CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/11
Paper 11 (Core)

Key messages

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

General comments

Candidates should pay attention to how a question is phrased. Workings are vital in questions with more than one mark, particularly those with no scaffolding such as **Questions 11**, **19** and **20**. This is particularly important with problem-solving questions – **Questions 9**, **13** and **22**. 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 1**, **2**, **4(a), 6** and **7**. Those that proved to be the most challenging were **Question 14** listing elements of a possible set, **Question 17** algebraic manipulation, **Question 20** volume of a sphere in terms of π and **Question 23** working with the equation of a straight line. In general, candidates attempted the vast majority of questions. Those that were occasionally left blank were **Questions 10**, **14** and **23**.

Comments on specific questions

Question 1

This opening question was accessible to virtually all candidates. A few struggled with spelling to the extent that their answers were unclear or ambiguous, for example, ninety or nine and seventy or seven.

Question 2

This was the question where a large majority of candidates were successful. There were some who confused next term with *n*th term.

Question 3

As all the words that candidates had to consider were given in the question, there was not the problem of ambiguous spelling. Mostly, candidates gave obtuse or acute for the first and chord or diameter for the second. Sometimes the words chosen were not the right type of word, such as choosing one of the lines for the angle. Some thought that angle *OMB* was a parallel angle – this does not exist.

Question 4

Like the last question, this is a multiple-choice question. As all possible answers are given, candidates are advised not to leave either part blank. Here, the candidates were told that there is one number for each part.

(a) This was answered well by most candidates as they correctly picked out the multiple of 3.

(b) Not as many got this part correct as fewer candidates knew the factors of 52.

Question 5

Candidates were not quite so confident with this question as different roundings of the number were seen. Some truncated the number at 520.8 or wrote 520.9 and then put three zeros after the 9 or gave the answer to the nearest integer. Some changed the position of the decimal point showing a misunderstanding of the instruction to write a value to a given number of decimal places. A few others gave the full number in standard form.

Question 6

As previously mentioned, in the vast majority of cases, this calculation was performed correctly. Sometimes there were arithmetic slips in the multiplication. A few thought that there were only 12 hours in a day.

Question 7

Both parts of this question were done well.

(a) Along with the correct answer, Midtown, some wrote 26 or just wrote 26 alone. Those who only gave 26 did not gain the mark as the name of the village was required, not the temperature.

(b) Most candidates gave correct answers by using the rows to fill in the missing temperatures. Some used the reverse operation so, instead of 16, the answer 36 was given and 47 instead of 9.

Question 8

A few gave $\frac{3}{8}$ as their answer rather than recognising that there is only one card numbered 3.

Question 9

This was the first problem-solving question and had no scaffolding. There were some good answers. A small number made errors when converting the units. Many had difficulty calculating accurately and efficiently. Build-up methods were common, leading to lengthy addition calculations, often with arithmetic slips. Many reached 33.333… but then struggled to deal with the 0.333… left over.

Question 10

This was a more complex mapping diagram compared to some recent questions. Most candidates seemed to look for a pattern working down the rows of the diagram. This method worked in this case, because the first three inputs form a linear sequence. Many reached the answer 4. 3 was a common wrong answer, possibly because it is the next integer after 2, the previous entry in the diagram. Candidates should check that their pattern does work for the whole diagram. No candidates used the route of finding the function. A sizable minority left this question blank.

Question 11

This was done well with most reaching the correct answer. Unlike **Question 9**, those who used build-up methods were usually successful, showing the need for candidates to have a range of strategies to draw on when calculating. It is also useful for candidates to check that the answer is correct in context – a snail is not going to move fast.

Question 12

The form of the given inequality shows that this is a line segment and so does not go off to infinity in either direction. Many candidates drew the line directly on top of that used in the number line. This made their work unclear for them to correctly show the symbols on the ends. Drawing the line above the number line is preferable. Candidates should use a pencil and ruler for these diagrams and take care of accuracy over where the lines finish.

Question 13

This was either done very well, with candidates reaching the correct answer of 16, or very poorly, with candidates unclear about how to tackle this question. Successful candidates often showed no working at all but that is a risky strategy as method marks are not available without working. Those who did show workings, either used a reverse calculation or wrote $\frac{3}{8}$ and scaled this up to $\frac{6}{16}$. Finding $\frac{3}{8}$ of 6 was a common wrong approach. Some worked out $6 \times 3 = 18$.

Question 14

Many identified possible subsets of *A*. There was some confusion of the meaning of $n(B) = 2$ as many gave subsets with more than 2 elements. A small number of candidates gave only one element for the subset. Questions that have various possible answers sometimes cause uncertainty for candidates.

Question 15

This is well known bookwork and was one of the easier questions on finding a mid-point as both points are in the first quadrant. It is useful for candidates to sketch a diagram to determine an approximate answer – few diagrams were seen. Many were successful having both coordinates correct for the single mark – mostly this was done by adding the *x*-coordinates and divided by 2 (and doing the same for the *y*-coordinates). This question caused difficulty for a significant number of candidates. More were able to find the *y*-coordinate of the mid-point than the *x*; this was due to one point having a zero *y*-coordinate. Those that found half the difference between the coordinates often forgot to apply this to one of *C* or *D* so left (2, 4) as the answer. Some just subtracted giving (4, 8).

Question 16

A common error was to try to treat this as a 'without replacement' question so the probability of the second pink ball became $\frac{1}{8}$ or $\frac{1}{9}$. Candidates did not check that each pair of branches added to 1.

Question 17

Those candidates that showed the algebra in stages were more successful than those who went straight to their answer. A wide variety of incorrect answers were seen. Common incorrect answers included $5cd$ and various other multiplications and divisions using *c*, *d*, 5 and 1. Also, some included the operator signs. This question caused real difficulty for many.

Question 18

(a) Many candidates drew acceptable, ruled lines. Many seemed to think that a line of best fit should always pass through the origin which is not always the case. Some drew lines that had far more points on one side of their line than on the other. Others drew lines that were not close to many of the points. Only a few candidates drew 'dot-to-dot' line segments.

(b) More candidates were correct than for the previous part. This question did not rely on the drawn line of best fit but was only concerned with counting up the points with a higher mark than 3 in biology regardless of the mark for chemistry.

Question 19

A range of efficient, proportional reasoning strategies were seen here, with many arriving at the correct answer. There are various approaches that could be used here – candidates should have analysed the problem and determined which method would work for them. Candidates could have divided 27 by 30 to find 1 litre then multiplied by 40. It is maybe more efficient to divide 27 by 3 to find the cost of 10 litres then either add that cost to \$27, or to multiply the cost of 10 litres by 4 for 40 litres. Some showed no working and did this mentally, often reaching the correct answer but this is risky if the final answer is wrong. A common incorrect method was to say that if 30 litres cost \$27 then 40 litres (10 more) cost \$37. Again, arithmetic issues with the calculations caused problems for a significant number.

