fully correct responses to this question involving similar triangles, but many candidates had real difficulty here. Some candidates showed a good understanding of similar triangles but were unable to complete the required calculation. A significant number got as far as $\frac{12}{9}$ but then worked with a decimal, leading them either to give up, because they could not calculate with a recurring decimal, or to work with a rounded value, which led to an inaccurate final answer. Some candidates did not understand the need to use ratios or multipliers; these often noticed that 9 + 3 = 12 and then added 3 to the length of 6, leading to the common wrong answer of 9 cm.

**Question 23**

Some candidates showed $\frac{1}{2} \times \frac{1}{3}$ and went on to reach the correct answer, but most found this question challenging. The most common error was to attempt to calculate $\frac{1}{2} + \frac{1}{3}$, leading to the common wrong answers $\frac{5}{6}$ or $\frac{2}{5}$.

# CAMBRIDGE INTERNATIONAL MATHEMATICS

**Paper 0607/13**
**Paper 1 (Core)**

## Key messages

To succeed with this paper, candidates

- need to have completed the full Core syllabus
- must be able to apply formulae and clearly show all necessary workings
- are reminded of the need to read the questions carefully, focussing on key words and instructions
- should check their answers for sense and accuracy.

## General comments

Candidates should pay attention to how a question is phrased. **Question 6** requires that the answer be given in hours and minutes and **Question 18** needs the answer in metres. Workings are vital in problem-solving questions – **Questions 14**, **16**, **17** and **20** – and those with more than one mark. Scaffolding is not present in problem-solving questions to encourage candidates to have confidence in their own abilities to tackle the problem, drawing on knowledge or skills from various areas of the syllabus. The aspect of candidates drawing their own tables or diagrams to aid themselves or visualise a situation, is a very important skill to learn as it is useful in other areas of the curriculum as well as life outside school. At the calculating stage, candidates must make sure that they do not make numerical slips especially in questions that are only worth one mark. Candidates were let down by their misunderstanding of directed numbers and not knowing their multiplication tables.

The questions that presented least difficulty were, in general, **Questions 1** to **8**. Those that proved to be the most challenging were **Question 11** measure a bearing, **Question 16** interior angle of a polygon. **Question 18** plotting a given line, **Question 20** working out values from a probability tree and **Question 21** solving simultaneous equations. In general, candidates attempted the majority of questions. Those that were the most often left blank were **Questions 11**, **12**, **15** and **16** – two of which have been mentioned as challenging.

## Comments on specific questions

### Question 1

This opening question was accessible to most candidates. Of the small number of wrong answers seen, the most common was to have the coordinates reversed or to include an *x* or a *y* with the numbers.

### Question 2

The correct answer was seen many times. The most common wrong answer was 500 ml along with the occasional 0.005 ml.

### Question 3

Not so many candidates got this question correct with some giving 4, the number of lines of symmetry for a square. Some were not sure and gave both 2 and 4 – these candidates did not gain the mark as only the 4 is correct.

**Question 4**

This was the question virtually all candidates got correct. A small number gave a prime number over 10 and some gave 1 as their answer.

**Question 5**

Candidates had more difficulty with the division by 2 for the item cost of the brake pads than the multiplication for the total cost of the tyres – some appeared not to understand the format of a bill as they used addition and subtraction instead of multiplication and division. The addition to the overall cost of the item was generally correct.

**Question 6**

A few candidates gave their answer as 3 h 25 min by adding the minutes and getting 85 then subtracting 1 hour which they added to the 2 hours between 6 pm and 8 pm. Some converted into 12-hour format before subtracting which is not necessary but not incorrect.

**Question 7**

Some worked out the mapping (×3) and others worked out the differences between adjacent numbers in each oval. A few had problems with their multiplication tables giving 28 instead of 21.

**Question 8**

Candidates should be aware of the terminology used in statistics and how to find the mean, mode, median and range.

**(a)** Some candidates did not order the values so gave 3.5 (the middle gap in the unordered list) as their answer. Some ordered the ages correctly then had difficulty working out where the median was as answers of 5 or 6 showed. Some gave the middle pair i.e. 5 and 6. A few attempted to work out the mean age.

**(b)** This was much more successfully answered than the median, with a large majority correct. Occasionally an answer of 5 or 8 was seen.

**Question 9**

There was some confusion with directed numbers here with $(–3)^2$ often evaluated as –9 or –6. Also the other part, –2 × –3, often became –6. When both parts were put together, the answer was frequently –15 or 0.

**Question 10**

Those that successfully gave the total number of pencils as 60, either went on to give the correct percentage or sometimes made slips cancelling their fraction on the way to find the percentage.

**Question 11**

This was the most challenging question on the paper. Candidates need to understand how bearings are expressed in order to measure the correct angle. They should remember that if the angle is less than 100°, then a zero must be added in front to make a 3-figure bearing. A large number of candidates measured the distance from *X* to *Y*. A few wrote 180° (perhaps as the diagram has parallel lines and the two enclosed angles will add to 180°).

**Question 12**

This question was to test the understanding of the symbols, $<$ and $\leqslant$. Some wrote (–2, 3) which is just an alternate form of the inequality and does not answer the question. Sometimes the 0 was missing from the lists. Occasionally, multiples of 3 were given. Zero alone was seen a few times – this appeared to be because it is the mean (or the median) of –3 and 3.

**Question 13**

There were some clear, well laid out methods here. A few gave $\frac{1}{3}$, $-\frac{1}{3}$ or $\frac{1}{-3}$ from subtracting the numerators then the denominators. Others had difficulty finding the correct values for the numerators. This was another question where correct methods were let down by poor numerical skills.

**Question 14**

Many answers contained the figures 28 – most often, 28 000. Those who knew they needed to base their answer on 7 × 4, incorrectly gave 21, 22, 29 or 35 as the answer before they converted the units into metres. Other incorrect answers seen were 400 or 7000.

**Question 15**

Here, candidates did not seem to be confident of the correct formula to use for area of a circle even though it is given on the formula page. Some were awarded a method mark for a correct statement with no further work as they did not know how to proceed. Many gave the answer 24.5 or left this question blank. A few tried to square root $\pi$ or to square 49.

**Question 16**

This was a problem-solving question that was both challenging as well as the one most often left blank. The question was made more complex as no diagram was given but candidates did not have to work out the number of sides from the use of the polygon’s name. Few diagrams were seen. The most straightforward method is to do this in two steps, first work out the external angle then subtract that from 180°. There are other more complex methods that use the total interior angle, (12 – 2) × 180 ÷ 12 = 150, but that method has more places for arithmetic slips to be made. A few gave workings such as 180 ÷ 12 = 15. Very few candidates were awarded both the method marks or full marks.

**Question 17**

This average speed question is made more complex by ging the information in km and minutes, but the answer is required in km/h. One approach is to realise that Sammy will cycle 4 km in 15 min or quarter of an hour so 4 × 4 = 16 is the speed in km/h. Some started with 12 ÷ 45 but then did not go on to multiply this by 60; this statement was awarded with a method mark. Many others began with 45 ÷ 12. As this gives an answer starting with 3, this working often led to an answer of 15.

**Question 18**

This skill of drawing a line on a grid should be familiar to candidates. Perhaps the position in the paper made candidates feel there was more to this question than there is as this question was not done well. Maybe also, this was because no table was given for candidates to complete. It is a good idea for candidates to make their own table just as diagrams are useful in other questions. Common errors include drawing the horizontal line $y = 2$ or just putting a cross at (0, 2) or (2, 0). Some drew lines with a negative gradient. In questions such as this, candidates need to use a pencil and ruler to draw accurate lines that cover as much of the grid as possible – short lines would not be awarded full marks.

**Question 19**

In general, this was handled much better than the previous few questions. The common error was to put some letters in more than one section of the Venn diagram. The simplest approach is to work out what letters go in the intersection and cross them out of *P*, *Q* and U. After this it is easy to see what letters go in the moon-shaped sections and what is left in U to put outside the circles. Many candidates were able to be awarded at least 1 mark here.

**Question 20**

This was a slightly different problem-solving question using a probability tree with some numbers missing from the fractions. It is vital to work out the missing numbers on the tree and to check that everything fits before filling in the answer lines – very few did this.

**Question 21**

Quite a few candidates omitted this question which should have been a familiar situation seen in textbooks or past examination papers. In general, the candidates did not do well solving this pair of equations. Here, either the first equation needs multiplying by 2 to be able to eliminate $y$ or the second by 5 to be able to eliminate $x$. In both cases, one equation needs to be subtracted from the other to leave $9x = 27$ or $9y = -90$. Once $x$ or $y$ is found, substituting it into either equation will produce the other value. There are other methods that candidates can use depending on which is most suitable for the particular equations. Whatever method is used, candidates should check their answers are correct for both equations as some gave solutions that fitted one equation only.

# CAMBRIDGE INTERNATIONAL MATHEMATICS

**Paper 0607/21**
**Paper 2 (Extended)**

## Key messages

Candidates generally did very well on the earlier, more straightforward questions. Candidates attempted the harder questions by trying a variety of approaches and they would be better off thinking about the question and considering a single approach before starting. Simple arithmetic and a lack of knowledge of multiplication tables and fractions cost some otherwise good mathematicians valuable marks. Understanding the rules of surds and logarithms is also an important area to become fluent in.

## General comments

Candidates were generally well prepared for the paper and were able to demonstrate clear knowledge and understanding across the breadth of the syllabus. Indeed, some candidates scored full marks on the paper demonstrating excellent mathematical skills. Written work was of a good standard, but on the longer questions, namely **Questions 9**, **13**, **14**, **15** and **16**, the working of some candidates was not always clearly presented. Some candidates' work was extremely hard to follow as they worked both right to left and bottom to top of the working space. Those that showed the steps in their working were often able to gain method marks even if their method was not completely correct. Candidates were generally able to complete the paper within the time and it was unusual to find any question not attempted.

Candidates need to ensure they know their multiplication tables and are able to divide accurately. Basic arithmetic slips cost some candidates a number of marks. The questions most affected included **Questions 6**, **7**, **9**, **13** and **15**.

Candidates need to be able to add fractions correctly, as in **Questions 2(b)** and **13**. They also need to be able to multiply and divide fractions efficiently such as in **Questions 13** and **15**.

Candidates should ensure they are fluent with surds and so practise with basic rules would be beneficial. Candidates should also learn the rules of logs and how to write them correctly as in **Question 15**.

Candidates need to learn the key trigonometry values for sine cosine and tangent for 0, 30, 45, 60 and 90.

Candidates should read questions carefully and follow instructions such as writing numbers in standard form, rather than rounding, in **Question 8** and using the point, *A,* rather than the mid-point of *AB,* in **Question 9**.

## Comments on specific questions

### Question 1

Almost every candidate answered this question correctly. The most common incorrect answers were 8, 32 and 64.

### Question 2

**(a)** The large majority of candidates answered this part correctly. The few errors seen included candidates incorrectly trying to simplify the given fraction or to divide 25 into 12 rather than using the fact that $25 \times 4 = 100$. Some candidates who correctly wrote $\frac{4 \times 12}{4 \times 25}$ evaluated the numerator incorrectly. A common incorrect answer was 0.48.

**(b)** Almost every candidate answered this question correctly. The most common error was $\frac{6}{14}$ from adding both the denominators as well as the numerators. If candidates cancelled this down they could realise that this is smaller than one of the terms they were adding and therefore could not be correct. A few candidates converted unnecessarily to 49ths and gave an equivalent acceptable answer of $\frac{42}{49}$.

**Question 3**

Most candidates answered this correctly. When errors were seen it was predominantly with the collection of the terms in $y$, with the most common incorrect answers being $4x - 3y$ or $4x + y$. Other errors included $4x^2 - y^2$ and otherwise correct, but unsimplified, expressions such as $x(3 + 1) + y(-2 + 1)$.

**Question 4**

This was one of the questions that candidates found most difficult to answer correctly. Most candidates wrote down some correct conversions such as 1 cm = 10 mm and 100 cm = 1 m but there were frequent errors with place value when dividing. Some did not appreciate that it was a conversion of area and simply converted 270 mm to 0.27 m. Others correctly converted from $mm^2$ to $cm^2$ but then divided by 100 rather than $100 \times 100$. A minority of candidates used the conversions the wrong way round not recognising that there will be fewer $m^2$ than $mm^2$.

The best answers were those given in standard form as $2.7 \times 10^{-4}$, although this was not required.

**Question 5**

Most candidates answered this question correctly. The most common incorrect answers were 0 and 9.

**Question 6**

This question was answered well using a wide variety of different formats and methods. These included factor trees, Venn diagrams and lists of multiples. Most candidates scored at least one mark for a correct method. Common errors included the answers 2 (the lowest common factor), 12 (the highest common factor) 2040 and 1440 (other common multiples) and answers such as $2^3 \times 3 \times 5$ that were not evaluated. Slips in arithmetic, whether in writing lists of the multiples or in factor trees when dividing, often spoilt otherwise correct working.

**Question 7**

Many candidates showed their understanding of magnitude by evidencing $\sqrt{9^2 + (-3)^2}$ and a fair proportion of these reached $\sqrt{90}$. Some errors were seen in the simplification with the most common being $10\sqrt{3}$. However various errors were seen, the most common being $\sqrt{9^2 + -3^2} = \sqrt{81 - 9}$ and 81 + 9 = 100. Other candidates did not understand the term 'magnitude', evidenced by reverse vectors, multiples of the vector and calculations such as $\sqrt{9 - 3}$ seen.

**Question 8**

**(a)** Most candidates could correctly write the number in standard form. Candidates who gave a rounded approximation of the given number in standard form, such as $3.7 \times 10^6$ did not score. Common errors included $3706 \times 10^3$, $3.706 \times 10^{-6}$, $3.706 \times 10^3$ and $3.706 \div 10^6$. A few candidates rounded the given number and gave an answer such as 4 000 000.

**(b)** There was a high correlation between the scores in this part and the previous part. Again, candidates who gave a rounded approximation of the given number in standard form did not score. Common incorrect answers included $1.010 \times 10^{-4}$, $0.101 \times 10^{-3}$, $1.01 \times 10^{3}$, $10.10 \times 10^{-4}$ and $1.01 \div 10^{3}$. Again a few candidates gave the given number to, for example, 3 decimal places as 0.001.

**Question 9**

Only a minority of candidates scored full marks on this question. Most candidates were able to find the gradient of line *AB*, but errors included slips with the numbers, signs and arithmetic. A further mark was gained by those able to find the negative reciprocal of their gradient. Finding the constant in the equation for line *l* was more tricky. Many correctly reached $3 = \frac{1}{5} \times 1 + c$ but then wrote $15 = 1 + c$. Others incorrectly thought that if they found the intercept from the line *AB*, it would be the same intercept in line *l*. Others substituted in the coordinates of the mid-point of *A* and *B* rather than the point *A*. However, a good number scored 3 marks for finding the correct line. However, frequently candidates were unsure of what writing their answer in the form $py + qx = r$ actually meant and could not score the final mark.

**Question 10**

**(a)** Most candidates answered this part correctly. The errors seen were almost always arithmetic slips.

**(b)** Most candidates answered this part correctly. The most common errors seen came from $\frac{12}{100}$ (assuming 100 people), $\frac{80}{12}$ (inverted fraction), incorrect cancelling of $\frac{12}{80}$ or giving the answer as a decimal or percentage, rather than a fraction as required.

**Question 11**

**(a)** This part was answered well by many. The most common errors included wrongly simplifying $\sqrt{a^2b}$ to $b\sqrt{a}$ or $\sqrt{a} - \sqrt{b} = \sqrt{a-b}$ with $2\sqrt{5}$ and $\sqrt{42}$ being seen.

**(b)** Again, this part was answered well by a fair proportion of candidates. Many evidenced a correct first step of multiplying by $\frac{\sqrt{7}+\sqrt{3}}{\sqrt{7}+\sqrt{3}}$ and candidates often reached $\frac{12\sqrt{7}+12\sqrt{3}}{4}$**.** However, many did not realise they could simplify this further, or simplified incorrectly to, for example, $3\sqrt{7} + 12\sqrt{3}$ or $\frac{\sqrt{84}+\sqrt{36}}{4}$ or $\frac{12\sqrt{10}}{4}$. Others who did not score usually started by wrongly multiplying by, for example $\frac{\sqrt{7}-\sqrt{3}}{\sqrt{7}-\sqrt{3}}$ or $\frac{\sqrt{7}+\sqrt{3}}{\sqrt{7}-\sqrt{3}}$ or $\frac{1}{\sqrt{7}+\sqrt{3}}$ or $\frac{\sqrt{7}+3}{\sqrt{7}+3}$ or, as in the previous part, used $\sqrt{a} - \sqrt{b} = \sqrt{a-b}$ and simplified the given fraction to $\frac{12}{\sqrt{7-3}}$.