Question 20

The formula for finding the volume of a sphere is given in the Formula List. As the diameter of the sphere is given, this must be divided by 2 to get the radius then this value substituted into the formula. There were very few completely correct answers here. Many reached the stage of writing $\frac{4}{3}\pi 3^3$, but then either left this unsimplified, or made errors when simplifying. Many started by finding 4 ÷ 3, reaching a decimal answer which they rounded, leading to an inaccurate final answer. A few multiplied the given diameter by 2 before substituting into the formula.

Question 21

There were some clear, well laid out workings for this question. Others candidates appeared not to know how to start this question, and left workings scattered over the working area. Most opted for elimination rather than substitution methods. Candidates should be confident with the various methods so they can choose which is best to deal with the given equations. Some candidates made errors when eliminating a variable, both arithmetic and sign errors. A number of these candidates went on to give a pair of values that fitted one equation, so were awarded the special case mark.

Question 22

This was generally done well. Again, arithmetic errors were fairly common. Only a small number of candidates put their values in the wrong sections of the Venn diagram.

Question 23

Fully correct answers were rare. Many candidates are not very confident with this area of the syllabus and here, there was the added complication that line L was not given in the more familiar form, $y = mx + c$. Most candidates attempted something in the same form as the given equation, such as $2y = x + 4$, leading to one mark for a correct gradient. Very few gave an equation of a line with the correct y-intercept. Some gave the same equation as line L but written in a different form, for example, $-2y = -x + 6$, which did not receive any marks.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/12
Paper 12 (Core)

Key messages

To succeed with this paper, candidates need to have completed the full Core syllabus. Many formulae are provided on the paper and candidates need to know how to apply these formulae to solve problems.

Calculators are not permitted on this paper, so candidates need to perform calculations accurately, showing clear working that includes all the steps in their method.

Candidates should check that their answers make sense in the context of the question. For example, in **Question 11** answers should be within the range specified in the question.

General comments

The paper was accessible to all candidates. Most attempted every question and reached the end of the paper. The exceptions that were sometimes left blank were **Question 5b** (bearings) and **Question 20** (gradients of parallel lines).

The questions that presented the least difficulty were **Questions 2**, **4**, **6** and **19**. Those that proved to be the most challenging were **Question 5b** (bearings), **Question 9** (deducing a rule in order to complete a mapping diagram), **Question 13** (problem involving finding the area of a composite shape made from rectangles), **Question 14** (listing the elements of a set), **Question 16** (converting units of area) and **Question 23** (gradients of parallel lines).

Most candidates showed their working; the stronger candidates set their work out clearly showing the steps in a logical order. Calculations need to be evaluated correctly, otherwise candidates will not gain full marks. A significant number of candidates lost marks because of basic arithmetic errors.

Comments on specific questions

Question 1

Most candidates listed two correct multiples, usually 15 and 30 or 30 and 45. The most common error was to list two factors.

Question 2

Most gave the correct answer. The most common wrong answer was −2, suggesting a misconception about the ordering of negative numbers.

Question 3

Most correctly identified the two diagonals as lines of symmetry. Some also joined the mid-points of opposite edges, leading to four lines in their answer, only two of which were correct, so this did not gain credit.

Question 4

Most candidates showed very clear working in both parts of this question.

(a) This was done well, with many reaching the correct answer. Some made errors when adding the numbers but scored a method mark for showing a complete correct method. Some candidates did not show any working, meaning that they lost both marks if they made an arithmetical error. A small number found the median rather than the mean.

(b) Most candidates gave the correct answer here. A few identified the highest and lowest values but left this as 9 − 1 or 1 – 9 rather than evaluating the range.

Question 5

(a) Most gave the correct answer. The most common wrong answer was east. The weaker candidates sometimes gave answers such as south-east or north-west, implying a lack of understanding of compass points.

(b) The higher achieving candidates usually gave the correct answer of 270. The weaker candidates found this challenging, with a number leaving this blank. The most common wrong answers were 90 and 180; other candidates wrote compass points such as north-east or used the three letters *A*, *B* and *N* from the diagram in their answer. A small number attempted to evaluate 360 – 90 but made arithmetical errors.

Question 6

Most answered all parts of this question correctly. The most common error was to give the answer *G* in **part (b)**, implying some confusion between *x*- and *y*-coordinates.

Question 7

Almost all candidates realised they needed to classify the data as discrete or continuous and most were able to give at least two correct responses.

Question 8

This was done well, with most candidates giving the correct answer. The most common error was to subtract 5 from 20 to give the increase in length rather than the scale factor.

Question 9

There were some good answers here, but this proved to be one of the more challenging questions on the paper.

Some arrived at the correct answer of 5 without showing any method, a few showed that they had identified both steps in the function $f(x) = \frac{x}{2} + 1$, others noted that the inputs increased by +4, then +2 and applied this pattern to the outputs, recognising that an increase of 2 would be followed by an increase of half as much.

The most common wrong answer was 6. Candidates who gave this answer looked for a pattern in the list of outputs and seeing 2 and then 4 assumed that the next number would be 6. Since the inputs do not form a linear sequence, this method will not lead to a correct answer.

Some did not realise that the function had two steps and so only looked at differences between the inputs and outputs; these candidates often wrote – 0, – 2, – 4, – 6 on the arrows, arriving at the incorrect answer of 4. Checking that the answer is greater than 4 (the previous value) and less than 8 (the next value) would have identified that this could not be correct.

Question 10

The higher achieving candidates usually arrived at the correct answer of $-3h$. Some factorised but did not finish the simplification and gave $h(1-4)$ as their final answer. The most common wrong answer was $3h$, but a variety of other answers was seen, including $4h$, $-5h$, 4 and –4.

Question 11

The most common correct answer was 53. Some listed both 53 and 59; some listed one correct value with one or more incorrect answers and so were not awarded the mark. Common errors were 51, 57 and 55. Some gave one or more numbers that were outside the given range.

Question 12

Most candidates reached the correct answer. The most common method was to divide 4500 by 100, then to multiply by 5. Some found 10% of \$4500, then halved their answer to reach 5%. A few multiplied 5 by 4500 but omitted the division by 100. Some started by simplifying $\frac{5}{100}$; those who went on to divide 4500 by 20 almost always arrived at the correct answer. A few multiplied 4500 by 20 or divided 4500 by 5.

A few candidates wrote statements, such as '10% of \$4500', rather than showing calculations, so they were not able to score any method marks if they made arithmetical errors.

Question 13

Many showed a correct method for the area of a rectangle. This was a challenging question and fewer than half of the candidates were able to reach the correct final answer here. Many had difficulty finding the length and width of each rectangle. Some arrived at a length and width with a total of 12, for example 8 cm and 4 cm, and so scored one mark. Some multiplied 18 by 12, finding the area of the surrounding rectangle, but did not know how to continue.

Question 14

There were some good answers, mainly from the higher achieving candidates. Many candidates seemed unfamiliar with some of the notation used, for example some did not interpret the inequality symbols correctly and included 9 in the universal set. Many found factors of 8, but some omitted 1. Some listed multiples of 8, either 8 alone or multiples outside the given range. Having listed factors, many made no further progress and gave the elements of set *A*, rather than set *A*', as their final answer.

Question 15

Successful candidates started by writing $C = 2\pi r$ or $10\pi = 2\pi r$. They were then able to solve this to find r. Many candidates found working with π difficult and did not eliminate it when solving; the answer 5π was seen in a number of cases. A significant proportion of the lower achieving candidates made no progress towards a solution on this question. Starting by writing down what they know about the circumference would be a good starting strategy when working on this type of problem-solving question.

Question 16

Most knew that 1 cm = 10 mm, a minority were able to apply this to convert units of area. The most common approach was to divide 780 by 10; some divided by 1000. The majority gave answers involving the digits 78, but some did additional calculations, for example multiplying by 2.

Question 17

Candidates who started by dividing 60 by 2 almost always went on to arrive at the correct answer. Many candidates treated 60 kg as if it was the total amount and started by dividing 60 by 5.

Question 18

Successful candidates used the difference of 5 to arrive at $5n$ and then subtracted 5 from 6 to reach +1. The most common wrong answer was $n + 5$. Some found the next term, 31, rather than the nth term.

Question 19

This was done well, with most reaching the correct answer. The most common wrong answer was r^2.

Question 20

This was the most challenging question on the paper. A significant number of candidates showed an attempt to calculate $\frac{\text{rise}}{\text{run}}$ rather than deducing the gradient from the equations. The most common answer was 3, but a variety of other numbers was seen. Some gave an equation, such as $y = x + 3$, as their final answer.

Question 21

Many candidates showed a correct method and reached the answer 48. A number of these then gave a probability of $\frac{48}{300}$ as their final answer, rather than stating that 48 sixes were expected. This suggests that the underlying concept of estimating a frequency was not clearly understood. Some candidates cancelled their fraction of $\frac{48}{300}$ to $\frac{4}{25}$ but did not realise that they had worked back to the probability given in the question.

Question 22

There were some excellent answers with clear correct algebra. Some candidates arrived at $x < 9$ in the working but then put 9, rather than $x < 9$, on the answer line. Sign errors were often made when adding 1 to both sides of the inequality, leading to the values 7 or –7 being seen in the working. Some candidates reframed this question as the equation $3x - 1 = 2x + 8$ which they then solved.

Question 23

There were some excellent responses here with clear working leading to the correct answer. Changing the mixed number to an improper fraction was not always handled correctly, with $3 \times \frac{1}{7}$ being seen and values of $\frac{3}{21}$, $\frac{21}{7}$, 21, 22 or $\frac{21}{3}$ being used. Some reached $\frac{22}{7}$ but were not able to complete the multiplication.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/13
Paper 13 (Core)

Key messages

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

General comments

Candidates should pay attention to how a question is phrased. **Question 16** requires that the answer is left in terms of π and **Question 18** needs the answer as a fraction in its simplest form.

Workings are vital in questions with more than one mark, particularly those with no scaffolding such as **Questions 11**, **15** and **16**. This is particularly important with problem-solving questions – **Questions 4**, **13** and **22**. Showing workings enables candidates to access method marks in case their final answer is wrong.

The questions that presented least difficulty were **Questions 5**, **7(a)**, **11**, **12** and **17(a)**. Those that proved to be the most challenging were **Question 13(a)** reading a timetable, **Question 17(b)** understand set notation. **Question 22** lengths in similar triangles and **Question 23(b)** finding the interquartile range. In general, candidates attempted the majority of questions. Those that were most often left blank were **Questions 6**, **22(b)** and **23(b)**.

Comments on specific questions

Question 1

This opening question was accessible to most candidates. There was some confusion about the number of zeros and fourteen was seen occasionally as 40. It was not correct to round this number, all digits must be given.

Question 2

The correct answer was frequently seen. Sometimes 7.6 or 76.42 were given as the answer.

Question 3

Very many got this question correct. 300 was the most common incorrect answer showing that some candidates thought there were 100g in a kilogram rather than 1000.

Question 4

The candidates who showed clear working were more likely to get this correct. The first step was to change the $5 into 500 cents – this is easier to deal with than changing the 30 cents into $0.30. Some used repeated addition while other divided 30 into 500. Others showed no workings and were mostly incorrect.

Question 5

Each side had to be worked out then compared. The majority of candidates got this correct. Hardly any candidates chose the equal sign.

Question 6

Candidates should draw a simple diagram using the information in the question. A few gave a compass direction or words such as triangle or rhombus instead of a bearing, maybe they were influenced by the next question.

Question 7

For questions like this, candidates should sketch diagrams of the shapes showing their lines of symmetry. Very few diagrams were seen and sometimes, if there was a diagram, the lines of symmetry were not correct. These are multiple-choice type questions as all possible answers are given so candidates should not leave either blank. Also, candidates should make sure they only give a single answer as a few candidates gave two shapes when the statements made it clear that a single shape is required for each.

(a) A vast majority of candidates were correct with the answer square. A small number gave rectangle, which only has 2 lines of symmetry.

(b) This was not so successfully answered with kite seen as a frequent incorrect answer.

Question 8

Here, only a minority gained full marks whilst some others were awarded a single mark. Candidates must do some calculations to get all the numbers into the same form in order to make comparisons. This use of workings would have benefitted those candidates who only wrote the numbers on the answer lines as often they were incorrect.

Question 9

Many candidates were successful here. Others wrote one term correctly instead of both. There was confusion over directed numbers as some treated the minus sign in front of 1 as addition as if there were brackets around the $6a - 1$. Common incorrect answers were $13a - 4$, $a - 2$ or $10a - 5$; these all came about because of sign misunderstandings. Others treated this as if it was $(7a + 3)(-6a - 1)$ and multiplied out these brackets. A few treated everything as if they were like terms combining all four terms together. Others went on to solve their answer as if it equalled zero, for example, $a + 2 = 0$, $a = -2$.

Question 10

There was a 13 involved in very many answers. Apart from the correct answer, –13, it was common to see (13, 0) or $\sqrt{13}$ as answers. A few candidates added the coordinates together to give (3, –4) or multiplied them to give (–40, 4).

Question 11

This was done very well. This particular question did not have the complication of changing units for either the distance or the time.

Question 12

Candidates were much more successful here if they gave their answer as a fraction rather than trying to work in percentages. The correct percentage did get the mark as no particular form was asked for. A few candidates inverted the probability fraction. Very occasionally, a candidate gave the answer as a ratio. This is never an acceptable form for a probability.