**Question 12**

This part was completed well by a fair proportion of candidates with many completely factorising the expression. A few candidates scored one mark for only taking out the *x* or the *y* rather than *xy* or for giving their answer in an untidy form such as $xy(xxy - 1)$ or $(xy + 0)(x^2 - 1^2)$. Some candidates, after scoring full marks, went on to factorise the correct answer further to $xy(x\sqrt{y} + 1)(x\sqrt{y} - 1)$, which showed good mathematics but was not required as the powers of *y* are no longer all integer values. A minority of candidates did not know how to start because they weren't looking for common terms in the two parts of the expression. Others recognised that *xy* was a common factor but could not work out that this required a – 1 inside the bracket.

**Question 13**

A good number of candidates answered this question correctly. The most common errors arose from only considering $\frac{5}{9}\times\frac{4}{8}$ and not multiplying by 2, adding $\frac{5}{9}+\frac{4}{8}$ rather than multiplying them, using replacement rather than without replacement, errors with arithmetic and adding fractions incorrectly, namely $\frac{20}{72}+\frac{20}{72}$ as $\frac{40}{144}$. Some candidates chose to use $1-[\text{P}(y,y)+\text{P}(w,w)]$ and were equally successful.

**Question 14**

There were some eloquent responses shown to this question, but most responses showed candidates making multiple attempts to make $x$ the subject of the formula with limited success. Most candidates recognised that, as a first step, they needed to multiply up by the denominators to remove the fractions. Most successfully completed this, but others made slips with the $p(x - 2)$, not always understanding the importance of the brackets. Others tried to use a common denominator of $x(x - 2)$, but this approach often led to an incorrect equation with terms in $x^2$ which candidates found problematic. Having completed a first step, candidates were not always able to isolate the $x$ by collecting terms in $x$ and factorising. Some chose one of the $x$ terms and rearranged to make that the subject with the other $x$ on the other side. Common errors seen included slips with signs when moving terms from one side of the equation to the other, and errors when multiplying or dividing with not all of the terms being included.

**Question 15**

There were a number of key log rules that candidates needed to be fluent with to simplify the given sum. Whilst some candidates scored full marks on this question, the majority were able to gain some credit by demonstrating the correct use of at least one log rule. Most were able to use $a\log b = \log b^a$ but fewer recognised that $1 = \log 10$. Others had some understanding that $\log a + \log b = \log ab$ but frequently candidates showed misconceptions such as
$\log 8 - \log 9 = \frac{\log 8}{\log 9} = \log\frac{8}{9}$. Other errors included writing, for example, $3\log 2 = \log 3^2$, $1+3\log 2 = 4\log 2$ and $-\log 9 - \log\frac{4}{9} = -\log\left(9 \div \frac{4}{9}\right)$. In addition, there were errors with arithmetic and when dealing with the fractions.

**Question 16**

There was a mixed response to this question. The first step required candidates to simplify the given equation to $\cos x = \pm\frac{\sqrt{3}}{2}$. Many candidates were able to rearrange to $\cos x = \sqrt{\frac{3}{4}}$ but not all recognised this as giving the principal value of 30. Others incorrectly disassociated the cos and the x giving, for example, $x = \sqrt{\frac{3}{\cos 4}}$. Of the candidates finding 30, some went on to find 330, often by drawing the graph or using an angle diagram, but only a minority considered the negative sign when square rooting and were able to give all four solutions.

# CAMBRIDGE INTERNATIONAL MATHEMATICS

**Paper 0607/22**
**Paper 2 (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 should check their working in each question to ensure that they have not made any careless numerical slips.

Candidates need to be able to describe transformations using mathematical terminology.

## General comments

Candidates were generally well prepared for the paper and were able to demonstrate good understanding and knowledge across many of the topics tested.

The standard of written work was generally good with many candidates clearly showing the methods they were using.

Candidates did not seem to have a problem with the time allowed to complete the paper and it was rare to find more than a few questions unanswered.

Candidates lost marks through incorrect simplification of a correct expression.

## Comments on specific questions

### Question 1

Nearly all candidates scored both marks, showing a good understanding of basic geometric properties.

### Question 2

**(a)** This part was correctly answered by virtually all candidates.

**(b)** The majority of candidates scored this mark.

### Question 3

This question was correctly answered by the majority of candidates. The common incorrect answer was 0.004.

### Question 4

The majority of candidates were able to give a correct prime number. The common incorrect answer was 87. A small number of candidates tried to give all of the prime numbers but lost the mark by including an incorrect answer with the two correct answers.

**Question 5**

Many candidates gave the correct answer. Candidates were able to interpret the problem into a precise mathematical formula.

**Question 6**

Although the majority of candidates gave a correct inequality an answer of $x = \frac{7}{11}$ was regularly seen.

**Question 7**

**(a)** The majority of candidates gave the correct answer of $7\sqrt{2}$ .

**(b)** Nearly all candidates scored the method mark, but there were careless mistakes when candidates tried to simplify a correct answer.

**Question 8**

The majority of candidates scored at least one mark. The common slip was giving answers of $\pm 4$ .

**Question 9**

This question was well answered. Candidates were able to demonstrate excellent algebraic skills.

**Question 10**

**(a)** Although there were many correct solutions to this part of the question, this part was not answered as well as the numerical calculation needed in **part (b)**.

**(b)** The majority of candidates gave the correct answer of 105.

**(c)** Fewer than half of the candidates managed to gain full marks in this part. The incorrect ratio equation $\frac{8}{5} = \frac{6}{CX}$ was regularly seen.

**Question 11**

This question on standard form proved to be demanding. Nearly all candidates scored one mark by finding the answer of $ab \times 10^{15}$, but were unable to convert this answer into standard form.

**Question 12**

This question proved to be a good discriminator.

**(a)** A fair number of candidates were unable to draw a sketch of $y = \cos x$ . The popular incorrect answer was to draw a reflection of $y = \sin x$ in the $x$-axis.

**(b)** Candidates found this part challenging.

**Question 13**

This question was a good test of candidates' knowledge of set theory.

**(a)** Very few candidates scored this mark. Candidates were unfamiliar with the null set.

**(b)** Nearly half of the candidates scored this mark. The common error was to include the 5 with their answer.

**(c)** Nearly half of candidates scored this mark.

**Question 14**

Many candidates scored at least one mark with an answer of $(5)^3 x^{24}$.

**Question 15**

There were many excellent attempts to this tricky question. Candidates who attempted to use the cosine rule scored at least one mark. Candidates needed to realise that the largest angle was opposite to the largest side. A small number of candidates tried a scale drawing. This approach did not score any marks.

**Question 16**

Although the majority of candidates scored at least one mark, they struggled to give a precise description of the required transformation.

For full marks candidates needed:
- stretch
- (factor) 0.5
- $x = -1$ invariant

**Question 17**

There were many excellent solutions to this trigonometric problem. Candidates were expected to use Pythagoras' theorem twice to find *PA*. Some candidates made careless numerical slips that spoiled an otherwise perfect solution.

# CAMBRIDGE INTERNATIONAL MATHEMATICS

**Paper 0607/23**
**Paper 23 (Extended)**

## Key messages

Candidates need to have covered the entire extended syllabus content in order to do well.

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 should check their working in each question to ensure that they have not made any careless numerical slips, especially on decimal calculations.

Candidates need to be able to recall basic log fact such as $\log 10 = 1$ and $\log 100 = 2$.

Candidates need to recall and apply the trigonometric ratios of key angles in problem situations.

## General comments

A significant number of candidates did not appear to be well prepared for the paper, although they were able to demonstrate good understanding and knowledge of algebra. The standard of written work was generally good with many candidates clearly showing the methods they were using. Candidates did not seem to have a problem with the time allowed to complete the paper.

## Comments on specific questions

### Question 1

Although the majority of candidates scored both marks, a significant number of candidates were unable to deal with the place value of $0.2^2$, with an answer of 0.7 being regularly seen.

### Question 2

This part was correctly answered by nearly all of the candidates.

### Question 3

This question proved to be challenging with only about half of the candidates being successful. The most common incorrect answer given was ‘trapezium’.

### Question 4

Candidates were able to demonstrate excellent algebraic skills with nearly all scoring full marks in both parts.

### Question 5

The majority of candidates scored at least two marks. The common slips occurred when drawing, with the accuracy of their sectors. Some candidates were not awarded the final mark as they omitted to label the three sectors.

**Question 6**

**(a)** The majority of candidates scored both marks. The common error was giving an answer of $34 \times 10^{-15}$.

**(b)** This part was far more challenging. Candidates were expected to change either *p* or *q* so that both numbers were expressed as the same power of 10, before adding.

**Question 7**

A common mistake in this question was candidates finding the highest common factor rather than the lowest common multiple. Candidates could score one mark if they gave any common multiple as their answer.

**Question 8**

The majority of candidates scored full marks which showed good algebraic skills.

**Question 9**

The majority of candidates scored full marks. It was encouraging to see the required sets being clearly shaded.

**Question 10**

**(a)** There were many correct solutions to this part.

**(b)** The interquartile range proved to be more challenging. Some candidates found values corresponding to 75 and 25 trees, rather than 90 and 30. Some candidates having correctly found the upper quartile and the lower quartile forgot to subtract their values to give the interquartile range.

**Question 11**

This question was challenging. Candidates needed to take out a factor of 3 before using ‘difference of 2 squares’ to complete the factorisation. Some candidates attempted to factorise the quadratic, with limited success.

**Question 12**

Many candidates scored the first mark by correctly using $y = \frac{k}{\sqrt{x}}$, but did not find the value of *k*. Some candidates scored three marks by correctly finding $y = \frac{6}{\sqrt{x}}$ and $v = 3y^2$, but were unable to eliminate *y* correctly.

**Question 13**

Most candidates scored the first mark by correctly using one of the rules of logs. Many candidates correctly found an answer of log 100, but were unable to give their final answer as 2.

**Question 14**

This question was very challenging and few candidates made much progress with it. Candidates were expected to use the given small triangle, with angles of 90°, 60°, 30° to find the required lengths.

# CAMBRIDGE INTERNATIONAL MATHEMATICS

**Paper 0607/31**
**Paper 3 (Core)**

## Key messages

Candidates should have a graphic display calculator and ensure that they know how to carry out all the functions that are listed in the syllabus.

The candidates should be encouraged to show all their working out. Many marks were lost because working out was not written down and the answer given to only one or two significant figures.

Teachers should ensure that the candidates are familiar with command words.

Candidates should bring the correct mathematical instruments to the exam.

## General comments

Most candidates attempted all the questions, so it appeared that they had sufficient time to complete the paper.

Many of the candidates appeared to have a graphical calculator and knew how to use them to draw graphs and find the minimum and intersection points accurately. Not all candidates had mathematical instruments with them. A ruler is needed to draw straight lines.

Candidates should be careful when writing their answers. If no specific accuracy is asked for in the question, then all answers should be given exactly or correct to 3 significant figures. Many marks were lost because working out was not written down and the answer given to only one or two significant figures. Giving answers to fewer significant figures will result in a loss of marks and, if no working out is seen, then no marks will be awarded. When working out is shown and is correct, then partial marks can be awarded.

The candidates should be aware that if the question states 'Write down' then they do not have to work anything out. Candidates should be familiar with correct mathematical terminology.

## Comments on specific questions

### Question 1

**(a)** Most candidates managed to write the number correctly. The most common wrong answer was 5037.

**(b)** Many candidates were not able to write this number as a decimal. The most common answer was 2.8. Candidates should practice changing mixed fractions to decimals.

**(c)** Most candidates knew that they had to multiply the 325 by 0.88 but a few divided instead.

**(d)** Many candidates found the correct ratios here. The most common error was to divide the 3600 by 5, then 6, then 7 to get 720, 600, 514.

**(e)** Many correct answers for the prime number were seen. Some candidates wrote 21 and some others wrote a prime number that was not between 18 and 24.

**(f)** There were many correct answers for the sale price. Some candidates were awarded 1 mark for calculating the reduction correctly.

**(g)** Some candidates found working with standard form challenging. Those who found 4530 were awarded 1 mark for finding the correct value but not writing it in standard form.

**Question 2**

**(a)** This part was very well answered with few mistakes being made.

**(b)** Here too the majority of candidates knew that blue was the answer. Only a few wrote 7 instead of the colour.

**(c)** There were many correct answers for the difference between the yellow and purple cards.

**(d)** The fraction of cards that were green was also answered correctly by most of the candidates.

**(e)** The probability of picking a red card was also answered correctly by nearly all candidates.

**(f)** The bar chart too was well drawn overall. Some candidates appeared not to have a ruler, and a few drew a line graph instead of a bar chart.

**Question 3**

**(a)** Overall, finding the percentage was well answered.

**(b)** Many candidates managed to write the three numbers in the correct order. Some put $\frac{7}{8}$ before the 80%.

**(c)** Most of those candidates who calculated the cube correctly were able to give their answer to 2 decimal places.

**(d)** This part proved more challenging. Some candidates were awarded 1 mark for writing the full answer but not correct to 4 significant figures. It is important to show working out in questions like these because those candidates who showed no working out and wrote 7.457 for their answer were not awarded any marks as they had not rounded correctly.

**(e)** Many candidates managed to write this fraction in its simplest form.

**(f)** Here too there were many correct answers for the amount raised.

**(g)** Many candidates were awarded all 3 marks for finding the correct number of packs of cards and the correct change. Some lost marks because the change was calculated incorrectly, and a few had an incorrect number of packs of cards.

**(h)** There were a good number of correct answers in **part (i)** for adding the two fractions. A few candidates just added the numerators and the denominators. In **part (ii)** there were fewer correct answers with the most common wrong answer being $\frac{3}{104}$.

**Question 4**

**(a)** Not all candidates read the question correctly here. Some put $x + 2 = 8$ to give them 6 for the value of $x$.

**(b)** The perimeter was usually found correctly by those candidates who had the correct answer to **part (a)**. Those who did not have the correct answer, could gain 1 mark by adding 2 to their answer for **part (a)**.

**(c)** There were fewer correct answers for the area of the triangle. Many candidates did not realise that they had to find the altitude of the triangle first before using $\frac{1}{2} \times$ base $\times$ height. The mark tariff should have made them realise there was quite a lot of work required.

**Question 5**

**(a)** A good number of candidates knew that the angle was 90° in **part (i)** but 64° was a common wrong answer. In **part (ii)** just over half of the candidates found the correct angle and similarly in **part (iii)**. In **part (iv)**, the reflex angle, there were fewer correct answers.

**(b)** Not many candidates attempted to use the correct formula for finding the minor arc length and 4 was the most common wrong answer.

**Question 6**

**(a)** Many candidates plotted the 4 points correctly with only a few mistaking the scale on the height axis.

**(b)** Here too there were many correct answers of positive.

**(c)** The mean ages and height were often correctly calculated. Some candidates gave answers for the medians rather than the means.

**(d)** Quite a few candidates lost both marks here because they did not draw a straight line with a ruler. Others drew a straight line, but it did not always go through the mean point or was not within the accepted tolerance.

**(e)** There were many correct answers or follow through marks awarded for this part.

**Question 7**

**(a)** Not all candidates seemed to be familiar with mapping diagrams and this part was sometimes left unanswered. A common wrong answer was just to write 1, 2, 3, 4 as the answers.

**(b)** There were some correct answers here and the most common wrong answer was 3.

**(c)** The candidates found it difficult to write the inequality represented in the number line. Many were awarded 1 mark for writing $-1 \leqslant$ or $< 4$.

**(d)** Transformation of functions proved problematic for most candidates. Very few candidates managed to draw **part (i)** correctly and even fewer managed **part (ii)**.

**Question 8**

**(a)** Most candidates managed to score at least one mark for the enlargement. Some candidates lost all marks because they mentioned more than one transformation in their answer. When the question asks for a single transformation then the candidates will gain no credit if they give more than one transformation.

**(b)** Some candidates were awarded 1 mark for having the correct orientation but the wrong position for the rotation.

**(c)** Some candidates drew *D* in the correct place, others reflected in the *x*-axis and were awarded 1 mark. Some reflected in the *y*-axis and were not awarded any marks.

**(d)** The translation was the best answered part of this question.

**Question 9**

**(a)** Candidates do not appear to be comfortable with inequalities. There were some correct answers but also incorrect answers such as –2 or $x = -2$.

**(b)** There were many correct answers for the equation.

**(c)** Many candidates knew that $x = 0$ was the correct answer to the first part. The most common wrong answers were 1 and 8. In the second part, the most common wrong answer was 5.

**(d)** Quite a good number of candidates could subtract the fractions correctly in **part (i)** or at least gain one mark by having a correct denominator. In **part (ii)** there were far fewer correct answers seen. Some were awarded 1 mark for reversing the second fraction and multiplying.

**Question 10**

**(a)** Many candidates found the correct modal class. The most common error was to write $2 < t \leqslant 12$.

**(b)** In **part (i)** the mid-point was often correct. In **part (ii)** there were fewer correct answers. The majority of candidates wrote $\frac{35}{5} = 7$ as their answer.

**(c)** Here too many candidates wrote 7 or 6 as their answer to **part (i)**. They did not use the cumulative frequency curve to find their answer. Similarly for **part (ii)**. **Part (iii)**, however, had many more correct answers than the other two parts.

**Question 11**

**(a)** This question was reasonably well answered by those candidates who had a graphic calculator and knew how to use it. There were many correct answers for the points where the curve cut the $x$-axis.