Question 13

(a) This first part was about understanding the conditions and then reading the timetable. The latest train that would get Javid to E before 11 am is the one at 08 05 and some did choose the correct train. Most picked the 10 05 train, but this arrives too late. Some wrote 9 15 but this is the time the train gets to E not the starting time of the train. Others filled boxes of the timetable of when they thought the train would get to the station without fully appreciating that a blank box means the train does not stop at that station.

(b) This part required candidates to pick out the correct train and the two stops and work out the time of Jacinta's journey between them. Most candidates were correct here. Some, who gave 76 as their answer, had taken 851 from 927 without thinking of the context, that of time. Candidates must remember that there are 60 minutes in an hour and not 100. Others incorporated other trains and stops into their calculation rather than keeping with the one train.

Question 14

Here, candidates treated this as addition of fractions or cross-multiplied giving answers such as $2a3b$ (or $6ab$) or $\frac{2b}{3a}$.

Question 15

For this calculation, the first stage is to work out 1% of \$600 and then add it to the \$600 investment as the question asks for the value of the investment at the end of the year not just for the interest amount. Some used an interest rate of 1% per day or 1% per month. Others said that 1% was 600 so that their final answer was \$1200.

Question 16

Here, candidates did not seem to be confident of the correct formula to use for the area of a circle. Those that found the radius then gave 9π often went on the multiply this out (using $\pi = 3.14$) instead of realising that, they had in fact, already got the answer in the form it was required. Answers of $9 \times \pi$ were only awarded a method mark.

Question 17

(a) Candidates did well here, listing all three elements of set B. Sometimes candidates omitted the 1 from the intersection of set A and set B.

(b) In this question the answer is 9 as all integers from 1 to 9 are present within the rectangle – it is not correct to list them. As well as a list of all integers, some others gave 1, 4, 8 and 9 – the elements of the union of sets A and B.

Question 18

Candidates can sometimes find the concept of relative frequency complex and do not make the connection with probability. What is needed is to choose the correct entry in the table (16 matches that had one goal) and use the total number of matches to form the fraction $\frac{16}{48}$. Some candidates stopped here and were awarded 1 mark. Many cancelled this down to $\frac{1}{3}$ as the question asked for the fraction to be in its simplest form. Some formed some or all of $\frac{0}{21}$, $\frac{1}{16}$ and $\frac{2}{11}$ from the number of matches and number of goals scored.

Question 19

This was one of the more complex questions on the paper. Some candidates did very well here. The major problem was that candidates substituted 48 for x in the function leading to an incorrect answer of $f(x) = 180$ instead of writing, $48 = 4(x - 3)$ and going on to solve this. This is a good example of checking carefully what information is given and what the question actually asks for.

Question 20

This question was on more familiar syllabus content. Many candidates gained both marks. The common error made by a small number of candidates was to answer with the highest common factor, 6 or other factors (2 or 3). It is important for candidates to understand the difference between LCM and HCF.

Question 21

The solution of simultaneous equations is a familiar procedure. In general, candidates did not do well solving this pair of equations. Only the first equation needs multiplying either by 3 to be able to eliminate g or by 5 to be able to eliminate h. In both cases, one equation needs to be subtracted from the other to Leave $2h = 4$ or $6g = 30$. Once h or g is found, substituting that into an equation will produce the other value. This should be checked in the other equation to see if the values are correct for both equations – this check is very rarely seen in examination papers and again, was not seen for this question.

Question 22

This question was complex as the two similar triangles were combined into one diagram. The question was designed in two parts to provide scaffolding to find the length of *BC* by finding the scale factor of the larger from the smaller.

(a) The length *AB* is given as 8 cm and the equivalent side, *AD,* in the enlargement has length 12 cm so the scale factor is 12 ÷ 8 = 1.5. A few gave an answer of 4 or +4. Scale factors are always found by division or multiplication and never by subtraction or addition.

(b) In this part, the question asked for the equivalent length in the small triangle, so the length is going to be less than 9 by a factor of 1.5 so the calculation is 9 ÷ 1.5 = 6. Some candidates gave the answer 4.5, maybe because 4 is half of 8. Some candidates had answers that were greater than 9 which cannot be correct for this diagram.

Question 23

(a) The majority of candidates did well here, reading 81 plants from the curve.

(b) Candidates were not so confident here. More steps were needed as well as remembering the procedure. The curve has to be read at a quarter the way from the top (at 75) and from the bottom (at 25) then the values subtracted. This was not straight forward to do because of the scale on the cumulative frequency curve.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/21
Paper 21 (Extended)

Key message

Candidates should ensure that they concentrate on the detail of their work and make sure that they copy their own work accurately within the answer space and to the answer line. They should also use a pencil for diagrams and questions, such as **Question 1a** and **6**, which may need several attempts, and consequently a rubber, so that their final answer is unambiguous and clear.

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, a good number of candidates scored full marks on the paper. Written work was of a good standard, with working being clearly shown. Particularly good algebra skills were demonstrated throughout and notably in **Question 15**. Candidates were able to complete the paper within the time and it was extremely rare to find any question not attempted.

Candidates should ensure they understand mathematical language such as “mixed number”, “clockwise”, “amplitude”, “period” and “varies inversely”.

Candidates should read questions carefully and apply learnt techniques appropriately. For example, in **Question 3**, where some candidates found the mid-point or the length rather than the vector.

Candidates should understand the importance of negative signs, including that the sign in front of a number or term belongs with that number or term. For example, $–5x$ in **Question 2** and within the algebra **Questions 4b**, **8, 15a** and **15b**. Some candidates need to practice, and be careful with, negative number arithmetic such as in **Questions 3a** and **3b**.

Candidates should not make assumptions about diagrams. For example, in **Question 10** they should not assume the triangle is isosceles without evidence such as a statement or a clear indication on the diagram or justification from their workings.

Comments on specific questions

Question 1

(a) Most candidates answered this question correctly and demonstrated a clear understanding of BIDMAS. The most common error was to include more than one pair of brackets. Other candidates tried inserting pairs of brackets in a variety of positions but, because their final answer was ambiguous, they were unable to score. These latter candidates are advised to try inserting the brackets using a pencil and then they can rub out any incorrect trials and show their final choice of brackets clearly.

(b) Many candidates answered this correctly. Most candidates worked in decimals as $0.2 \times 0.2 \times 0.2 = 0.008$ whilst others were successful evaluating using fractions $\frac{2}{10} \times \frac{2}{10} \times \frac{2}{10} = \frac{8}{1000}$ or $\frac{1}{5} \times \frac{1}{5} \times \frac{1}{5} = \frac{1}{125}$. Common incorrect answers included 0.8, 0.08, 0.0008, 0.002, 0.6 and 0.006.