**(b)** Here too there were many correct answers for the minimum point by the candidates who answered the question.

**(c)** Those who attempted to draw the parabola were usually successful.

**(d)** The points of intersection were often given correct to 3 significant figures which was good to see.

# CAMBRIDGE INTERNATIONAL MATHEMATICS

**Paper 0607/32**
**Paper 32 (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 graphic display calculator that are listed in the syllabus.

## General comments

The standard of work demonstrated on this paper was pleasing; the majority of candidates were well prepared for the examination. Candidates found the paper accessible and were able to attempt all questions to show their knowledge of the syllabus content. All candidates had sufficient time to complete the paper.

In general, work was well presented and candidates communicated clearly their approach to each question. Few topic areas caused any major problems. Calculators were used accurately and efficiently although it was clear that some candidates did not have access to a graphic display calculator, essential for this paper.

## Comments on specific questions

### Question 1

**(a)** Nearly all of the candidates were able to write the number in words.

**(b) (i)** Most candidates could write the number correct to two decimal places. Some thought the question required them to move the decimal point two places either to the left or the right.

**(ii)** Many found the rounding difficult here, with 348.9 being a common incorrect answer.

**(iii)** Rounding to the nearest 10 was performed correctly by most candidates.

**(c)** It was common to see candidates take the sensible approach of writing all of the numbers as decimals to help them to order the values. A few wrote the values in the reverse order.

**(d)** Most candidates used their calculators effectively and arrived at correct answers. Some used pencil and paper methods, not always arriving at the correct answers.

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**(e)** The majority of candidates found the two values correctly. Of those that did not, it should have been clear that their answers were incorrect when their two values did not add up to 216. It is always a good idea to do this check when dealing with ratio questions.

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**(f)** Another well answered question with many scoring full marks. A few only partially cancelled the ratio and so did not reduce it to its simplest form.

### Question 2

**(a)** Most candidates knew to divide the two values to get their answer.

**(b)** Very few did not multiply the 160 by 12 to get the answer.

**(c)** Few candidates used a correct formula. Of those that did, some used 12% instead of 1.2%. There was much misquoting of the compound interest formula. Others incorrectly used the simple interest formula. Most successful were those candidates who did a year-by-year approach.

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**(d)** This was generally answered well, although some just found the reduction and not the sale price.

**(e)** Many incorrectly gave the time taken as 1.15 hours instead of 1.25 hours. Most knew to divide distance by time to get the required speed and a good number went on to make a correct comparison with 34 to support their decision.

**Question 3**

**(a)** Although there were many correct answers, a significant number of candidates did not appear to have much experience with stem-and-leaf diagrams and wrote the two figure values for the leaves. A few omitted to complete the key.

**(b)** Most knew that the fastest reaction time was the smallest value in the list.

**(c)** The range and mean were both answered well by many. The median and interquartile range proved more of a problem since an even number of values meant the median, lower quartile and upper quartile each required finding the average of two of the values.

**Question 4**

**(a)** Completing the pattern in **part (i)** and completing the table in **part (ii)** were invariably done well. Many did not understand the question in **part (iii)**. It was common to see an answer of 28 although the question was requiring the 'sum' that led to this answer; that is 27 + 1.

**(b)** Although finding the next term in the sequence in **part (i)** was answered well, finding the *n*th term, in **part (ii)**, was less successful with many giving $n + 4$ as their answer.

**Question 5**

**(a)** A number of candidates did not know the mathematical name of the quadrilateral.

**(b) (i)** Candidates knew to find the area of the rectangle and the area of the triangle and add their two answers.

**(ii)** Many realised that first they needed to find the length of *AB* using Pythagoras' Theorem. Often, these then went on to find the perimeter of the shape correctly.

**(iii)** In general, candidates were not comfortable with trigonometry. Some chose an appropriate formula and applied it correctly. Others used trigonometry but found angle *BAE* instead of angle *EBA*. A number quoted one or all of the SOH, CAH, TOA triples but then did not know how to proceed. There were also answers given, always incorrect, with no supporting work.

**Question 6**

**(a) (i)(ii)** There were many correct answers. A small number of candidates wrote the coordinates the wrong way round.

**(iii)** It was common to see candidates using a formula to find the gradient. However, this was often done incorrectly with some writing the formula upside down and others ignoring the negative sign of their answer.

**(iv)** Very few found the equation of the vertical line *AD*.

**(b)** Although many candidates scored some marks here, few scored all three. Some missed out, or misquoted, the centre of rotation and others thought it was a 90° rotation. Common wrong answers involved reflection or translation or a combination of the two.

**Question 7**

**(a) (i)** Although there were many correct answers, a number of candidates found the union rather than the intersection of the two sets.

**(ii)** This part was generally answered well although some neglected to include C on the outside of the two sets.

**(iii)** The elements of Y' were often given as R,T or A,E,L,R,T rather than C,G,N.

**(b)** This question was found difficult by candidates, particularly finding the notation for the second diagram.

**Question 8**

**(a)** Nearly all candidates correctly gave the time shown on the clock.

**(b)** Only a minority of candidates chose the wrong scale factor to change kilometres to metres.

**(c)** The total cost and the change were found correctly by most candidates.

**(d)** Drawing the bar chart and finding the probability were both done well. **Part (iii)** was less successful where some candidates used their answer to **part (ii)** and others just did $180 \div 4$.

**Question 9**

**(a)** The mathematical names for the lengths were not well known. More candidates knew that *DE* was a tangent than knew that *AB* was a chord.

**(b)** A good number of candidates knew that a tangent was perpendicular to a radius. In **part (ii)**, many did not realise that the triangle was isosceles and tried to use trigonometry and other methods to find the angle required.

**(c)** Many had the correct units for their answer but the wrong working. The method for finding the area of a sector was not well known. Some thought that the question was asking for the area of the triangle *AOB*. Pythagoras' theorem, trigonometry and area formulae were seen often in incorrect attempts to find the area of the sector.

**Question 10**

Many candidates had a good understanding of algebra and got every part of this question correct.

**(a)** Although solving the equations in **parts (ii)** and **(iii)** were handled quite well, the inequality in **part (i)** posed more of a problem. Instead of an inequality as the answer, candidates often gave a single number answer, usually 5.

**(b)** Many candidates correctly collected some, if not all, of the associated parts.

**(c)** It was common to see a correct start to this calculation but then either not take the simplification far enough or make an error in the simplification which led to incorrect answers. Inverting and multiplying the second fraction or 'cross cancelling' $2x$ and $4x$ and/or 9 and 3 was the usual first step.

**(d)** Most correctly got an answer of 8 with just a few incorrectly giving 3.

**(e)** Rearranging the formula had varied success. There were errors in signs as well as errors in dividing by 6.

**Question 11**

It appears that many candidates do not have access to a graphic display calculator. It is a requirement for this syllabus and those candidate who either do not have one or do not know how to use it are at a disadvantage. There were a number of candidates not attempting any part of this question.

**(a)** Those with a graphic display calculator managed to sketch the graph of the hyperbola well.

**(b)** Many correctly found the coordinate of the point where the graph crosses the $y$-axis.

**(c)** There were very few correct answers to this part. It was clear that many candidates did not know what an asymptote was.

**(d)** The graph of the straight line was sketched accurately in many cases.

**(e)** Although there were a good number of correct answers here, many candidates did not know how to present their answers. Some gave the answers as coordinate points and others did not give their answers to a sufficient degree of accuracy.

# CAMBRIDGE INTERNATIONAL MATHEMATICS

**Paper 0607/33**
**Paper 3 (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 graphic display calculator that are listed in the syllabus.

## General comments

There were some encouraging performances on this paper. Candidates were quite 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. An incorrect answer with no working scores zero whereas an incorrect answer with working shown may score some of the method marks available. Calculators were used with confidence, although it does appear that some do not have a graphic display calculator, as the syllabus requires. Candidates had sufficient time to complete the paper.

## Comments on specific questions

### Question 1

**(a)** Candidates had little difficulty writing the number in words.

**(b)** Although most candidates could round the number to the nearest thousand, few knew how to round to one significant figure.

**(c)** Many candidates wrote a factor for both of these parts. 5 was a common answer to **part (i)**.

**(d)** Calculators were used appropriately here with most arriving at a correct answer to each part.

### Question 2

**(a)(b)(c)** The first three parts of this question were answered well by the majority of the candidates.

**(d)** Candidates, in general, correctly give their answers to this probability question as a fraction, a decimal or a percentage. Very few got this part wrong.

**(e)** In general, the bar chart was drawn well with few errors seen.

### Question 3

**(a)** In **part (i)**, few candidates knew that an angle of 130° was obtuse. Although $x$ and $y$ were often found correctly the geometrical reasons were less well known. Many just wrote down the calculations needed to obtain the answers.

**(b)** The mathematical name for the triangle was rarely correct. However, some did go on and correctly found the value of $p$.

**Question 4**

Many of the candidates scored full marks for every part of this question. Although a calculator could be used for some parts of the question, most used pencil and paper methods to find their answers.

**(a)** This was mostly answered correctly, although a few candidates gave an incorrect answer of 4%.

**(b)** There were fewer correct answers here, with common wrong answers being 0.78, 0.87 and 0.88.

**(c)** Again, there were many correct answers. Incorrect answers seen were 5.5% and 0.55%.

**(d)** Most knew how to start this although some did not cancel the fraction into its simplest form.

**(e)** Although there were many correct answers, a few reduced 2500 by 6%.

**(f)** Although this part could be done using a calculator, many did not feel the need. Nearly all candidates gave the correct answer.

**Question 5**

**(a)** Most candidates could work out the next three terms and give a clear explanation of the rule for continuing the sequence.

**(b)** Although generally well answered, some candidates added 4 lots of 6 to 31 instead of subtracting. Some others subtracted 5 lots of 6 from 31 instead of 4 lots of 6.

**(c)** Some correctly substituted 1, 2 and 3 for $n$ in the formula to find the required three terms. A common wrong answer was to work out $1^2 + 4 = 5$, $5^2 + 4 = 29$ and $29^2 + 4 = 845$.

**(d)** Finding the $n$th term of the sequence was not well done. Many incorrectly wrote $n + 2$ as their answer since the sequence was going up by 2 each time.

**Question 6**

**(a)** Many candidates could plot the five points correctly on the grid. Some, however, omitted a point and a few others plotted incorrectly.

**(b)** Most knew that the points displayed positive correlation.

**(c)** The means of the two sets of values were usually calculated correctly. Few realised that these means were needed when drawing a line of best fit. The lines of best fit drawn were often either not through the mean point, or outside the tolerance allowed for the position and gradient of the line. Some others were not straight lines.

**(d)** Some candidates realised that they needed to use their line of best fit, as the question had stated, and read off the technology mark where the science mark was 35. Where this happened, many were successful with their answer.

**Question 7**

**(a)** Candidates showed a good understanding of the methods required when solving equations. There were many correct answers to both parts.

**(b)** This was answered successfully by many. However, the method used was not always the one expected. Often seen as a first step was $(x+3)+(x+3)+(x+3)+(x+3)$ rather than $4\times x+4\times 3$.

**(c)** Many were less successful with factorising. It was clear that this is a less well understood topic.

**(d)** Although candidates, in general, knew what to do in **part (i)**, many omitted to evaluate their expression correctly. It was common to see $3x \times 2x$ as an answer or $3x \times 2x = 6x$. A few found a formula for perimeter instead of one for area. Some went on to correctly solve (their expression in *x*) = 54 in **part (ii)**. Others found the correct answers by trial and error.

**Question 8**

**(a)** Candidates managed to score some marks here but rarely full marks. Some did not find the area of all six sides, others chose the wrong units and a few found the volume instead of the surface area.

**(b)** Many located the correct formula from the formula page, substituted values correctly and gave the correct answer.

**(c)** In **part (i)**, very few knew that tangent/radius was the geometrical reason the angle was 90°. Most answers were based on half the 180° angle on the straight line. Others just said it was 90° because it was a right angle. In **part (ii)(a)**, a number realised they needed to use Pythagoras' Theorem to find the length. This was often done correctly. Few managed to employ trigonometry in **part (ii)(b)** to find the angle. Often the size of the angle was guessed or measured on the diagram.

**Question 9**

**(a)** Many correctly wrote the population as an ordinary number.

**(b)** A significant number found the total as an ordinary number but then did not write this in standard form, as required.

**(c)** Most knew what to do here but often the answer had too many or too few zeros.

**(d)** Again, most could perform the calculation but few rounded their answer correctly to the nearest integer.

**(e)** Only a minority of candidates could write this number in standard form.

**Question 10**

**(a)** Many correctly reflected the given triangle in both the *x*-axis and the *y*-axis. However, describing the transformation to map triangle *Y* onto triangle *X* was less well done. Some gave insufficient detail in their answer and others quoted more than one transformation.

**(b)** The translation was, in general, drawn well, with a few having just one of the *x*-move or *y*-move correct.

**Question 11**

**(a)** Most found the number of cars for each newspaper and subtracted the values.

**(b)** There was clearly some misreading of the vertical scale in answers to this part. A number of candidates did not read the question carefully and found the number of cars costing $8000 or less.

**(c)** A significant number did not know how to find the median and the interquartile range. Some correct attempts were marred by candidates' misreading of the horizontal scale.

**(d)** Many made a correct choice and gave an appropriate reason here. Candidates used the diagram well to support their answer.

**Question 12**

It appears that many candidates do not have access to a graphic display calculator. It is a requirement of the syllabus. Candidates who do not have a graphic display calculator, or do not know how to use it, are at a disadvantage. There were a number of candidates not attempting any part of this question.

**(a)** Where candidates had access to a graphic display calculator, sketches were mostly clear and accurate. Some found the *x*-coordinate of the minimum point accurately whereas others did not use their calculator properly and had a less accurate answer.

**(b)** Those with a calculator often sketched the graph well.

**(c)** Although there were some correct answers here, a few gave the answers as coordinate points. Others did not find their answers to a sufficient degree of accuracy.

# CAMBRIDGE INTERNATIONAL MATHEMATICS

**Paper 0607/41**
**Paper 4 (Extended)**

## Key messages

Sufficient working should be shown in order to gain method marks if the final answer is incorrect.

The general instruction is that answers should be given correct to three significant figures unless the answer is exact or the question states otherwise. A few candidates lost marks through giving answers too inaccurately.

If a question asks for an answer to be shown to be correct to a certain accuracy, it is necessary to first show that answer to a greater degree of accuracy.

Some candidates appeared to use equation solving functions on their calculators. Candidates should be reminded that this is not permitted. Solutions using graph sketches from a graphic display calculator are accepted and even encouraged but, if used, should be accompanied by copies of the sketches.

## General comments

The paper proved accessible to almost all the candidates with few candidates scoring very low marks and omission rates were extremely low. There were scores across the entire range, but very low scores were comparatively rare.

## Comments on specific questions

### Question 1

**(a) (i)** This was almost always correct with just a few candidates making sign errors.

**(ii)** This was also done very well with, again, sign errors being the main source of mistakes.

**(b)** The elimination method was the most method used. Any errors that occurred in this method were usually in adding or subtracting negatives wrongly. Those using the substitution method often had problems dealing with the fractions.

**(c)** Most candidates were able to reach $x > 4$ but very few the second answer. The error was usually caused by starting with $2x + 1 > -9$. A few candidates kept the modulus sign in throughout their working including the answer.

### Question 2

**(a) (i)** Candidates achieved a high success rate on this question. However, some still continue to ignore the frequencies and find the mean of the mid-points or even the mean of the frequencies.

**(ii) (a)** Almost all candidates gave the correct cumulative frequencies

**(b)** Most candidates drew an acceptable cumulative frequency diagram with very few plotting other than at the right-hand end of the intervals. A few candidates chose to draw a line of best fit and a handful of bar charts were seen.

**(c)** Most of the candidates with successful cumulative frequency diagrams were able to find the correct interquartile range.

**(b)** This part proved more difficult for candidates. Even those who gave correct expressions, in terms of *k*, for the mid-interval values, often found the algebra too difficult. Common incorrect expressions for the mid-interval values were $\frac{k-20}{2}$ and $\frac{80-k}{2}$.

**Question 3**

**(a)** Almost all candidates translated the triangle correctly.

**(b)** Almost all candidates recognised that the transformation was a translation. A few made sign errors with the vector and some gave the original vector not the vector representing the inverse.

**(c)** The majority of candidates gave a correct diagram although a number rotated about the wrong centre or rotated anti-clockwise.

**(d)** This part was less well done with many reflecting about a wrong line.

**(e)** Most candidates recognised the transformation as a rotation but a few gave the wrong angle or direction. The centre proved more difficult although better candidates were usually successful.

**Question 4**

**(a)** The vast majority of candidates were successful here.

**(b)** This was also done well although slightly less well than **part (a)**. The most common mistake was to find 125% of 960, resulting in an answer of 1200.

**(c) (i)** The majority of candidates were able to quote and successfully apply the compound interest formula. A few used step by step methods and this too was usually successful. A minority of candidates used simple interest.

**(ii)** This question was very well done. Many used trial and improvement and a substantial number used logs. A few of these did not give the number of complete years but left the answer as, for example, 10.3.

Here too, a small number used simple interest. Just a few candidates gave the decimal answer.

**(d) (i)** Almost all candidates reached the correct answer.

**(ii)** This part proved more difficult but many candidates did it well. Many used 75 and 45 from **part (i)**. Others worked with the shares 3 and 5 or with percentages. A number of candidates worked with fractions and did not revert to ratios for their conclusion.

**Question 5**

**(a)** Most recognised the quadrilateral as a trapezium but there were a variety of wrong answers seen.

**(b)** Many candidates were successful here but also many omitted to mention radius and/or tangent. It is always safer in these questions to quote the statement in the syllabus.

**(c) (i)** This was very well done.

**(ii)** This too was very well done.

**(iii)** This part proved much more difficult. Most candidates did not recognise the parallel line property.

**(iv)** This was found to be easier than **part (iii)**. Many candidates recognised that angle *AOC* was twice angle *ABC* but some of those could not use the isosceles triangle property.

**Question 6**

**(a)** Sketches were usually of a fairly high standard although a few could not cope with the modulus correctly. There remain a very few candidates who used plotting rather than their graphic display calculator.

**(b)** This was generally well done although a number of candidates did not give the answer to a sufficient accuracy. It was surprising to see a few candidates using a Pythagoras formula for the distance between two points when the two points were on the *x*-axis.

**(c)** Here too a number of candidates did not give answers to the required degree of accuracy. A number of candidates tried to solve the equation algebraically rather than using their graphic display calculator. This was rarely successful.

**(d)** The majority of candidates could find the minimum point but there were also many incorrect answers.

**(e)** This part proved more difficult. Many did not realise what was required and answers using the answers to **part (c)** were common. That said, very able candidates gave both parts of the answer correctly.

**Question 7**

**(a) (i)** This was done very well but a number gave the answer $\frac{0}{5}$ which was not accepted.

**(ii)** This was almost always correct.

**(iii)** Many candidates found this difficult. Very few sample spaces were drawn. Those using products of probabilities often had more than 4 pairs of products. However, better candidates did it well mostly using products of probabilities.

**(iv)** Similarly to **part (iii)**, many found it difficult. Many candidates using products of probabilities had more than three pairs. Here too, able candidates did it well.

**(b) (i)** The Venn diagram was usually correct.

**(ii)** There were many correct answers here. The main error was using the union symbol instead of the intersection symbol. Weaker candidates often used incorrect set language such as *AB*'.

**(iii)** This was usually correct although some chose the number in the wrong subset.

**Question 8**

**(a)** Most candidates were able to apply the cosine rule correctly. However, there are still too many candidates who do not recognise that, in order to show a result correct to one decimal place, it is necessary to first show it to at least two decimal places.

**(b)** The majority of candidates used the sine rule as demanded by the question and were able to quote and transform it correctly. Candidates should realise that it is best to quote and transform the rule with the original data and only work out the result at the end. This way they do not lose accuracy. Too often, when results are worked out part way through, accuracy is lost.

**(c)** A large majority of the candidates used the correct area formula successfully.

**(d)** Middle and more able candidates did this very well indeed. There were some very long methods seen for the area of the isosceles triangle *BCD* which often lost accuracy. A few candidates treated the shaded area as a semi-circle.

**(e)** Most candidates did this well. However, a fairly high proportion used the straight line *CD* rather than the length of the arc *CD*.

**Question 9**

**(a)** The majority of candidates realised that it was necessary to work out the perpendicular height and were able to use Pythagoras' Theorem correctly. A few use $60^2 + 40^2$ instead of $60^2 - 40^2$ and some used a three significant figure answer in their volume calculation which meant their final answer was not accurate enough. A few candidates used the slant height instead of the perpendicular height.

**(b)** Most candidates were able to show the result satisfactorily. Exact results were required and so those substituting decimals for π and working back to 4000π did not gain full credit. When asked to show a result, it is important to show all the steps not go straight to 1600π or 2400π.

**(c)** Many candidates understood that the linear scale factor was equal to the square root of the area scale factor and so were able to show the result correctly. Here too, exact results were required and so those substituting decimals for π and hence not reaching 20 exactly did not gain full credit.

**(d)** Candidates found this part difficult and a number of candidates omitted this question. Many candidates simply subtracted the surface areas of the two cones and were unable to cope with the flat surfaces correctly, often reaching 3000π or 3400π. Those working the three surfaces out separately were the most successful.

**Question 10**

**(a) (i)** Most candidates did this well using the correct proportionality between *x* and *y*. A significant number stopped once they had reached $y = \frac{36}{\sqrt{x+1}}$. The common wrong proportionalities used were direct proportion and inverse proportion to $(x + 1)^2$

**(ii)** The candidates who used the correct proportionality in **part (i)**, were usually able to reach $\sqrt{x+1} = \frac{36}{1.5}$. However, many of them could not solve the equation correctly.

**(b)** This part proved more difficult. Those using the correct proportionality could usually reach $w = 9\sqrt{x+1}$ but many could proceed no further. A few more able candidates realised that *wy* was constant and so went to the answer directly.

**Question 11**

**(a)** This was very well done with almost all candidates reaching the correct answer.

**(b)** This too was well done although a number made sign errors and some found f(–7) rather than solving f(*x*) = –7.

**(c)** Most managed to start finding the inverse correctly but some made algebraic errors in finding the final function with sign errors being the most common. A few, having reached *x* = f(*y*), omitted to go back to a function in *x*.

**(d)** Although reaching a fully correct derivation proved difficult for most candidates, most were able to make some progress for which they gained partial credit. Some, in finding, 7h(f(*x*)) multiplied both the top and bottom of the fraction by 7. Others made sign errors in expanding brackets or rearranging the equation. A number, having found the quadratic equation, omitted the working in finding their solution. In eliminating the fractions, some omitted the brackets in (5 – 2*x*). That said, there were a significant number of fully correct solutions from able candidates.

# CAMBRIDGE INTERNATIONAL MATHEMATICS

**Paper 0607/42**
**Paper 4 (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 at least 3 significant figures. Candidates are strongly advised not to round off during their working but to work at a minimum of 4 significant figures. Most candidates followed the rubric instructions carefully but there continues to be a number of candidates of all abilities losing unnecessary accuracy marks either by making premature approximations in the middle of a calculation or by not giving answers correct to the specified degree of accuracy.

The graphic display 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.

Many candidates needed a greater 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. This is particularly noticeable in ‘show that’ style questions when working to a given accuracy. There could be some improvements in the following areas:

- care in copying values from one line to the next
- care in reading the question carefully, for example, transformation questions which ask for a single transformation or ‘with/without replacement’ in probability questions.

The sketching of graphs continues to improve and there was more evidence of the use of a graphic display calculator supported by working, this is in the spirit of the syllabus. However, there was evidence of use of facilities in the calculator that are not listed in the syllabus. These facilities often lead to answers given by candidates without any working and this must be seen as a high-risk strategy.

Topics on which questions were well answered include transformations, simple probability, simultaneous equations, percentages, compound interest, cumulative frequency diagrams, Pythagoras Theorem, trigonometry and curve sketching.

Difficult topics were combined probability, laws of logarithms, understanding of mathematical language, interpretation of data from frequency diagrams, inequalities and mensuration.

**Comments on specific questions**

**Question 1**

**(a)** This part was intended to be an easy opening question, but candidates found it difficult, with many only scoring a single method mark. A common error was to use the formula for the volume of a pyramid rather than a prism, resulting in an answer of 51. Another common incorrect answer was 8.5, resulting from the candidate thinking they needed to solve $8 \times 7 \times l = 476$ to find the length, rather than the area of the cross-section × length; often the factor of 2 was missing.

**(b) (i)** The majority of candidates gained this mark. Errors were sometimes made when changing their answer to kilograms, for example, dividing by 100 with the figures 6288 often seen. Occasionally candidates did not convert their answer from grams or rounded their answer to 2 significant figures or truncated their answer to 62.8.

**(ii)** Many candidates scored full marks on this part. However, those who did not usually scored the first method mark for finding 20 as the cube root of 8000. A common error was to divide by 3 rather than taking the cube root. Some candidates did not complete the question correctly from this point as they only found the area of one face rather than all 6.

**(iii)** In this part many candidates incorrectly quoted the volume of a sphere as $\frac{4}{3}\pi r^2$ and gained no credit, whilst others stated the correct formula but then substituted incorrectly by squaring the radius. Many lost the final mark as they gave the answer out of context as for example 44.5 instead of 44, or they rounded up to 45. Some tried to use the area of a circle formula to try to find the volume.

**Question 2**

**(a)** The usual method attempted was the straightforward method of dividing 210 by 7 and then multiplying the result by 8 to find 240. Another valid method seen was to recognise that 210 represented $\frac{7}{15}$ of the total amount, hence the total amount (450) could be calculated, with many then subtracting 210 to obtain 240 as required. Some candidates used the given value of 240 and essentially verified that it was correct by dividing by 30 to obtain the given ratio. Such methods are not acceptable as candidates cannot assume the given result in a 'show that' or 'prove' type question. Other solutions involved comparing ratios to obtain fractional equivalences such as $\frac{8}{7} = \frac{x}{210}$.

**(b) (i)** This part was the best answered response on the paper with nearly all candidates gaining the mark. Most candidates simply wrote down their answer with little or no working seen. Occasionally some candidates were confused with the required multiplier and used 0.79.

**(ii)** Most candidates gained at least one mark for setting up the correct fraction. There were minimal errors with rounding and/or percentage calculation misunderstandings with this question. A small number of candidates added their values incorrectly, or rounded their 114.1 before working out the percentage, which in most cases did not take their answer outside the acceptable range. However, candidates would be advised to use exact values, essential in all subsequent work where a previous answer is to be followed through, and also to give all figures for their final answer before rounding as required.

**(c)** In this part it was generally observed that candidates had mastered the concept of reverse percentages. It was unusual to see the incorrect answer of 168 but some calculated 80% of 140 and obtained 112 or multiplied 140 by 1.2.

**(d)** This part differentiated well between candidates. Common errors were in calculating the remainder incorrectly, and/or comparing the incorrect ratios, for example, 114.1 compared to 35. It was unusual to see, for example, 47.5% of 240 compared with 33% of 210. Some candidates appeared to be seeking an integer value of *n*.

**Question 3**

**(a) (i)** Most candidates scored the available mark and it was evident that candidates were using their calculators well to answer all parts of **(a)**. There was a significant number of candidates that answered the question algebraically by substituting $x = 7$ into the equation.

**(ii)** Most candidates gave a correct answer here. Incorrect answers were either the *x*-coordinate (horizontal distance = 5 m) that gave the maximum height or the answer was given in coordinates as (5, 2.5).

**(iii)** Similarly, mostly correct answers were seen here with candidates able to read the value from their calculators. Generally the candidates who did not get this part correct were those using an algebraic approach.

**(iv)** This part was not answered so well. However, the majority of candidates still gained both marks. There were more candidates approaching this in an algebraic manner but with less success taking this approach. Those that did work it through often only gave answers to 2 significant figures. Very rarely was $2\sqrt{5}$ seen as a final answer.

**(b) (i)** Many candidates scored full marks and were clearly able to use their graphic display calculators to draw and then replicate the graphs. The branch in quadrant 2 was invariably drawn correctly; not touching or crossing the axes and with good shape/formation. The branch crossing quadrants 4 and 1 was not shaped as well with the upper part often tending towards a straight line rather than a curve. Very little excessive feathering or joined branches was seen.

**(ii)** Here it was clear that many candidates were not familiar with the terminology of asymptote and gave answers that did not relate to the question. Occasionally candidates did give additional equations as well as $x = 0$ and $y = 0$ or put a condition on the asymptote such as $y = 0$ when $x < 0$.

**(iii)** This part was found difficult, with only the more able candidates being awarded the single available mark. Many lost the mark for stating $k = 0$.

**(iv) (a)** Most candidates scored the first mark for drawing a straight line with a negative gradient and positive *y*-intercept. The second mark was often generously given for intent rather than their line passing through (3, 0) and this did lead to the majority of candidates scoring full marks here.

**(b)** Many candidates used their calculators correctly to find both answers to the required degree of accuracy and gained full marks. The first value was sometimes incorrectly given as – 0.38 or 0.382 and on some responses the *y*-coordinates were also given meaning that full marks were not awarded. It was also evident that some candidates were not using their calculator to solve this and put the two equations equal to each other and tried to solve algebraically, usually unsuccessfully.

**Question 4**

**(a)** Most candidates made a good attempt at this part and there were a lot of correct answers. Some were unable to solve the equation having formed it correctly, possibly as it involved decimals. The most common error was to put $\frac{(25+x)}{6} = 3.75$ which led to a negative value for *x*; others did obtain the correct numerator gaining one mark but then divided by 6 and not $(25 + x)$.

**(b) (i)** Most candidates knew that they needed to use the mid-intervals of the groups and were able to gain at least one mark for showing these values. Many candidates did not show sufficient working and lost marks when slips were made with calculations or rounding.

**(ii)(a)** The cumulative frequency table was nearly always completed correctly. The consequences of not obtaining an increasing curve were significant in that no further marks could be awarded in **part (b)(ii)**.

**(b)** Usually points were plotted very accurately, although some candidates used excessively large crosses which obscured the accuracy of the curve. The scales were straightforward to use and it was pleasing to see most plotting at the correct *t* values.

**(c)** Candidates understood how to find the median but despite the scale being straightforward on the horizontal axis, a number of candidates read their 11.5 as 13.

**(d)** This was a well answered part except for those candidates who had misread their median as 13 and then read from 11.5 back to 35. Most knew to subtract their reading from 70 to obtain the correct answer and very few just gave their reading as the final answer.

**Question 5**

**(a)** This was answered well with the most common approach being to calculate $\frac{1}{2}\times 12\times 12\times \sin 60$, often with the final answer left as $36\sqrt{3}$. A common misinterpretation was to calculate $\frac{1}{2}$ × 12 × 12, showing a misunderstanding of how the $\frac{1}{2}$ × base × height formula relates to a triangle. The alternative approach of using Pythagoras initially to find the height and then using the area of a triangle formula was also seen on many responses. Premature rounding often cost candidates the final mark here.

**(b)** A reasonably well answered part, although several candidates incorrectly assumed 30 to be the radius. The method marks could only be awarded for using a radius found from a valid method. Many also rounded prematurely here resulting in an answer out of range.

**(c)** A discriminating part in which the majority of candidates began by finding the area of one triangle and then multiplying their answer by 10. Other, more laborious and often unsuccessful, methods were seen with varying sub-divisions of the decagon. Some responses could have been more explicit when finding the height or the 'radius' side, leaving gaps in stages of their working. Some candidates did not really comprehend how to find a valid area. However, they often scored a mark for stating a correct angle, often seen on the diagram.

**Question 6**

In all parts of this question, it was important to realise that, for example, 1 + 2.5% alone is not creditworthy when a final answer does not gain full marks, whereas 1 + $\frac{2.5}{100}$ or an equivalent is.

**(a)** In this part it was clear that most candidates had experience of this type of question with the most common approach using logarithms to obtain the decimal solution of 10.6… and then rounding up to 11 years. Trial and improvement solutions were less common and sketch solutions were rarely seen. Errors manipulating their correct logarithmic equation and/or rounding errors were reasonably common here, and it was evident that some weaker candidates still struggle to process logarithmic equations and with using the laws of logarithms to solve these equations.

**(b)** This was a more challenging part for the candidates and they were less successful here. This was mainly due to the misunderstanding of how to calculate the 'original' amount to base their calculations for the 2027 amount on. It was very common to see candidates calculate 97.5% of the 2024 amount to obtain the 2023 amount (usually computed as $23 970), which ultimately led to errors with the overall method. Some candidates managed to find the year 2000 value and used that as the basis for their calculation to obtain the 2027 value, which was equally valid and usually correct. However, even amongst the incorrect responses seen, the 2027 value was often calculated correctly which allowed many candidates to gain at least one mark. Some candidates left their final answer as a decimal, despite the clear instructions of the question to give their answer correct to the nearest dollar.

**Question 7**

**(a)** A very well answered part with most candidates correctly expanding the brackets as an initial step rather than dividing both sides by 8. Errors were often seen in the next step when rearranging the equation to isolate the term in *a*, with a sign error occurring at this point. Full marks were scored by the majority with the answers given in fractional and decimal forms. Premature rounding or truncation cost several candidates the final mark here.

**(b)** This was a potentially tricky simultaneous equations problem with fractional coefficients. A range of correct methods were used well by the majority, elimination and substitution were equally used. The fractions did not appear to pose too many problems for most whilst some did convert them to decimals immediately often losing a mark through their final inaccuracy. Many multiplied the equations by suitable integer values to eliminate the fractions as a first step, leaving them with whole numbers in their equations. There were a few arithmetic slips but generally this question was very well done.

**(c) (i)** Candidates usually scored full marks here, although some reversed the signs but did earn a mark. There were two main methods evident; either splitting the middle term or finding factors of – 56 that added to –1.

**(ii)** A well answered part with most following on successfully from the previous part but a small number restarted using the quadratic formula with most being awarded the mark.