(c) A good number of candidates answered this correctly. Some candidates correctly gave both 83 and 89, even though only one was required. The most common wrong answer was 87, which candidates did not recognise as a multiple of 3. Other common incorrect answers included 81 and 97.

Question 2

Most candidates answered this question correctly. The most common errors arose from slips with signs such as, $5x = -10$ or $5x = 4$ or $5x = -4$ or giving their final answer as $\frac{10}{5}$ rather than working it out as 2.

Question 3

(a) This question was answered well. The most common errors came from sign errors such as answers $\begin{pmatrix} -6 \\ 1 \end{pmatrix}$, $\begin{pmatrix} -4 \\ -1 \end{pmatrix}$ or $\begin{pmatrix} -4 \\ 1 \end{pmatrix}$. A few candidates gave the correct values but included a fraction line which was not accepted. A minority of candidates thought this was a fraction question and evaluated $\frac{1}{2} - \frac{-5}{3}$ or $\frac{1}{2} \times \left(-\frac{-5}{3}\right)$.

(b) This question was answered well with candidates using vectors and/or arithmetic successfully. Many drew a grid and plotted the points to find the answer. The most common error was to find $\overrightarrow{QP}$ rather than $\overrightarrow{PQ}$, which did not score. Other errors usually included a sign error such as $\begin{pmatrix} 3 \\ 4 \end{pmatrix}$ or $\begin{pmatrix} -3 \\ -4 \end{pmatrix}$ or the adding of a fraction line, all of which lost at least one mark. A few did not read the question carefully and attempted to find the mid-point or the length of PQ or merely added $\begin{pmatrix} -3 \\ 6 \end{pmatrix} + \begin{pmatrix} 0 \\ 2 \end{pmatrix}$.

Question 4

(a) This question was answered very well. Although $2p(p - \frac{1}{2}q)$ is an equivalent expression, candidates are expected to factorise without fractions or decimals within the expression so this answer did not score. Common incorrect answers included $2p(p - q)$ and expressions with p and q in both brackets such as, $(2p + q)(p - q)$.

(b) This question was also answered very well. Common errors included writing $2p$ for p^2, making sign errors when evaluating $3p - 7p$ as $+4p$ or $-10p$, evaluating -7×3 as -4 or $+21$ or omitting two terms with an answer $p^2 - 21$. Some candidates lost a mark because they made slips when transferring their answer to the answer line or they refactorised their expansion.

Question 5

(a) Most candidates correctly added the fractions. A number of candidates did not score full marks because they did not give their answer as a mixed number in its simplest form but gave an answer such as $\frac{5}{3}$ or, for example, $\frac{80}{48}$ or $1\frac{8}{12}$ or $1.\dot{6}$. Other errors seen included errors in arithmetic such as $11 + 9 = 19$ or using the wrong process such as $\frac{11}{12} + \frac{3}{4} = \frac{11+3}{12+4}$ or $\frac{11}{12} + \frac{3}{4} = \frac{11 \times 4}{12 \times 3}$.

(b) Most candidates correctly divided the fractions. The most common error was to invert the first fraction rather than the second fraction, giving the incorrect answer $\frac{bx}{2ay}$. Other common errors included inverting the second fraction but then cross multiplying, for example, $\frac{a}{x}\times\frac{2y}{b}=\frac{2xy}{ab}$ or subtracting rather than dividing the fractions. A few candidates did not score because they misread their own handwriting, reading their *a* as 9 to give $\frac{2\times 9\times y}{bx}=\frac{18y}{bx}$ or their *b* as 6 to give $\frac{2ay}{6x}=\frac{ay}{3x}$. Candidates were expected to write $a\times 2y$ as $2ay$ and $b\times x$ as bx.

Question 6

This question was answered well with the majority of candidates rotating the triangle correctly. Most other candidates scored one mark for a triangle drawn with the correct orientation but in the wrong position or for rotating the triangle anticlockwise about $(2, 1)$. Candidates are advised to use a pencil for diagrams so that they can erase incorrect attempts rather than crossing out triangles and leaving unclear answers.

Question 7

Many candidates answered this question correctly. The easiest method was to divide the exterior angle, from 180 – 140 = 40, into 360 and the candidates using this method almost always scored 3 marks, with relatively few making errors such as $\frac{360}{80}=8$, $\frac{180}{40}$ or $\frac{360}{140}$. Some others were successful using $\frac{180(n-2)}{n}=140$ either then rearranging or using trial and error but frequently errors were seen in the rearranging or in the arithmetic. Others made errors in the formula, the most common being $\frac{360(n-2)}{n}=140$ and $180(n-2)=140$. A good number of candidates attempted to find the lowest common multiple (LCM) of 140 and 180, almost always by writing out lists of multiples rather than considering prime factors. Few of these candidates reached 1260 without arithmetic errors and even those who did, were rarely able to deduce that $n = 9$ since $9\times 140=1260$.

A significant number spent a lot of time using trial and improvement methods, often filling a whole page with calculations and rarely being successful.

Question 8

The majority of candidates rearranged the equation correctly. The most common errors came from the mathematical presentation of candidates' answers. For example, $x=\frac{y-2}{7}$ requires a fraction line which passes under both of *y* and –2. It can be written as $x=\frac{(y-2)}{7}$ but not as $x=y-\frac{2}{7}$. Similarly, $x=\frac{-2+y}{7}$ is not correct if it is written as $x=-\frac{2+y}{7}$.

Question 9

The majority of candidates scored full marks on this question. Frequently those not giving the correct answer scored one mark for an answer of kw^9 or $27w^k$. Common incorrect answers included $27w^6$, $3w^9$, $9w^9$, $27w^{27}$ and $81w^9$.

Question 10

A good number of candidates recognised that the alternate segment theorem could be used to correctly place 39 in the triangle or 62 on the straight line *AB*. Although some arithmetic slips were seen, by using a geometrical property, either angles in a triangle sum to 180 or the angles on a straight-line sum to 180, most of these candidates went on to find $x=79$. However, it was very common for candidates to make incorrect assumptions about the diagram. These included: the triangle is isosceles and $x = 62$ or 56 or 59, the diagram is symmetrical and $x = 180 - 2\times 39$ or the tangent and the side are at right angles so $\frac{1}{2}x + 39 = 90$.

Question 11

Many candidates demonstrated good manipulation of surds in this question. However, there were a number of common misconceptions. These included simplifying $\sqrt{a^2b}$ as $b\sqrt{a}$ rather than $a\sqrt{b}$, for example $\sqrt{12} = \sqrt{2^2\times 3} \ne 3\sqrt{2}$ and $\sqrt{27} + \sqrt{12} - \sqrt{108} \ne \sqrt{27+12-108}$ and $\sqrt{3^2\times 2^2\times 3} \ne (3+2)\sqrt{3}$ Other common errors included arithmetic errors, particularly when trying to find a square number that divided into 108 and sign oversights with $5\sqrt{3} - 6\sqrt{3} \ne 11\sqrt{3}$.