**Question 8**

**(a)** In this part, many candidates lost marks for not reading and implementing the instruction 'single transformation'. Giving more than one transformation automatically scores zero.

**(i)** A well answered part with the majority gaining both marks. Incorrect answers included translocation and transition for the first mark. The work for the second mark was sometimes given as coordinates or with a fraction bar seen. The vector was allowed to be given in words but some incorrectly stated the *y* displacement before the *x*.

**(ii)** Most scored at least one mark in this part, usually for enlargement although reduction was seen on a few scripts. The scale factor was often given as $-\frac{1}{2}$ and the centre of enlargement sometimes only had one correct coordinate; the vector form was allowed here.

**(b) (i)** Most candidates gained the single available mark although a common incorrect answer seen was (– 8, 9), for subtracting instead of adding the values.

**(ii)** A reasonably well answered part with most understanding the need to use Pythagoras to find the magnitude. $\sqrt{74}$ as a final answer was seen on many responses.

**(c)** A good set of responses was seen with most candidates initially finding the correct gradient, although some divided the *x* increment by the *y*. The second mark was often awarded for a choice of valid methods, occasionally some used the mid-point (–1, 5) for their substitution. A few candidates misread or mis-interpreted the question and found the equation of the perpendicular bisector instead.

**Question 9**

**(a) (i)** This was one of the more accessible questions on the paper with nearly all responses correct.

**(ii)** The majority of candidates achieved at least two marks, usually for 4 084 101 seen. Of the remainder most gained a method mark for $21^5$. Most candidates who wrote their answer in standard form did so with $10^6$. However, several did not give their answer to 4 significant figures as required or gave $10^{-6}$. Answers of $4.08 \times 10^6$ and $4.084 \times 10^3$ were also evident.

**(iii)** The majority of candidates gained full marks; many others gained at least one mark for a correct expression often leading to the second mark for a correct expansion. Common errors from the expansion were only having one $6x$ term and giving $2x^2$ instead of $4x^2$. Unfortunately, some candidates achieved the correct answer but then divided this by two for their final answer.

**(iv)** The majority of candidates gained full marks here whilst most others were awarded the method mark for a correct first step with $x = 3 + 2y$ regularly seen.

**(v)** Most candidates gained a mark for finding –1 and 32 but many did not follow on to put the inequality together correctly. Many lost marks for using $x$ whilst others only found one correct value. The use of $y$ in place of $h(x)$ was acceptable and often seen.

**(b) (i)** Either full marks or 0 were awarded on the majority of responses with very few gaining the method mark alone for $2x = 10^3$. A lack of understanding in the use of logarithms was evident in many unsuccessful attempts.

**(ii)** Another part in which many candidates scored a mark for a correct first step with $x = \log(2y)$ or $2x = 10^y$ seen. The correct answer was often seen in the working but spoiled by giving a final answer of $5^x$.

**(iii)** Many candidates gained a single mark for $\log(2x)^3$ or $\log(8x^3)$, but were unable to complete to the correct final answer. Many candidates did not place brackets correctly here with $\log 2x^3$ regularly seen, earning no credit.

**Question 10**

In all parts of this question, decimal and percentage equivalents were allowed with the usual rules of accuracy being applied. Equally, candidates were not penalised for incorrect cancellations or conversions from correct fractions to equivalent forms.

**(a) (i)** Most candidates gained the mark here with only a few responses showing random incorrect answers or not attempted.

**(ii)** This was a well answered part with most candidates either correct or following on correctly from their answer in **part (a)(i)**, providing their final answer was an integer value. $\frac{25}{60}$ was seen on some responses.

**(b) (i)** Most candidates understood that they needed to multiply fractions to obtain the final answer with the majority scoring full marks, decimal equivalents were not seen on many responses. A common slip was for candidates scoring one mark for $\frac{4}{12} \times \frac{3}{11}$ but then giving a final answer of $\frac{12}{121}$.

**(ii)** A well answered part with the majority gaining at least one mark. Many scored the first mark by showing $\frac{5}{12} \times \frac{4}{11}$ or $\frac{5}{33}$. Very few candidates scored the second mark, indicating that they did not realise that there was more than one way to achieve the required outcome. In both parts of **(b)** many did not spot that this was a 'without replacement' probability question.

**(c)** Only the more able candidates scored full marks here. A few missed the requirement for the 'replacement' of the ball and used fractions with a reducing denominator. However, some did reach an answer of $\frac{19}{66}$, which was awarded a special case mark, as it required understanding that there were three products.

**Question 11**

**(a)** Responses had a variety of outcomes with many candidates simply cancelling parts of the numerator and denominator incorrectly. Many candidates did factorise correctly, usually with greater success with the factorisation of the denominator than the numerator. Common errors were omitting to fully factorise the denominator and not recognising the difference of two squares in the numerator. Some candidates achieved the correct answer, but then spoiled their final answer with incorrect cancellation.

**(b)** **(i)** This challenging 'show that' part also had many varied outcomes. However, the majority of candidates achieved a mark for a successful expansion of brackets. The common errors seen were as a result of not using brackets and sign errors on the $x^2$ term. Many worked through the solution successfully but then omitted writing the answer as an equation, or omitted '= 0'. Candidates who worked steadily through with careful working out were the most successful with those who initially cleared the fraction generally gaining full marks.

**(ii)** Many candidates gained at least two marks for the correct answers given to the required degree of accuracy but often showed no working, relying on their calculator answers. Method marks usually were lost through lack of care; – 41 was often seen instead of – (–41) and $(-41)^2$ was regularly seen without brackets; short fraction bars and square root signs were also evident. A few candidates opted to provide a suitable sketch as an alternative for the method marks.

# CAMBRIDGE INTERNATIONAL MATHEMATICS

**Paper 0607/43**
**Paper 4 (Extended)**

## Key messages

Full syllabus coverage is necessary as candidates must answer all questions. This includes all core topics as well as the extended topics. The recall and application of formulae and mathematical facts to apply in familiar and unfamiliar situations is required as well as the ability to interpret mathematically and problem solve with unstructured questions.

Candidates need to understand that different parts of a question are often related as the answer to one part may need to be used in a subsequent part. Experience of questions that combine topics is also essential for success at Extended level.

Communication and suitable accuracy are 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 use their calculator efficiently and work with a minimum of 4 significant figures to avoid losing accuracy marks.

The efficient use of a graphics display calculator is required and sketching from the calculator will usually be regarded as working. Such sketches should show all points of interest, for example, when sketching a quadratic function, the points of intersection with the $x$-axis should be clearly indicated.

It is anticipated that the calculator has been used as a teaching and learning aid throughout the course. Candidates should be aware that the more advanced functions will usually remove the opportunity to show working. The syllabus states which built-in functions candidates are permitted to use. Those candidates who choose to use other built-in functions will not be able to gain credit for 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

Many candidates were well prepared and all candidates were able to complete the paper in the time allowed. However, many candidates found it difficult to make any progress on the more challenging questions and scored few marks.

Most candidates gave answers to the required accuracy. Sometimes, in longer questions, candidates' final answers were outside the accepted range because of premature rounding in intermediate calculations.

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.

This paper contained a number of 'show that' questions and these caused problems for most candidates. It is essential for candidates to understand that the given value must not be used in the calculations which must begin by using the information given in the question. The working will then move towards finding the given value. It is important that the method is clearly shown and intermediate working keeps accuracy to at least 1 significant figure greater than that of the given answer. The final mark will be awarded for a more accurate value which rounds to the given answer.

Some candidates show clear working, but others cause difficulties for themselves by overwriting a previous answer. If an answer is replaced, the previous answer must be clearly crossed out. In graph work, there are many good sketches but also some where it is unclear which line or curve is part of the intended answer.

It was good to see that there was more evidence of the use of a graphics calculator in support of working.

There was, however, evidence of use of facilities in the calculator that are not listed in the syllabus, for example, in financial calculations. These facilities usually lead to answers given without any working and this must be seen as a high-risk strategy as a slight error will result in 0 marks.

Topics which were successful included dealing with compound interest, simple transformations, finding the height of a pyramid, and finding the mass of an object involving different shapes, and factorising.

Difficulties were seen in finding some statistical measures from a simple frequency table, working with simple interest, finding the gradient and *y*-intercept from the equation of a line given in implicit form, finding the range of values for which the gradient of a graph is positive, the inverse of a stretch transformation, dealing with absolute value, dealing with a composite function involving a sine function, and bearings.

## Comments on specific questions

### Question 1

**(a) (i)** The correct mode of 0 was given by most candidates, but a common error was to give the value as 3.

**(ii)** The correct answer was often seen, but many candidates were not familiar with finding the median from a table of single values with their frequencies.

**(iii)** Many candidates found the range correctly, but an error commonly seen was for the candidates to subtract the lowest frequency from the highest frequency.

**(iv)** The correct answer was often seen, but many candidates were more used to finding the quartiles from a cumulative frequency polygon and were unable to cope with just having a table of frequencies.

**(v)** Very few candidates showed any working and, as a result, some lost both marks when a truncated value of 2.17 was given as the answer instead of the correct value of 2.175 or the rounded value of 2.18, correct to 3 significant figures.

**(b)** This was a much more demanding question for which many candidates gave no response.

Some candidates gave the correct answer but with no working and this was a risky strategy eliminating the possibility of method marks being gained had an error been made. There were many good solutions, with full working clearly set out. The most common problem was candidates omitting to correctly multiply the mean of 2.28 by the denominator of $111 + n$.

### Question 2

**(a)** The majority of candidates gave the correct answer. The most common error was to divide 3000 by 9 and then multiply by 4.

**(b)** Many candidates found it more difficult to deal with simple interest than with compound interest, and a minority answered this part as a compound interest question. The most common error was for candidates to include 3840 as part of a calculation instead of dealing with the interest of $840 separately. This often led to the incorrect answer of 0.128.

**(c)** Candidates were on much more familiar ground here and there were many correct answers with very good working which was well set out and easy to follow.

**(d)** This was again a standard type of financial problem and the great majority of candidates understood the need to round up their calculated value to give the correct whole number of years. There were many answers which followed clearly set out working, sometimes involving the confident handling of logarithms. However, some candidates rely on using their calculator to work towards the first value exceeding $6000 and, although usually successful, an unfortunate touch on the wrong calculator key could lead to a loss of some or all method marks.

**Question 3**

**(a) (i)** This was a straightforward probability question which was answered correctly by most candidates.

**(ii)** This was a straightforward probability question which was answered correctly by most candidates.

**(b) (i)** There were many correct answers but sometimes the correct method was seen but followed by an error the most common of which was $\frac{1}{6} \times \frac{1}{6} = \frac{1}{12}$.

**(ii)** Some candidates realised that all that was required was to subtract their previous answer from 1, but many chose to work out the answer directly and usually made an error by omitting a required set of probabilities. Given that the answer was worth only 1 mark, this is an indication that an approach involving much calculation is almost certainly not the optimal one to take.

**(c) (i)** The great majority of candidates placed the probabilities correctly on the given tree diagram.

**(ii)** Many candidates used the correct method and gave the correct answer but some lost a mark by giving their answer as 0.44 with no more accurate value seen. It must be remembered that all rounded answers must be given to at least 3 significant figures.

**Question 4**

**(a)** The equation of a straight line given in this form made this a difficult question for many candidates. Some did realise that the first step required division by 3 followed by the isolation of the term involving *y*. Those who did this often continued to the final answers, but some gave the gradient as $-\frac{2}{3}\times$.

**(b)** This was a question which required the candidates to 'show that…'. In this type of question the candidates are expected to start from the information given and use this to derive the given result. In this case, using the equation of line *L* from the previous part, candidates were expected to first find the gradient of a line perpendicular to *L* and then find the equation of the perpendicular which passed through the point (2, 10). This equation then had to be shown to be equal to the equation given at the start of this part.

Those candidates who started from the equation given in this part almost inevitably scored 0 marks.

**(c)** This part required candidates to solve the two given equations of the lines *L* and *P* as a pair of simultaneous equations and to show all working. It was good to see that some candidates used a graphical approach to show their working, a perfectly acceptable and welcome approach, and gave the solution as the co-ordinates of the point of intersection of the two lines. Others chose an algebraic approach and were often successful. Those candidates who gave no working could only score 1 mark out of the 4 marks available as they had been instructed to show their working.

**Question 5**

**(a)** Many candidates gave an acceptable sketch of the quadratic, but some untidy work was seen with multiple lines and crossings out. A number of candidates gave no sketch and scored no marks on the whole question.

**(b)** Many candidates realised that the required answers were the 3 values at which the curve crossed the *x*-axis, but some lost a mark by giving these values inside co-ordinates, for example, (–4.19, 0).

**(c)** Many candidates seemed to be unsure of the meaning of the term 'local minimum'.

**(d)** This was a very challenging question for all but a few of the candidates. This part was linked to the previous part as the lower bound for *a* was the *x* coordinate of the local minimum.

**(e)** This was also very difficult for all students, as not only did they need to realise that the values were the *y*-values of the function either 'above' the local maximum or 'below' the local minimum, but also the answer had to be given as an integer.

**Question 6**

**(a) (i)** This proved to be a difficult transformation for most candidates. The most common error was a reflection in the *y*-axis.

**(ii)** Many candidates gave the correct rotation but finding the centre of rotation proved to be more difficult. There were still a few candidates who gave two transformations despite the clear instruction to find a single transformation.

**(iii)** This was another difficult transformation. Of those who attempted an answer, most correctly gave an enlargement and realised that a scale factor of 2 was involved but omitted the negative sign. The centre of enlargement also proved elusive.

**(b) (i)** Most candidates realised the inverse was also a translation but with the signs of the vector components reversed. An error sometimes seen was the *x* and *y* components being swapped over.

**(ii)** This was an unusual and more difficult inverse which very few candidates answered completely correctly. Many realised the inverse was also a stretch, and many gave the factor correctly, but a common error was for candidates to give the invariant line as $y = -1$.

**Question 7**

**(a)** This question received very few correct answers and the great majority of candidates scored no marks at all. The most common approach was to use the given value of 4.14 to show that the perimeter is 37 cm and this scored 0 marks. In a 'show that' question the candidate is required to set up a correct initial equation, here for example $\pi d = 13$, solve it, giving 4.1380…, and writing this result to at least 4 significant figures.

**(b)** Candidates chose one of two methods. The one more often chosen was to use the cosine rule but some candidates chose to use the fact that the triangle was isosceles and then use simple trigonometry to find the half-angle and then double it.

**(c)** This part received a number of correct answers with working clearly set out showing the calculations for the area of the triangle and for the two semi-circles.

**(d)** This proved to be more difficult with most candidates not taking the square root of the ratio of the areas in order to find the scale factor for the perimeter.

**Question 8**

**(a)** There were many good answers from candidates who understood that Pythagoras had to be used twice, first to find the length of a diagonal of the square base, and then using this to find the height. Some of these candidates, however, lost the final mark because, as in **Question 7(a)**, in order to gain this mark, a more accurate answer had to be written down, here again to at least 4 significant figures. As the answer of 0.628 was given, candidates were expected to write down a value in the range (0.6284, 0.6285).

**(b)** There were also many good answers here, with many candidates scoring full marks. Four stages of working were required, to find the volumes of the cuboid, the cylinder and the pyramids, and then to multiply their sum by the given density to find the total mass.

It is important that these calculations are clearly set out so that method marks can be awarded as appropriate, so it was good to see many candidates attempting to do this.

The errors most commonly seen were to omit the multiplication of the volume of a pyramid by 49, or to divide the volumes by the density instead of multiplying.

**Question 9**

**(a) (i)** Most candidates gave the correct answer, but some omitted the negative sign.

**(ii)** This was a difficult question for most candidates who appear to lack confidence in dealing with an absolute value. A minority found the answer of –1 but most omitted the other answer of –5.

**(b)** Some good factorisation was seen, and some candidates who did not score both marks gained a method mark for correctly extracting 2 or more factors.

**(c)** There were some good attempts at simplifying the expression to a single fraction in its simplest form, and those candidates who made a mistake were usually able to gain 1 or 2 marks. The most common error was in omitting to deal correctly with the negative sign preceding the second part of the numerator. It was good to see many candidates leaving the denominator as a pair of brackets instead of expanding them.

**(d)** This was answered well by some candidates who showed full working as required in the question. Some lost a mark by omitting important detail such as giving the determinant as $\sqrt{65}$ directly instead of showing $\sqrt{3^2 - 4 \times 2 \times (-7)}$. Some candidates lost the final mark as they did not give their answers correct to 2 decimal places as required by the question.

**Question 10**

**(a)** This was answered correctly by most candidates.

**(b)** This was answered correctly by most candidates and those who did not score both marks usually gained 1 mark for writing down the equation correctly.

**(c)** Most candidates gained the method mark for writing down the expression correctly, but then many made an error in dealing with the double bracket and/or the negative sign.

**(d)** This was made more difficult by the brackets, but some candidates made a correct first step and then, of these candidates, many went on to give a correct answer.