Question 12

Whilst some candidates gained full marks on this question, it was clear that many did not understand the meaning of the terms as evidenced by the responses given and the number of candidates who did not attempt this question. Some candidates thought this was a graph transformation question. The most common incorrect answers for the amplitude included 4, 5, 7, 12 and $\frac{1}{3}$. There was less success with the period of the function and common incorrect answers included 3, 4, 12, 360, $\frac{90}{x}$, $\frac{1}{4}$ as well as answers in terms of π.

Question 13

This question was answered well. Candidates should start by writing a clear equation involving y, k and x before introducing the numbers. Some candidates scored only one of the two marks because they either substituted and rearranged incorrectly or, although they set up the equation correctly and found $k = 6$, they gave $y = 2$ rather than an equation on the answer line. Those scoring no marks had frequently used direct rather than inverse proportion.

Question 14

There was a mixed response to this question with many candidates unsure how to proceed with it, consequently this question was answered correctly by a minority of candidates. Common incorrect responses included $\sqrt[7]{x}$, $\frac{1}{\sqrt[7]{x}}$, $-7\sqrt{x}$, $-x^7$, x^{-7}, 7^x y^7, $y^{\frac{1}{7}}$ and answers with logarithms.

Question 15

(a) A good number of candidates scored full marks on this question. Whilst many candidates attempted to find the numerator as $3(x-1) - 2(x+2)$, many candidates were not accurate in their use of brackets or expansion of this with common errors such as $3x - 1 - 2x - 4$ or $3x - 3 - 2x + 4$ or $3x - 3 - 2x - 2$ frequently seen. Candidates often used the correct denominator of $(x+2)(x-1)$ or $x^2 + x - 2$. After reaching the correct answer of $\frac{x-7}{(x+2)(x-1)}$ it was not uncommon for candidates to either expand the denominator incorrectly as $x^2 - x - 2$ or $x^2 + x - 1$ or to try to simplify the correct answer by incorrect cancelling of the x terms to, for example, $\frac{x-7}{x^2+x-2.} \ne \frac{-7}{x^2-2}$. A minority of candidates were able to find the common denominator but did not adjust the top and simply worked out $\frac{3-2}{(x+2)(x-1)}$.

(b) Again, a good proportion of candidates answered this question correctly and showed excellent skills in factorising the two different expressions. Other candidates were able to gain partial marks for being able to factorise, or nearly factorise, one or other of the numerator and denominator.

Many candidates did not have a strategy for factorising the numerator and resorted to random trials. Factorisations such as $(2x-3)(3x+4)$ or $(6x+4)(x-3)$ that did not give $1x$ and expressions such as $x(6x+1)-12$ were frequently seen. Candidates who wrote the denominator as $2a(3x-4)-3x+4$ and thus $\frac{(2x+3)(3x-4)}{2a(3x-4)-3x+4}$ commonly incorrectly then cancelled this to $\frac{(2x+3)}{2a-3x+4}$. Many candidates did not recognise that $-3x+4$ could be written as $-(3x-4)$ which would have enabled them to find the correct expression for the denominator. Others obtained the correct answer but then incorrectly divided by 2, writing $\frac{2x+3}{2a-1}=\frac{x+3}{a-1}$. Had candidates multiplied out to check both of their factorised expressions they may have been able to avoid many of the sign errors that occurred.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/22
Paper 22 (Extended)

Key message

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. Errors in solving simultaneous equations could have been addressed if candidates had checked their solutions by substituting their answers back into the original equations.

Candidates need to be aware of the definitions of different types of numbers such as irrational numbers.

Candidates need to recall and state the geometrical reasons for angles to be equal.

General comments

Candidates were well prepared for the paper and there were many excellent scripts. 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

(a) This part was well answered with most candidates able to demonstrate their knowledge of square numbers.

(b) This part proved to be more difficult. Some candidates tried to find a common denominator, but if they used twelfths, many gave an answer of $\frac{8.5}{12}$. Another successful approach was to convert to decimals and $\frac{7}{10}$ was a common correct answer here.

(c) Many candidates did not understand what an irrational number was and simply gave a decimal that was in the given range. It was refreshing to see an answer of 2π.

Question 2

(a) Candidates showed a good knowledge of division of negative numbers but some left their answer as $\frac{7}{2}$ which did not score the mark.

(b) This part proved to be more challenging than expected with a number of candidates giving an answer of 0.9.

Question 3

(a) Most candidates were able to solve this simple inequality.

(b) Candidates were able to use the correct notation of an empty circle and lines long enough, or with an arrow, to indicate direction.

Question 4

This question was very well answered, with nearly all candidates scoring both marks.

Question 5

This question was not well answered. Some candidates simply divided 360 by 3, and there were many scripts that tried dividing 90 by 4. There were also a number of candidates who found the reflex angle. These candidates scored one mark.

Question 6

This question was very well answered. Candidates clearly have a good understanding of indices.

Question 7

Solutions to this question were much better than in previous sessions. The most common incorrect answer was 25, which was found from simply averaging the two speeds. Some candidate struggled to find the total time.

Question 8

(a) This question was not well answered, as many candidates did not seem to understand that the relative frequencies sum to 1. There were a significant number of candidates who tried to find a pattern in the table.

(b) Candidates who tried to multiply 0.3 by 4000 were usually successful.

Question 9

The first Venn diagram was usually correct. Although there were many correct solutions to the second Venn diagram, there appeared to be some confusion between union and intersection.

Question 10

The majority of candidates scored this mark. The common mistake was an answer of ‘positive’.

Question 11

This was quite a tricky pair of equations to solve involving negatives and fractions. Due to the variety of different approaches, it is essential that candidates show their working clearly. A number of candidates started the question correctly but made mistakes when solving $1.5x = 9$. Candidates are strongly advised to check their solutions by substituting their answers into the original equations.

Question 12

All parts of this question were well answered by the majority of candidates.

Question 13

Most candidates recognised that they needed to multiply by $\frac{3+\sqrt{5}}{3+\sqrt{5}}$ as the first step, and many went on to score full marks. The common error was omitting to simplify their expression and leaving $\frac{6+2\sqrt{5}}{4}$ as the final answer.

Question 14

There were many very good solutions, showing a good understanding of variation. The common mistake was that instead of using the equation y = $\frac{k}{(x-3)^2}$, candidates used $y=\frac{k}{x-3}$.

Question 15

(a) This part proved to be more challenging than **part (b)** with many answers of –3.

(b) Most candidates correctly used at least one law of logs. Some candidates only showed minimal working and often an answer of 10 was given. Stronger candidates were able to score full marks by recognising log 10 = 1.

Question 16

(a) Many candidates did not use correct angle notation and simply referred to angles as e.g. *D*. In addition, candidates are expected to give correct mathematical reasons for angles being equal in any geometrical proof.

(b) This question proved to be a suitable challenge for stronger candidates. Only a minority of candidates were able to use the correct lengths and then find correct the area scale factor. The most common answer was 4:9.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/23
Paper 23 (Extended)

Key message

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 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 need to be familiar with changing units, see **Question 5**.

General comments

Candidates were well prepared for the paper and there were many excellent scripts. 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 questions not attempted. Candidates lost marks through careless numerical slips and others lost marks through incorrect simplification of a correct answer.

Comments on specific questions

Question 1

Although the majority of candidates scored one mark, a significant number of candidates thought that 51 was a prime number.

Question 2

This question was correctly answered by virtually all candidates.

Question 3

(a) The majority of candidates gave the correct answer. The common error was giving an incorrect place value.

(b) This part proved to be challenging. There were very few numerical values of 25 seen, with many candidates giving numerical values of 4 or 16. A significant number of candidates who gave 25, did not go on to give the correct answer.

Question 4

(a) Virtually all candidates scored this mark.

(b) Most candidates gave the correct answer, the common error was giving an answer of 0.3.

Question 5

This question was not well answered. Candidates were unsure of the number of millimetres in a metre.

Question 6

The majority of candidates scored both marks. Candidates are clearly familiar with expanding algebraic brackets.

Question 7

(a) This question proved to be a good discriminator. Although nearly all candidates realised that 3.08 was needed, there were many errors in finding the corresponding power of 10.

(b) The most popular answer was 21×10^{-2} which scored one mark. The good candidates were able to change this answer into correct standard form.

Question 8

The majority of candidates scored the first mark giving an answer of 71. Finding the *n*th term proved to be more challenging. Candidates who realised that the sequence was a quadratic scored one mark, as did candidates who correctly found the second row of differences all being 4.

Question 9

This question was well answered although candidates sometimes mixed pens and pencils. There was evidence that some candidates did check their answers which is pleasing and should be encouraged.

Question 10

There were many perfect solutions to this question. Some candidates made slips by not giving their final answer in terms of prime numbers.

Question 11

(a) This part was poorly answered with very few correct answers. The most common answer was 43.

(b) This question was answered far better this session than in previous occasions. Candidates realised that initially they needed to find the total of the twelve numbers and the total of the ten numbers.

Question 12

(a) This question proved to be a good discriminator. Many candidates realised that the question was testing the difference of two squares, but unfortunately a significant number gave their answer as $(9y-4)(9y+4)$.

(b) Most candidates scored at least one mark. The most common error was candidates being unable to take out a negative factor to complete the solution.

Question 13

(a) Nearly all candidates scored this mark.

(b) Although many candidates scored this mark, some candidates gave the answer including the intersection of the two sets.

Question 14

Most candidates earned one mark, which was for $\frac{7}{10}\times\frac{7}{10}\times\frac{3}{10}$ being seen. Many candidates did not consider that there were three ways of hitting the target twice.

Question 15

There were many excellent solutions to this tricky question. Candidates were expected to expand the brackets, before collecting the x terms, and then dividing throughout.

Question 16

This question showed that many candidates have a good understanding of coordinate geometry. However, this was a challenging question and only a minority of candidates were able to score full marks.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/31
Paper 31 (Core)

Key messages

It is important that candidates have all necessary equipment, including a ruler which is required for drawing straight lines. 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. The candidates need to learn the difference between significant figures and decimal places. If the answer to a question is exact, then the candidate should write that answer down fully unless otherwise asked for in the question. Teachers should ensure that the candidates are familiar with command words. 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. Marks were lost because the candidates did not know the words “alternate” and “corresponding”.

General comments

Most candidates attempted all the questions. Most candidates appeared to have a graphics display calculator and knew how to use it to draw graphs and find intersection points accurately.

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 to 3 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.

Comments on specific questions

Question 1

(a) (i) The majority of candidates wrote the coordinates down correctly. A few confused x and y when writing them down.

(ii) D was always in the correct place. Again, a few confused x and y when writing down the coordinates of D.

(iii) There were many correct answers seen for the area and perimeter. The most common wrong answer for the area was 400 and, for the perimeter, 9.

(b) Many candidates drew the two correct lines of symmetry. A lot of candidates also drew in the two diagonals and so were not awarded the marks.

Question 2

(a) Most candidates found the correct answer. Some gained marks for working out 100 and 20 but then forgot to take the sum away from 200. Others found 10% of 100 rather than 10% of 200.

(b) The majority found that they could buy 6 bottles, but they did not always work out the correct change.

(c) Quite a number of candidates knew that there were 1000 ml in a litre and then continued to work out the correct ratios. Others found it difficult to find the ratios with some just putting 500 and 300 for their answer.

(d) Some candidates found the correct answer here. Other candidates only found the interest and were awarded 2 marks. Some candidates tried to use the compound interest formula.

Question 3

(a) (i) Most candidates found the correct number of students. A few added up all the numbers after the stem to arrive at 54 and some added up all the numbers to arrive at 354.

(ii) The range was well answered overall.

(iii) Many candidates found the correct mode. The most common wrong answer was 2.

(iv) Here too many candidates found the correct median. The most common wrong answer was 2 and 21.5. Some candidates found the mean rather than the median.

(v) Many candidates found the probability correctly.

(b) (i) Most candidates knew how to find the mean. A few candidates found the median instead.

(ii) The stem-and-leaf diagram was well completed. A few candidates did not put the numbers in the correct order, and a few missed out one number.

(iii) Most candidates could write the fraction in its simplest form as requested in the question. A few candidates wrote their answer as 0.80 rather than a fraction.

(iv) Here too the majority of the candidates knew that this was 90%. Only a few wrote 9% or 0.9%.

Question 4

(a) The candidates found it easier to find the size of the angles than to write down the reasons. Only a few candidates knew the name “alternate” and “corresponding”.

(b) A good number of candidates found the correct exterior angle. Other candidates found the size of the interior angle instead of the exterior angle.

Question 5

(a) There were many incorrect answers in writing the 4 decimals in the correct order of size.

(b) Many candidates found the correct answer to 3 significant figures. Others wrote the answer to 3 decimal places. Some just wrote 5.38 with no working shown and so did not gain any marks.

(c) (i) There were many incorrect answers here such as 35×10^{-4} or 3.5×10^{5}.

(ii) Quite a number of candidates gained 1 mark here for writing 50 000 000 or 0.5×10^{8}.

Question 6

(a) Many candidates worked out the correct pay for the week. A few candidates multiplied 8.5 by 40 and then multiplied that answer by 20, rather than adding the 20.

(b) (i) Most candidates found this a difficult question. The most common wrong answers were $m\times1.5$, $m-1.5$ and $\frac{m}{1.5}$.