**(e)** Many candidates dealt with the composite function correctly but did not go on to give the final value of 1.

**(f)** This was a very difficult question for the great majority of candidates many of whom gave no response. Of those who did make an attempt hardly any sketched the two functions (a sine curve and a straight line).

**Question 11**

**(a)** Candidates find questions involving bearings difficult and many gave no response. This was shown here very clearly as this part simply needed the correct use of the cosine rule to find the required angle, a standard technique which is well understood by most candidates, and yet there were many who gave no working at all.

**(b)** Most candidates gave no response. The important first step was to split the given angle *ABC* of $80.6^\circ$ into an angle of $40^\circ$ and an angle of $40.6^\circ$ and a mark was given for the value of 40.6.

**(c)** This was a very demanding question and proved too difficult for the great majority of candidates. It was vital for the candidates to understand that the point *P* where the ship is at its shortest distance from *B* lies on the line *AC* and is perpendicular to it. A mistake sometimes seen here was for a candidate to assume that *P* bisected *AC*. The first 3 marks for working out angle *BAC* and then length *AP* were rarely awarded. Some candidates, however, did score marks for dividing their *AP* by 32 to find their time and then adding this to 13:00 to find the time when the ship reached the point *P*.

# CAMBRIDGE INTERNATIONAL MATHEMATICS

**Paper 0607/51**
**Paper 5 (Core)**

## Key messages

To find solutions to quadratic equations, candidates should be able to use the graph drawing facility on their graphic display calculator and be able to communicate their findings using labelled sketches as part of their answer.

## General comments

Candidates were successful with the task as a whole and especially the numeracy aspects, understanding the processes involved. They found the algebraic parts more difficult and consequently were sometimes not thorough in communicating all the steps in their mathematics. The weakest element was in solving the quadratic equation in the final question; the resilience of many candidates in attempting ways to do this was good. Candidates are expected to be able to solve quadratic equations using their graphic display calculator.

## Comments on specific questions

### Question 1

**(a)** This was well understood and answered correctly by almost all the candidates.

**(b)** A very straight forward question, missed by only a very few candidates who perhaps did not notice the answer space in the last column. Candidates are advised not to rush, especially in reading the instructions for the investigation.

### Question 2

Very well answered by most candidates. The common error made by those who did not achieve full marks was to write the second row from left to right as 4 5 6 instead of 6 5 4. This led to a third row of 5 7 9 and most candidates were still able to recover to $3 \times 7 = 21$. Again, more careful reading of the instructions in the stem would have helped these candidates.

### Question 3

Some weaker candidates may not have realised that the three dots in each row represented all the missing numbers. Where the answers of 28, 29 and 30 should have been written, 4 5 6 or 16 17 18 or 17 18 19 were seen, either right to left or left to right. It was also quite common to find 17 placed below the 16 on the third line. These errors were commensurate with candidates not following the method shown in **part (b)** of **Question 1**. Some candidates who did not score for the first two rows often achieved $15 \times 31$ although it was also common to see other factor pairs of 465.

### Question 4

This time the question did not tell candidates to use the method in **Question 1(b)**. By now candidates should have realised that this was a very quick method to find the sum of positive integers. A good majority used $80 \times 161$ to earn all 3 marks. Some candidates attempted to replicate the full method in **Question 1** which became muddled with so many numbers to line up. Others who had struggled with the previous questions did manage to get a correct answer by adding all 160 integers.

**Question 5**

Candidates did very well in spotting the patterns to be found in this table. The answers for **Questions 1, 2, 3** and **4** that had already been marked were not awarded marks in this question. This left four cells which most of the candidates completed correctly

**Question 6**

Moving into algebra, the better candidates did well here. Linear expressions were quite common. There was a variety of forms of the correct formula, many of them different unsimplified versions. Many candidates also wrote what would have been a correct formula/expression but by missing out brackets it became incorrect. The most common form was $T = \frac{n}{2} \times n + 1$ or similar, when it should have been $T = \frac{n}{2}(n + 1)$. Practice is advised on writing and simplifying algebraic expressions and formulas.

**Question 7**

Some stronger candidates were able to show that the substitution of 7 for $n$ gave the correct answer of 28 which they also found by adding the first 7 integers. Incorrect formulae that did not lead to 28 still gained a mark for correct substitution and the mark for adding the first 7 integers correctly was also available. Candidates need to read the questions very carefully. This was a question which also needed an answer – 'Yes' or 'No', dependent on the candidate's results. If candidates are required to show something that is not given, they should be aware that they need to obtain the result in two different ways.

**Question 8**

**(a)** This table was very well completed. Candidates used the patterns to complete the empty cells. There were some errors in writing and a few in arithmetic. Candidates should always try to write carefully and not to rush when they find something relatively straightforward to answer.

**(b)(i)** This was not answered particularly well. A variety of different names were given for square numbers. Some of the most common were triangular, prime, cube, sequence and parallel. It is important that candidates can distinguish between the names of different sequences, recognise them and know the meaning of standard mathematical words.

**(ii)** Many candidates who did not name the sequence as square numbers in **part (i)** were still able to write this formula correctly. Again, some only wrote an expression, missing the $T$ = and a few confused $T$ and $S$ or wrote $T = \sqrt{S}$ . Candidates need to be able to write some special sequences algebraically, often using patterns to adapt a well-known sequence.

**(c)** Candidates should be encouraged to show every step of their working. Many candidates found the correct answer of 672 400 without fully communicating their method. In an answer like this that requires substitution, the substitution needs to be explicitly seen to earn the communication mark. Many candidates earned at least one mark for some part of their working. Some candidates did the substitution and then went straight to 820 whilst others went straight to 20 × 41 without the substitution. There were three marks available for correct working even if the candidate's formula was incorrect.

**(d)** To complete this investigation and to answer this question, candidates were required to bring together and use both of the formulas they had written earlier in the paper. Again, there were follow through marks for an incorrect original formula. Many candidates found the square root of 396 900, and the answer of 35 was achieved in various ways. Very few candidates used sketches on their graphical calculators, a method that should be encouraged for solving or finding values on a quadratic equation. Attempts to solve algebraically are not covered on this syllabus and often resulted in the use of trials. Several did earn a communications mark for a trial showing that 35 did lead to the correct answer. Some candidates went back to listing and finding the sum of all the numbers up to 35 or all the cubed numbers up to $35^3$. This is not a method to be encouraged and was exceptionally time consuming, but it did earn a mark if correctly shown.

# CAMBRIDGE INTERNATIONAL MATHEMATICS

**Paper 0607/52**
**Paper 5 (Core)**

## Key messages

The numerical questions on this paper were answered well. To score high marks candidates needed to recognise patterns in numbers as well as being able to translate these patterns into algebraic expressions. Good communication required working that was fully labelled, explicit substitution and even the simplest of sums written out.

## General comments

In general, many of the candidates attempted most of the questions. More correct answers were seen to the numerical questions than the algebraic ones. Sometimes a value could have been checked by taking a different route to the answer. This would have been very useful when completing tables of values. Algebraic answers could also have been checked by the substitution of a value for which the answer was known.

## Comments on specific questions

### Question 1

**(a)** This was a straightforward question and was very well answered.

**(b)** This time the candidates had to find the values from the tree diagram. It was again well answered with most candidates also being awarded the communication mark for writing down the three values.

**(c)** Apart from a few arithmetical slips most answers to this part were also correct and many candidates scored the communication mark as well.

### Question 2

**(a)** There were 4 cells to be marked here because the remaining 3 had already been marked in **Question 1**. Many candidates found the $B$ and $T$ columns for row 8 more difficult to complete correctly. Much more often they correctly completed the missing values for the $A – B$ and the $A + B – T$ columns. Candidates should know that they might need to look for patterns down columns as well as across rows and to check that their answers fit both ways. The communication mark was usually awarded for the correct numbers being written in the correct places on the tree in the stem of **Question 1**. Calculations and common differences, although equally valid, were seen less frequently.

**(b) (i)** Candidates should be advised that if they have a choice as to whether to use given figures or those that they have found themselves, then it is better to choose the given figures, just in case of prior mistakes. They also need to show separately that the calculations with their chosen values of $A – B$ and $1.5n$ gave the same result.

**(ii)** A straightforward comparison of the numbers in the 2 columns gave the required expression. This was generally achieved by the better candidates. Candidates need to practice finding algebraic expressions and formulae from patterns in values.

**Question 3**

**(a)** Candidates did a little better in completing this table than the one in **part (a)** of **Question 2**. As before, probably the easiest method was to look for patterns in the columns and then to check whether their answers matched the column headings for the rows. Candidates should be reminded that rather than trying to change an answer it is better to cross out a figure they want to change and to write the correct value underneath, above or at the side, indicating which cell it should be in. Good candidates gained the communication mark by writing the correct 8 leaf numbers in the correct places on the tree in the stem for **Question 3**.

**(b) (i)** Again candidates should know that it is better to use the given figures for a comparison to find an algebraic expression rather than those they have calculated themselves. Either of rows $n = 2$ or $n = 4$ could have been used to find this connection.

**(ii)** This was the third question asking for a straightforward algebraic connection. This time there were 3 rows of given values for the $n$ and the $A + B – T$ columns. Practice at finding such expressions would be very beneficial to all candidates.

**Question 4**

This question again asked for algebraic connections between results that were given in the table. Answers were very varied and often not simplified. Many candidates appeared to be looking for much more complicated answers than were needed.

**Question 5**

**(a)** The answers for the last row in this table depended on the answers the candidates had given for the preceding questions. When the answers to these previous questions were all correct, the expressions for the final row were straightforward to follow the pattern.

**(b)** For the first expression some candidates appeared to miss the $\frac{n}{2}$ that was already printed in the answer space on the paper. In general, candidates had more success with the second expression than the first one. This question was more difficult to answer for those candidates who had incorrect answers in **part (a)**. Candidates really need to practice finding algebraic expressions and formula from numerical sequences.

**(c)** Candidates could only find the correct numerical values if their answers to **part (b)** were correct. Most candidates who attempted this question identified $n$ as 16 and $x$ as 7 correctly. Candidates should be aware that if asked to show that something is true, they need to work with each side of the equation separately. In this case, by explicit substitution into the right-hand side of the equation to show that this is equal to the left-hand side. Candidates needed to clarify that they were finding $A – B$ first and then $A + B – T$.

**Question 6**

**(a)** Back to numeracy and this question was well attempted by many more candidates than the ones on algebraic expressions. Candidates managed to find mostly correct values for $A$, $B$ and $T$. For some of them their communication marks would have been improved if they had identified which value belonged to which letter. Candidates should be encouraged to clearly label all their working.

**(b)** There was a follow through mark for the explicit substitution of 2 for $x$ and 5 for $n$ into the expression given in the first answer in **part (b)** of **Question 5**. Some candidates again omitted to use the $\frac{n}{2}$ as given as part of this expression.

**(c)** This was like **part (b).** Candidates had more success with this part because more of them had correctly identified the second expression in **part (b)** of **Question 5**.

**(d)** Few candidates realised that they were looking for factor pairs of 18. Many of those who wrote $xn = 18$ did not see how to use this fact. Sometimes it appeared more by luck than calculation that candidates discovered one of the correct combinations. Many answers included branches ($n$) as even numbers. In an open question like this candidates might find it helpful to start by rewriting the given information in note form and then adding to these notes anything else that they might know by looking back at their answers to the rest of the investigation.

# CAMBRIDGE INTERNATIONAL MATHEMATICS

**Paper 0607/53**
**Paper 5 (Core)**

## Key messages

This paper awards marks specifically for clear and precise communication of mathematics. Therefore, it is essential to provide full reasons and steps in working to achieve full marks.

Candidates should always follow any instruction to use a previous part. Such instructions are intended to aid the candidate in attaining full credit.

## General comments

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 the investigation in latter parts.

More practice of 'show that' type questions would be beneficial to candidates, especially where algebraic manipulation and substitution are required. It is important for candidates to learn when to use numerical examples and when algebra is required.

## Comments on specific questions

### Question 1

The question required candidates to follow the rules and fill in both calculations in stages. Nearly all candidates could do this correctly.

### Question 2

**(a)** Candidates were expected to substitute the given values for *x, y* and *z* into both calculations. It was essential to include brackets in calculation 1 if calculated in one line: $(4+9)\times 3 = 39$ and not $4+9\times 3$ as this equals 31. Nearly all candidates could do this correctly.

**(b)** Those candidates who answered **part (a)** correctly could see that the answers were the same.

### Question 3

**(a)** Almost all candidates could repeat the calculations correctly and thus complete the table.

**(b)** Most candidates could follow the pattern and add and complete two more rows in the table to find where the results were the same.

**(c)** Successful candidates filled the table in using *y* ascending numerically and found that *y* = 7. Those who did not, risked not finding 7 or finding 7 but not gaining a communication mark for showing other completed rows.

**Question 4**

**(a)** To gain full marks, candidates had to write the results they found in **Question 3** into the first three rows of the table and then follow the pattern. Those that did not use their previous results, found a different pattern and gained one mark and not three.

**(b)** Most candidates realised that $z = 2x$, but if they had not filled in the table as mentioned in **part (a)** then they did not find $y = 2x – 1$.

**Question 5**

**(a)** Candidates were required to substitute $x = 1$, $y = 1$ and $z = z$ into both calculations separately and show that they were equal. A few were able to do this correctly. The use of numbers as examples to show that the results were the same did not gain marks.

**(b)** If **part (a)** was answered correctly, then candidates could see that $z$ could be any integer.

**Question 6**

**(a)** Nearly all candidates could fill in the table correctly with consecutive numbers.

**(b)** Most candidates knew that if $x$ was an integer, then the next two consecutively were $x + 1$ and $x + 2$.

**(c)** Successful candidates were able to substitute $y = x + 1$ and $z = x + 2$ into the expression $(y + z) \times x$ and manipulate it algebraically to show the expression given.

**(d)** To gain full marks, successful candidates had to substitute $y = x + 1$ and $z = x + 2$ into the expression $(y \times z) + x$ and manipulate it algebraically to reach $x^2 + 4x + 2$. Some candidates were able to find the correct algebraic expression by trial and error using 15, 16 and 17, but this only earned them one mark.

**(e)** To gain the mark, candidates were required to equate the expression given in **part (c)** with the one found in **part (d)** and rearrange it to show the given equation.

**(f)** Candidates had to realise that they should use the expression given in **part (e)** and that $x$ had to be the lowest of the three consecutive integers whilst all three had to be in the given range. Some candidates were able to find both sets of values for two marks, mainly using trial and error. For four marks, detailed evidence of their substitution of $x = 2$ and $x = –1$ into $x^2 – x – 2 = 0$ was required.

# CAMBRIDGE INTERNATIONAL MATHEMATICS

**Paper 0607/61**
**Paper 6 (Extended)**

## Key messages

In order to do well in this examination, candidates need to give clear and methodical answers to questions, showing enough method so that marks, particularly communication marks, can be awarded. Candidates are expected to have access to, and to be able to use, a graphic display 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. Candidates should be aware of the functions that they are permitted to use on their calculator, and they should know that use of other in-built applications will not be credited. Explanations, when required, need to be clear and not contradictory and based on the mathematics under consideration. When answers to questions are large and exact, candidates should not round these values unless the question directs them to do so.

## General comments

Candidates generally found the initial stages of both the investigation and the modelling tasks to be reasonably accessible. **Questions 5** and **7** in the investigation and **Questions 12** and **13** in the modelling were found challenging by many candidates.

The majority of candidates presented their work in an orderly way and used correct mathematical form, including brackets, to indicate a correct order of operations. Other candidates may have improved if they had given a little more consideration to this.

Methods used in solutions generally needed to be detailed enough to communicate understanding to earn full credit. Communication could be achieved in a variety of ways. In the investigation this included showing steps in the methods given, stating calculations, showing substitution of values into formulae and expressions, stating equivalent fractions and differences in sequences. In the modelling task, examples are drawing sketch-graphs, stating expressions and calculations. Candidates should have been aware that they needed to detail any simple process that formed part of their solution. The level of communication was fairly good early in the investigation task, although fewer marks were awarded in the later stages of this task. Communication was also reasonably good in **Question 11** of the modelling task, but in other questions in the modelling, candidates communicated much less well.

## Comments on specific questions

### *Part A Investigation: Sums of powers*

**Question 1**

This question involved the summation of positive integers using the method detailed in the given example. This allowed candidates to apply the method, with structure to support their solutions. A good proportion of candidates earned full credit. Some candidates struggled with recording steps 1 and 2 of the method but were often able to see the patterns needed to successfully complete step 3 and step 4. Completion of the first two lines with ... 60 and 60, 59, 58 … 1 was seen fairly often from these candidates. The few weak responses offered showed little engagement with the method. In these cases, steps 1 and 2 were generally completed with values that bore little resemblance to the method in the example.

**Question 2**

Again, candidates needed to find a sum of positive integers using the method. In this question, however, they needed to structure the method for themselves. Candidates found this to be accessible and many earned full credit once again.

Two communication marks were available in this question and the communication shown was usually good. The first of the communication marks was for clear derivation of the initial value, 129, from the summation of steps 1 and 2. The majority of candidates offered sufficient working to earn this mark, usually pairing 1 with 128 and 2 with 127. The second communication mark was for stating the product in step 4 that gave rise to the answer. Again, the majority of candidates showed this step. A small number of candidates showed insufficient derivation of the initial value to earn the first communication mark. For example, some candidates wrote $128 \div 2 = 64$ and $128 + 1 = 129$ then offered $64 \times 129$. This earned the second communication mark but not the first. A few candidates offered no communication at all to support their answer. Candidates who stated the correct answer and then went on to round this to three significant figures were penalised. The answer was exact and therefore should not have been rounded. Regardless of that, the main reason why an efficient method was used for the summation was so that the exact value could be found with relative ease. Candidates who estimated the answer, therefore, missed this essential point.

**Question 3**

Candidates now needed to complete a table to show, numerically, the pattern needed to write down the products generated by the method.

This question was answered very well with only a few candidates not earning the mark available.

**Question 4**

Candidates should know that, when the question requires a formula, it is expected that the subject of the formula be stated. In this question, candidates translated the pattern into a correctly-expressed algebraic product to state a formula for the sum of the first $n$ positive integers. Many candidates did this correctly. Many of these offered a formula in its simplest form, although unsimplified expressions were also acceptable. Some candidates did not offer a correctly written expression but were able to earn partial credit for a sufficiently clear product which indicated that they understood the process. These commonly wrote their formula without the brackets that were necessary for a correct order of operations, or with incorrectly positioned brackets. Other candidates were partially credited for an expression that was completely in terms of another variable, such as $x$ rather than $n$. The weakest responses often offered a numerical answer or an expression in both $n$ and another variable such as $x$ or $T$, for example $\frac{n+1}{T}$.

**Question 5**

The task now developed into considering the sum of the first $n$ square numbers.

**(a)** In this part of the question, calculations and sequences were presented in a table for candidates to interpret and complete. This linked to the previous work. Candidates needed to complete the sequence for the ratio of sums, $\frac{S}{T}$. To support them in seeing the pattern in this sequence later in the question, candidates needed to write the fractions with denominator 3. A good number of candidates completed the table correctly and earned the 2 marks available for this. A communication mark was available for candidates who showed at least one equivalent fraction from which they had found a correct fraction with denominator 3. This communication mark was not as commonly earned as those earlier in the task. Some candidates did not correctly interpret the information in the table. For example, completion of the table with $\frac{14}{3}$, $\frac{30}{3}$ and $\frac{55}{3}$ was seen on many occasions, usually in weaker responses.

**(b)** Candidates were now required to find the pattern for the $n$th term of the sequence formed by $\frac{S}{T}$ using differences, or similar. A communication mark was available for seeing at least 3 constant differences or for demonstrating the validity of the algebraic pattern they had stated for the numerator of $\frac{S}{T}$ using specific values of *n* at least 3 times. Some candidates communicated well and earned all the marks available. A few candidates offered no communication or insufficient communication. Although the numerator formed a fairly simple linear sequence, the question was too challenging for a fair number of candidates. Some became confused and attempted to find $\frac{n\text{th term for } S}{n\text{th term for } T}$. Frequently in these cases, expressions offered had the expression from **Question 4(a)** as the denominator, rather than 3. These candidates had clearly not understood the usefulness of the sequence of numbers in the right-hand column of the table and had missed an important connection.

Some candidates used their graphics display calculator to perform a cubic regression, which is not a built-in application that they should be using. This is clearly stated in the syllabus. Candidates who found *S* in this way were not credited. Candidates who derived the cubic expression for *S* from first principles were credited, although this required very much more work than the finding of the *n*th term of the linear sequence and was prone to omissions and errors, so is not recommended as an alternative method.

Some candidates attempted both the cubic regression and used differences and stated the linear expression. In these cases, the use of the graphics display calculator to perform the regression was ignored and the differences and the answer were credited.

**(c)** Candidates now had the opportunity to demonstrate that they understood how to use what they had just derived by substituting *T* = 1830 and *n* = 60 into the formula $\frac{S}{T} = \frac{2n+1}{3}$, or their similar formula, to find the sum of the first 60 square numbers. The communication mark available in this question was awarded to candidates who communicated the full method that gave rise to the answer. The simplest way to do this was to state $\frac{2\times 60+1}{3}\times 1830$. A few candidates offered, for example, $\frac{121}{3}=\frac{S}{1830}$, $1830\times 121 = 3S$, $221430 = 3S$, $S = 73810$ which was sufficient. Other candidates offered, for example, $\frac{121}{3}=\frac{S}{1830}$, $221430 = 3S$, $S = 73810$ which was not sufficient as a key step was omitted. A reasonable number of candidates earned both the communication mark and the mark for the correct sum. A few candidates earned the mark for the correct sum only. As with **Question 2**, candidates should know that the answer to this type of question should not be rounded. Some candidates simply summed the first 60 square numbers and did not use the formula they had generated. This was not credited for communication as it did not use the patterns that had been developed as part of the task, which was part of what was being assessed. Some candidates used the method for the summation of the first *n* positive integers and simply replaced the integers with the first *n* square numbers, stating the actual answer to **Question 6(c)** in this part of the task. These candidates missed the purpose of the previous parts of this question.

**(d)** Candidates found this part of the task somewhat challenging, with very few able to state a correct formula for *S* using their expressions for *T* and $\frac{S}{T}$. Some candidates attempted to work with acceptable expressions for *T* and $\frac{S}{T}$ but divided the expressions, rather than multiplying them, and/or omitted the 3 in the denominator of $\frac{S}{T}$. A few candidates offered answers of $S = \frac{2n+1}{3}\times T$, $S = 2n+1$ or similar.

**Question 6**

In this question candidates considered the sum of the first *n* cube numbers.

**(a)** Candidates needed to complete a table to demonstrate that they had understood the pattern numerically in this part of the question. Very many candidates were able to do this successfully.

**(b)** Candidates were also fairly successful in this part, with many able to state the correct formula, $C = T^2$. For this simple formula, it was necessary for the subject of the formula, $C$, to be stated in order to earn the mark. The majority of those candidates who were not awarded the mark stated $T^2$ only. A small number of candidates gave a formula for $T$ in terms of $C$. This was also not credited.

**(c)** Candidates now had the opportunity to demonstrate that they understood how to use the formula they had just derived by substitution of $T = 1830$ into $C = T^2$ to find the sum of the first 60 cube numbers. There was a communication mark available and most candidates were able to earn this mark for the simple statement of $1830^2$. As with earlier questions, candidates should know that the answer to this type of question should not be rounded.

**Question 7**

In this question candidates considered the sum of the first $n$ numbers raised to the 5th power.
Candidates who found **Question 5** to be challenging, often also found this question to be challenging.

**(a)** As with **Question 5(a)**, candidates were given calculations and sequences in a table which they needed to interpret and complete. Once again, to support them in seeing the pattern in this sequence later in the question, candidates needed to write the fractions with denominator 3. A reasonable number of candidates earned both marks. A good number of candidates earned a mark for correctly reducing $\frac{12201}{441}$ to $\frac{83}{3}$, or for stating both $\frac{12201}{441}$ and $\frac{1300}{100}$, for example.

**(b)** Candidates now needed to derive the quadratic expression in $n$ for the numerator of the fraction $\frac{F}{C}$. A communication mark was available for showing at least 3 second constant differences. A small number of candidates earned all the marks available in this part of the question. Some candidates earned 3 marks but did not earn the communication mark. Usually this was because they showed fewer than 3 constant second differences. Some earned the communication mark and at least one further mark for having an answer with only $2n^2$ correct. A few candidates stated a correct expression for the numerator but then went on to spoil it in some way. For example, a few candidates multiplied it by 3 or attempted to find an expression for $F$ as their final answer, using $C = T^2 = \left(\frac{n^2+n}{2}\right)^2$. Weaker candidates often made no attempt to answer or simply offered expressions involving some or all of $F$, $C$, $n$, 3 and some sort of division.

**(c)** Candidates now had the opportunity to demonstrate that they understood how to use what they had just derived by substituting $C = 3\,348\,900$ and $n = 60$ into the formula $\frac{F}{C} = \frac{2n^2+2n-1}{3}$, or their similar quadratic formula, to find the sum of the first 60 numbers raised to the 5th power. The communication mark available in this question was awarded to candidates who communicated the full method that gave rise to the answer. The simplest way to do this was to state $\frac{2\times 60^2+2\times 60-1}{3}\times 3\,348\,900$. A few candidates offered, for example, $\frac{F}{3\,348\,900}=\frac{7319}{3}$ which was not sufficient as the key steps of substituting 60 and multiplication by 3 348 900 were omitted. A few candidates earned both the communication mark and the mark for the correct sum. Some candidates earned the mark for the correct sum only. Some candidates simply summed the first 60 numbers raised to the 5th power. This was not credited for communication and was often incorrect. As with earlier questions, candidates should know that the answer to this type of question should not be rounded. The weakest responses often offered $1830^5$. Other candidates made no attempt to answer.

***Part B Modelling: Income inequality***

**Question 8**

This question introduced the idea of the line of perfect equality of income.

**(a)** Most candidates plotted and labelled a point and were able to interpret it correctly. Most of these candidates sensibly chose a point on the line that was at the intersection of two gridlines, making the values easier to read.

**(b)** A good proportion of candidates were able to state $y = x$ or a correct equivalent of this equation. A few candidates offered $f(x) = x$ and this was not accepted as the question defined $y$ but did not define $f(x)$.

**Question 9**

In this question, candidates used a Lorenz curve to model income inequality.

**(a)** Again, a good proportion of candidates were successful in this part. Most chose a point on the curve that was at the intersection of two gridlines once again and most were able to interpret this point for the poorest proportion of the population. A small number of candidates made a statement about the richest proportion of the population in this part. This was not accepted.

**(b)** Candidates found the ideas in this part of this question slightly more challenging than the initial stages of the modelling task.

**(i)** Candidates needed to justify the new statement made using point $V$ for the richest proportion of the population. In order to do this, candidates were expected to write down a pair of calculations such as $1 - 0.7 = 0.3$ and $1 - 0.4 = 0.6$ and many did so. A few candidates stated only one correct calculation or made a completely irrelevant statement such as $0.3 + 0.6 = 0.9$. A few candidates offered narrative answers which, for example, mentioned reflections of points in the line $y = x$ or similar.

**(ii)** Here, candidates could show that they had understood the link developed in the previous part of the question. To do this they used the point they had previously chosen and wrote an equivalent statement for the richest proportion of the population. Again many were able to do this successfully. Some candidates, commonly those who referenced reflections, for example, simply reversed the order of the values as well as replacing ‘poorest’ with ‘richest’. Some candidates offered only similar calculations to those from **part (b)(i)**, and not the similar statement that was required. This was not accepted.

**Question 10**

In this question, candidates worked with the Gini coefficient and considered its value for perfect equality and maximum inequality of income.

**(a)** A reasonable proportion of candidates were able to deduce that the Gini coefficient would be 0 as the line of perfect equality and the Lorenz curve would coincide in this case. Commonly seen incorrect answers were 1, $\frac{1}{2}$ and 2.

**(b)** Fewer candidates were successful in this part. Candidates needed to deduce that the shaded area would be the triangle enclosed by the line $y = x$, the line $x = 1$ and the $x$-axis. A fair number of candidates stated the correct answer and some of these communicated the process they had used to find the value stated. A communication mark was available for indicating either the appropriate shaded area or the complete calculation needed to find the answer. Some candidates earned the communication mark for a sketch of the correct triangular region or for shading the region required on the diagram at the start of the question. Other candidates stated the calculation $\frac{1}{2} \times 2 = 1$. Many candidates seemed to recognise the correct shaded area but stated the answer $\frac{1}{2}$ rather than 1. Other commonly seen incorrect answers were 0 and 2.

**Question 11**

Candidates now used a method to approximate the Gini coefficient.

A reasonable proportion of candidates offered excellent solutions to this question and earned all the marks available. Four communication marks were available. The first three of these marks could be earned by showing full and complete method to find the value of $T$. A reasonable number of candidates earned all three of these marks. A few candidates stated the three correct area calculations and the correct value of $T$ but omitted to state or show that the areas needed to be summed. These candidates earned two of the communication marks for showing at least two correct area calculations. Some candidates should be aware that the use of a bracket for grouping calculations is not sufficient to indicate summation. A small number of candidates earned one communication mark for stating at least two correct areas without complete derivation of these being shown. As candidates were required to do step 3, they needed to state the value of $T$ and a good proportion of candidates did so. A reasonable number of these then went on to communicate the next step, subtracting $T$ from 0.5 and doubling to complete the solution. A few candidates subtracted $T$ from 1 and the resulting answers, when doubled, were larger than 1. These candidates may have improved if they had given a little more thought to the likelihood of this being a correct value in this context. A few candidates attempted 0.35 – 0.14. It seems likely that these candidates did not read step 4 carefully enough and found the difference of $T$ and the larger of the two triangles in step 2. Several candidates seemed to be counting squares to find the areas of the two triangles and the rectangle. Some of these candidates reversed the scaling this method introduced, later in the question and these could be fully credited. Candidates who did not reverse this scaling were not able to earn the final two marks. Some responses to this question were very poorly presented and difficult to follow.

**Question 12**

In this question, candidates considered the algebraic presentation of the approximate method they used in the previous question.

**(a)** Candidates found this question to be challenging. Three communication marks were available in this part of the question. In order to earn all 3 of these marks, candidates needed to present a sum of correctly expressed areas prior to these areas being simplified and terms collected. Two correctly expressed area terms earned two communication marks. Alternatively, one correctly expressed area term earned one communication mark and another could be earned for completing the rectangle and indicating either a correct $1 - x$ or $1 - y$ in some way. A relatively small number of fully correct answers were seen. A few candidates earned partial communication and also earned a mark for a correct expansion of $(1 - x)(1 - y)$. A few candidates benefitted from subsequent working being ignored once a correct expression, free of brackets, had been stated. Common errors were to omit necessary brackets completely in the first step, possibly misinterpreting the instruction in the question, or to work back from the answer to **part (b)** or to think that point $P$ was centred on the $x$-axis so that the length of the rectangle was also $x$.

**(b)** Very few candidates were able to earn both marks in this part of the question as complete success depended on having a correct algebraic expression from **part (a)**. For the accuracy mark, no recovery was permitted from errors as the answer had been given. Some candidates made sign errors in their working. This was more common in candidates who were working with an expression such as $\frac{1}{2} - \frac{1 + y - x}{2}$. A few candidates were able to earn partial credit for subtracting an acceptable expression from 0.5. Some candidates did not have an expression from **part (a)** that had, or would simplify to include, an $x$ term and a $y$ term and these could not be credited.

**(c)** Candidates were given the opportunity to show that they understood and could explain why the approximation they were using resulted in a value smaller than the value being approximated. The simplest explanations suggested that the area found in the approximate method was less than the shaded area as the two triangles cut off some of the shaded area. Candidates who made comments that suggested that the curve, rather than the area, was not all included, or that human error was made or that the method was only an approximation, for example, were not credited.

**Question 13**

In this final part of the modelling task, candidates had the opportunity to consider the most accurate approximation that could be found using the method developed in the previous two questions and use this approximation to make a comparison.

**(a)** Candidates found this part of the question to be challenging. A communication mark was available in this part, for indication of how the answer had been found. This could be earned by a suitable sketch marked with at least the $x$-coordinate of the maximum point, for example, or an appropriate calculation. Some candidates were able to identify the correct maximum point but did not link this to their sketch. Some sketches were not good enough to be credited for communication as they were clearly not sketches of the required function. For example, some did not pass through (0, 0) and others had a maximum point touching the $x$-axis. No communication mark was given for lists of trials with $0.5 – 0.5^2$ as one of those in the list. Even though the maximum point was also the point of intersection of the curve and $y = x^2$, this was coincidental. This did, however, seem to confuse some candidates. Quite a few candidates used $x = 0.7$ and found $0.7 – 0.7^2 = 0.21$. This was possibly from the point $V$ in **Question 9**. It was not uncommon to see the coordinates of the maximum point stated as the final answer, showing a misinterpretation of what was needed. Some candidates were confused as to which of the two coordinates was the answer with the $x$-coordinate also often stated on the answer line. Quite a few candidates made no attempt to answer.

**(b) (i)** Candidates were more successful in this part and a fair number earned the mark available for the statement of both (0, 0) and (1, 1). Some candidates only stated one correct point or stated only the values 0 and 1. Some candidates made no attempt to answer.

**(ii)** Again, candidates were fairly successful in this part, with a good number finding $a = 1$. Some candidates attempted to find some sort of algebraic answer, missing the key word ‘value’ in the question. Some candidates made no attempt to answer.

**(iii)** This part of the question was not well answered. A few candidates earned partial credit but graphs that earned full credit were rare. Commonly, candidates reproduced graphs that had similar curvature to the Lorenz curve in **Question 9** or simply drew straight lines. Quite a few candidates made no attempt to answer.

**(c)** Only a minority of candidates could give a correct response for this part of the task. A communication mark was available for candidates who indicated the maximum value of $G$ in some way. A few of the candidates that did have the correct maximum point incorrectly chose the $x$-coordinate as the maximum value. These candidates had usually made this error in **part (a)** also and therefore determined that country $B$ had the greater income inequality. Quite a few candidates made no attempt to answer.

# CAMBRIDGE INTERNATIONAL MATHEMATICS

**Paper 0607/62**
**Paper 6 (Extended)**

## Key messages

An important component of this paper is to show where answers come from. If a candidate wants to use a calculator for a question then it is very likely that a communication mark will be awarded for showing which calculation he or she typed in. Candidates should also realise that labelling quantities is important in making working clear. Many candidates would have benefitted from better organisation on the page. It is best to start at the top left of the workspace, moving downwards and only on to a new column if necessary.

## General comments

Many candidates showed good algebraic skills and, with some questions, even preferring to use algebraic techniques rather than the graphic display calculator. Candidates also showed good skills when writing equations from a table of data, solving simultaneous equations, finding patterns in numbers and providing a correct generalisation. An improvement over previous years was seen in the writing down of an algebraic model.

Candidates have little difficulty in getting a graph on the calculator but more care in sketching it on the examination paper would have benefitted many. If a sketch occupies the lowest centimetre of the answer space only, then it is unlikely to be correct.

## Comments on specific questions

***Part A Investigation: Integer trees***

**Question 1**

Nearly all candidates found the correct totals. A significant number could have improved their mark by communicating how this total was calculated.

**Question 2**

**(a)** The large majority of candidates found the correct numbers for the table but most did not say how these answers were obtained. There were opportunities for a communication mark here: either by extending the tree to 8 branches or by showing the common differences in the later columns.

The most common numerical error was to see the wrong value of $T$ for 8 branches.

**(b) (i)** Most candidates gave a numerical example equating $A - B$ and $1.5n$, the first row of the table giving the most popular answer of $3 = 1.5 \times 2$. A small number read this as having to solve an equation and the necessary calculation was not seen.

**(ii)** Nearly all candidates recognised that $2n$ was the correct expression for $A + B - T$. The most common error was to misunderstand the requirement for an expression in terms of $n$ and $n = \dfrac{A + B - T}{2}$ was seen several times.

**Question 3**

**(a)** The large majority of candidates correctly calculated the values of $A$, $B$ and $T$ for 6 and 8 branches. The few errors seen all occurred in the numbers for the tree with 8 branches, probably because the given diagram only went as far as 6 branches.

**(b) (i)** The same comments for $2n$ apply here as in **Question 2(b)(ii)**.

**(ii)** The same comments as in **Question 2(b)(iii)** apply here for $3n$.

**Question 4**

**(a)** Nearly all candidates entered $2.5n$ and $4n$ correctly into the table for trees with 4 leaves on each branch. Occasionally $2n + 0.5n$ was seen for $2.5n$. While correct, this did not help with finding the general formula in the next part.

**(b)** By noticing the pattern in the table in **part (a)**, a large majority of candidates could write the general expression for $A – B$. A smaller number could complete the expression for $A + B – T$. A common error was to write $+ x$ in the bracket.

**Question 5**

**(a)** While nearly all candidates found the correct values for $A – B$ and $A + B – T$, many should have gone further and gained a communication mark for showing the values of $A$, $B$ and $T$ or the calculation that was used to find the answers.

**(b)** To decide on the correctness of their first expression in **part (a)**, the values $n = 5$ and $x = 2$ had to be seen in a substitution and a value calculated (7.5 if they had the correct expression for $A – B$). Several candidates only described the process in words and some could have improved their answer by ensuring all the numerical details were given.

For $A + B – T$ the formula gives the correct result. Some candidates omitted to say this. Others omitted the necessary calculation to show that this was so.

A small number of candidates did not attempt this question.

**(c)** While most candidates gave the correct expression for $A + B – T$, finding $A – B$ was a challenging question in which only the best candidates were successful. With a large table of numerical information given on the question paper, a large number of candidates did not know how to start and a systematic plan would have helped many.

Candidates who tried to work systematically often used differences to find equations. This approach, if continued correctly, would have given a communication mark for finding an expression for a particular value of $n$ or $x$. However, many did not account for $n$ increasing by 2 instead of 1. Those who found such an expression often did not get the communication mark because the particular value of $n$ or $x$ was not linked to the expression.

A few candidates assumed, incorrectly, that the expression was of the form $ax + bn$ and used simultaneous equations.

For an advanced question like this, candidates need to organise their work on the page clearly.

**Question 6**

**(a)** This is an introduction to the general tree and the question leads them to add $p$ onto the given $k + p + 1$ to show the required answer. A large number of candidates substituted particular values for $k$ or $p$ instead and so could not score the mark. Candidates should realise that general results cannot be proved by substituting numbers. Substitution of numbers may however be used in seeking a pattern, but this was not relevant here. There were a significant number of candidates who did not answer this question.

**(b)** Many candidates were successful in finding the expressions on the 3rd branch of the general tree. The common error was to muddle what was increasing by $p$ and what was increasing by 1 as they went through the tree.

**(c) (i)** Candidates were expected to write out clearly the combination of expressions that gave $A + B - T$. A frequent source of error was in not using brackets when subtracting the terms that added to $T$.

Candidates who had the wrong answer in **part (b)** could only find the expression for 2 branches correctly. The details of the adding and subtraction of terms were rewarded with communication marks. Some candidates needed to be much clearer about which expressions they were using and how these came about. No mark was awarded for giving the final simplified answer without such working.

**(ii)** Candidates who found the correct final answers in **part (c)(ii)**, even with faulty or incomplete working, usually wrote down the correct expression for $A + B - T$ for the general tree.

***Part B Modelling: Carbon footprint of air travel***

**Question 7**

The large majority of candidates were able to do the division and find the fuel consumption in kg/km.
A small number of candidates did not give the units and so did not gain a communication mark. This was the most common error. A few wrote $F$ kg/km for the units, mixing up a variable with units. Candidates should understand that this modelling context expects a decimal answer for the measurement of fuel use.

**Question 8**

**(a)** Nearly all candidates wrote that the fuel use per km was decreasing.

**(b) (i)** Most candidates took the correct data from the table and formed suitable equations. The instruction *Write down* indicates to candidates that no working is required or expected. In spite of that, several candidates chose to rewrite the equations, sometimes introducing an error.

**(ii)** There were several methods used to solve the simultaneous equations and the large majority of candidates were very good in demonstrating what they had done. Several candidates did not cope with the fractions well, either in subtracting $\frac{1}{1200}$ from $\frac{1}{400}$, or in clearing fractions by multiplication by 400 or 1200, where a few candidates forgot to multiply $a$ by the denominator. A very small number of candidates spoiled their work by writing the model without the necessary $F =$ before the expression in $L$.

**Question 9**

**(a)** This exercise in plotting points and joining them with a smooth curve required more precision than many candidates gave. Half-square accuracy was expected for all the points and for drawing the curve through those points. Joining points by ruled straight lines was not credited. A very large number of candidates did not draw a curve at all. The instruction *Plot these values … and draw the graph…* was not read in full by many candidates. Candidates need to realise that both journey length and average fuel use are continuous data quantities and so must be represented by a continuous graph and not a set of points. A few candidates drew their curve through the points that were not part of the model and some candidates omitted to plot a point, often one of the last two.

**(b)** The majority of candidates, including many who had not drawn a curve, realised that the graph fitted the data very well and used appropriate words that suggested this. Others qualified their words, as in, 'quite well', which is not a strong enough expression for a model with a very good fit.

**(c)** Finding the average fuel use for a given length of flight was done successfully by most candidates. Only candidates who did not have a satisfactory model in **Question 8(b)(ii)** had difficulty.

**(d)** Since 10 000 km is outside the data set for the journey length the model is not valid for $L = 10\,000$. A good number of candidates correctly used the word *extrapolate* as their reason for the model not being valid.

Very many felt that 3.18 kg/km would be close to the actual answer and so they wrote that it was valid and that the graph would continue to flatten out as before.

A common incorrect reason for it not being valid was to comment on aircraft flight distances (too long) or expected fuel use (too little).

**Question 10**

**(a)** The calculation for finding the grams/km is to multiply the grams/kg by the kg/km, both quantities being given in the question. The information that the aircraft flew 800 km is not relevant for this calculation. Including the 800 km in the calculation was a very frequent error. However, there were many candidates who did show the correct multiplication leading to the correct answer.

A communication mark was awarded for showing the correct multiplication even if it was embedded in a calculation with 800 km. Some candidates set up a proportion table but without the necessary operation(s) this was insufficient.

**(b) (i)** Although many candidates had the correct starting model, they were not so successful in showing that it had to be multiplied by $\frac{3200}{200}$. A common error was to multiply by 16 without any evidence from where this came. A number of candidates started their explanation in the middle of the workspace, so that the steps in their argument did not always follow logically. Several candidates multiplied by 3200 and then later divided by 200, which was acceptable.

**(ii)** Many good graphs were seen but a significant number could have improved their mark by ensuring they only drew the graph for the given domain $200 \leqslant L \leqslant 1600$. A large number of graphs were partly to the left of $L = 200$. Those candidates were perhaps not aware that a graphic display calculator allows the drawing of restricted domains.

Some candidates needed to look more carefully at their screen because the other common error was to draw a graph which suggested the $L$-axis was an asymptote though the lowest value for the model was 66. In this respect candidates should understand the importance of setting an appropriate window. Quite a number of candidates finished their graph too low at the right side.

A number of candidates understood the need for a scale, a good one being to put 50, 100, 150, and especially 200 on the vertical axis. Many chose 192, giving a hard scale to read, though accepted here as the coordinate of an end point of the graph. A few chose a scale that was not consistent with the correct graph and some wrote coordinates at points on the graph, which was condoned as indicating the scale.

**(c)** Nearly all candidates used the given model correctly and found that the carbon footprint for one person was 80 grams. An error common to the large majority of candidates was then to overlook that the 80 g was for each kilometre flown. At some point multiplication by 900 was necessary, either before, or after, converting the grams to kilograms. A small minority used 100 g for 1 kg.

**Question 11**

**(a)** Many candidates sketched a horizontal line, and labelled the intercept or gave its equation for a communication mark. There were, though, a significant number who did not attempt this question possibly because of a problem with their time.

**(b)** In spite of the difficulty of this question there was a significant number of correct or nearly correct answers. To check the statement, candidates had to find when 30% of the model intersected with the straight line from **part (a)**. Very few candidates drew the 30% curve. Those that did showed a quick method of finding the solution to the question.

Many candidates preferred to solve the corresponding equation algebraically and were often successful in showing good manipulative skills. Others solved an equivalent equation by finding when the model for aircraft equalled 133.33. Less successful were those who tried out values of $L$. Although this implied a method, it was not followed up by tabulating the necessary values for $L$ (337 and 338) in the calculator.

# CAMBRIDGE INTERNATIONAL MATHEMATICS

**Paper 0607/63**
**Paper 6 (Extended)**

## Key messages

This paper awards marks specifically for clear and precise communication of mathematics. Therefore, it is essential to provide full reasons and steps in working to achieve full marks.

Candidates should always follow any instruction to use a previous part. Such instructions are intended to aid the candidate in attaining full credit.

## General comments

The investigation was, on the whole, answered better than the modelling. 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 the investigation.

Several questions in the modelling were not even attempted by many candidates, so centres need to spend more time on the modelling and to encourage better use of time within the exam as the modelling is worth as many marks as the investigation.

More practice of 'show that' type questions would be beneficial to candidates, especially where algebraic manipulation and substitution are required. Candidates need more practise at knowing when to use numbers as examples and when to use algebra to show expressions that are true for all values of the variable.

Candidates need to remain mindful of the context of the modelling throughout that section of the paper. In this paper, it is about area which cannot be zero or negative. Units are also essential whether m, m$^2$ or $.

Although not detailed graphs, sketches need to be the correct shape and have scale communicated. If using their graphic display calculator, then they need to set a suitable scale and copy that onto the axes given.

## Comments on specific questions

***Part A Investigation: Changing the order of operations***

**Question 1**

Nearly all candidates could fill in the table correctly for 3 marks. To achieve 4 marks, they had to show at least one of each type of calculation written out.

**Question 2**

Candidates were expected to substitute the given *x, y* and *z* into both calculations. It was essential to include brackets in calculation 1 if calculated in one line. $(4 + 9) \times 3 = 39$ and not $4 + 9 \times 3$ as this equals 31. Nearly all candidates could do this correctly.

**Question 3**

Many candidates showed that $x = 3$ made the two calculations give the same result. However, the best answers were from those substituting $y = 5$ and $z = 6$ into each of the calculations and equating them, then solving $11x = 30 + x$.

**Question 4**

**(a)** Nearly all candidates could complete the table correctly.

**(b)** Most candidates could recognise that $z = 2x$ and many candidates could then see that $y$ was one less than $z$ making $y = 2x – 1$.

**(c)** Successful candidates were able to substitute $y = 2x – 1$ and $z = 2x$ into $(y + z) \times x$ and $(y \times z) + x$ and manipulate them algebraically to both give $4x^2 – x$.

**Question 5**

**(a)** Most candidates knew that if $x$ was an integer, then the next two consecutively were $x + 1$ and $x + 2$.

**(b)** To gain full marks, successful candidates had to substitute $y = x + 1$ and $z = x + 2$ into the expressions $(y + z) \times x$ and $(y \times z) + x$, equate them and manipulate them algebraically to reach $x^2 – x – 2 = 0$.

**(c)** Candidates had to realise that they should solve the expression given in **part (b)** and that these two values of $x$ had to be the lowest of the three consecutive integers in each set. Some candidates solved the equation in **part (b)** instead of showing it, but then did not use this information in **part (c)**.

**Question 6**

**(a)** Many candidates could expand the brackets correctly and some could then rearrange this to show the required expression.

**(b)** Many candidates used the expression that they had to show from **part (a)** and not the equation $x(x – 1) = (y – x)(z – x)$. To gain full marks, they had to substitute $x = 6$ into this equation and find pairs of integers that multiplied together to make 30 and then add 6 to each of these to find $y$ and $z$.

***Part B Modelling: Farmers' Fields***

**Question 7**

**(a)** To gain full marks, candidates had to clearly show that the other side of the field was $300 – x$, using the 600 and either dividing by two first or after subtracting $2x$.

**(b)** Successful candidates realised that for $A = x(300 – x)$ to make a possible area, $x$ had to be greater than 0 and $(300 – x)$ had to be greater than 0. Values of $x$ less than zero make no sense for the length of a field and values of $x$ greater than 300 would give a negative area. Some candidates used the wrong meaning of the word range and did 300 – 0 = 300 or 300 – 1 = 299.

**(c)** Few candidates got full marks. Sketches needed to have an indication of scale and a sensible choice of values of $x$. Some had just copied the screen of their graphic display calculator, without changing the scale. An awareness that $A$ would produce a quadratic graph was needed and that $x$ would make $A = 0$ at $x = 0$ and $x = 300$.

**(d)** Some candidates realised that the maximum area would be when $x$ was 150 m and calculated that the corresponding maximum $A$ was 22 500 $m^2$. For full marks, candidates had to give the correct units.

**Question 8**

**(a)** Successful candidates realised that one side of the field was a wall, so they could not just replace the 300 with 250 in *A.* The side $x$ had to be subtracted from the 500 and then the remainder divided by two to get the other sides. For full marks, candidates had to include $B$ = in their answer to show that it was a model.

**(b)** A few candidates were able to realise that $B$ would be a maximum when $x$ was 250, calculate the corresponding area and use their answer from **Question 7(d)** to work out which area had the highest maximum. Some candidates realised what was required and gained a mark for completing the process correctly using their incorrect model for $B$ from **part (a)**.

**Question 9**

**(a)** Successful candidates worked from the written information to construct $C$ rather than backwards from the given model. The best method was to work out that the grass seed and fertiliser was $0.35 per square metre, then multiplying this by the model for $A$ and then adding 7000:
$C = 0.35 \times (300 - x) + 7000$.

**(b)** Some candidates were able to substitute $x = 150$ into $C$ to work out the cost of making the field with the maximum area, but to gain full marks, they had to include $ in their answer.

**(c) (i)** Most candidates realised that they needed to subtract the number of sheep multiplied by 5 from $C$. Some realised that the number of sheep was the area divided by 450 and a few successful candidates used $A = x(300 - x)$ as this area.

**(ii)** A few successful candidates were able to work out the number of sheep when $x$ was 150 and subtract this from their cost found in **part (b)**.

**Question 10**

**(a)** Some candidates realised that they needed to use trigonometry and not Pythagoras' Theorem. The few successful candidates were able to show that the two sides were $200\cos w$ and $200\sin w$ and then multiply them together to calculate the area of a rectangle.

**(b)** This question required candidates to realise that $w$ could only be between 0 and 90 and sketch the graph for that range of $w$ indicating the scale for maximum marks.

**(c) (i)** A few successful candidates realised that the maximum area would be when $w$ was 45.

**(ii)** Candidates could realise that the maximum area was when the field was square and square root 20 000 and then multiply by four. Alternatively they could realise that the maximum was when $w$ was 45 and work out one side as $200\cos 45$ or $200\sin 45$ and multiply by four.