(ii) Here too, there were many incorrect answers. A good number of candidates gained 1 mark for writing $98m$.

(c) (i) The majority of candidates found the correct value for *P*.

(ii) Finding *n* was well attempted. A few candidates wrote down the expression correctly but then subtracted 15 from 90 rather than dividing 90 by 15.

(iii) Candidates had difficulty rearranging the expression. Only a few knew to multiply out the brackets first or divide by *n*. Many candidates just replaced *P* with *S*.

Question 7

(a) Few candidates gained the full 3 marks for the enlargement. The most common mistake was to put the scale factor as 2 or have an incorrect centre. Some candidates gave two different transformations and so gained no marks.

(b) Reflecting in the *y*-axis was quite well done. Only a few candidates reflected in the *x*-axis. A common error was to omit the tail of the flag.

(c) The translation was reasonably well attempted.

(d) The rotation was less successful, but many candidates scored 1 mark for having the correct orientation but the wrong position.

Question 8

(a) There were many correct answers seen. The most common wrong answer was $12x^3$.

(b) Here too there were many correct answers for the expansion.

(c) Not all candidates knew what "factorise completely" meant. There were a good number of correct answers. However, some candidates only took out the 2 or the x and others just wrote $26x^2y$.

(d) (i) The majority of the candidates solved this equation correctly.

(ii) Fewer candidates managed to solve this equation correctly. They knew to take –11 to the other side of the equation to get 15 but did not know what to do with the *x*.

Question 9

(a) The candidates could work out the area of the triangle but many did not give the correct units. The most common wrong answer for the area was 420 and for the units was m or cm^2.

(b) A good number of candidates found the correct perimeter. Some candidates worked out the length of the hypotenuse but then forgot to add on the other two sides. Some candidates just added 12 to 35 and gave 47 for their answer.

(c) Using trigonometry was not so successful. Many candidates just had a guess at what the angle was – 45° or 60° were common. Other candidates knew to use trigonometry but then put the wrong ratio or wrote their answer as 71 rather than 71.1.

Question 10

(a) Many candidates plotted the points correctly and connected them with a line. Occasionally there was a point incorrectly plotted or the line did not pass through all their points.

(b) (i) Candidates found it difficult to find the median. Many candidates appeared to use the raw data or use the wrong axis. More work in this area would be beneficial.

(ii) There were even fewer correct answers for the interquartile range.

(iii) The number of students who raised more than $525 was better attempted. Some candidates forgot to subtract their answer from 120.

Question 11

(a) (i) Those who attempted this question were usually able to sketch the graph reasonably well.

(ii) Here too, those who successfully drew the curve also found the correct intersection with the y-axis.

(b) The straight line was also well done by those who attempted it.

(c) Not all candidates who attempted this question managed to find both points of intersection correctly. Some found 0. Others wrote 1.7 instead of 1.72 and, as a result, lost a mark.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/32
Paper 32 (Core)

Key messages

To succeed in this paper, it is essential for candidates to have completed 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 did not have access to a graphic display calculator, essential for this paper.

Comments on specific questions

Question 1

(a) Most candidates worked out 365 × 24 × 60 × 60 either in one calculation or in steps. Others did $\frac{31536000}{(24\times60\times60)}$ in one calculation or in steps.

(b)(i) Most had no problem in writing the number in words.

(ii) Although candidates knew that writing a number in standard form involved a number and a power of ten, many did not realise that the number had to be a decimal between 1. … and 9. … . Answers like 31.536×10^6 and 31536×10^3 were common.

(c) It was common for candidates to find all three factors. Some only gave two of them.

(d) Although many found the percentage correctly, a few wrote 0.25% as their answer, mixing the decimal equivalent and percentage.

(e) This was answered well. Candidates used their calculator appropriately and rounded their answer to 3 decimal places as required.

(f) Although the expression was evaluated correctly, many did not round their answer to 4 significant figures. It was often given to 4 decimal places. Some dropped the negative sign in their answer.

(g) In general, the ordering of the decimals was done well with a few having one value misplaced.

Question 2

(a) Most gave the mode correctly but a few gave the frequency of the modal value as their answer.

(b) Both sections of this part were answered well.

(c) It was pleasing to see candidates only using fractions, decimals or percentages as values for probability.

(i) Most found this probability correctly.

(ii) Some candidates misread the question, finding the probability of 1 sibling or the probability of 1 or more siblings.

Question 3

(a) There were many correct answers to this question. Often, candidates used a trial and error approach working out the cost of different whole numbers of litres of petrol. A small number worked out 10 × 0.76 rather than 10 ÷ 0.76.

(b) (i) Although there was a majority of correct answers, a significant number of candidates worked out 50 + 4 × 28 instead of 50 + 3 × 28.

(ii) Most correctly worked out the cost using Company B. Many made the same error as in **(b)(i)** and worked out 50 + 14 × 28. All could correctly establish which was the cheaper company to use.

Question 4

(a) Most knew to subtract the two heights.

(b) (i) It was common for candidates to use correctly 'distance divide by speed' to find the time taken.

(ii) Although many knew to divide the 10 by 1000, few went on to multiply the answer by (60 × 60).

(c) Some candidates did not read the question fully and found only the increase and not the total number of people. A number did not give their answer to a sufficient degree of accuracy. Answers like 1.9 and 1.87 did not gain credit.

Question 5

(a) (i) In general, candidates substituted correctly and then correctly evaluated their expression.

(ii) Again, values were substituted correctly but many had trouble rearranging their equation.

(iii) Although candidates had knowledge of how to rearrange a formula, their efforts were often marred by sign errors.

(b)(i) Candidates knew to replace x by 10 and evaluate the ensuing expression.

(ii) Many just found f(–34.5). Of those who realised they must form an equation in x and solve it, many made algebraic errors in their manipulation.

Question 6

(a) (i) Although there were many correct answers to the median, some incorrectly found $\frac{1}{2}$ of 60 and read off 100 as their answer.

(ii) Many still do not know what the interquartile range is and how to find it. A number found one of the quartiles correctly. As in **part (a)(i)**, some used the graph the wrong way round, starting with finding $\frac{1}{4}$ of 60 and $\frac{3}{4}$ of 60.

(b) There were many correct answers to this part although some overlooked the 'more than' part of the question and stopped at 140. A few read the scale incorrectly and used values of 141 and 150 in their work.

(c) (i) Very few knew how to find the frequencies from the cumulative frequency graph.

(ii) A number of candidates could not identify the middle of the given group.

(iii) Very few candidates knew to combine information from the two previous parts to find the mean. This was true even when those previous two parts were correct.

Question 7

(a) There were many fully correct answers to **part (a)**. A few were unable to draw a reflex angle.

(b) This question was a good discriminator. A good number had a fully correct set of answers. Others misremembered their angle relationships. For *a*, 180 – 94 = 86 (where candidates were using alternate angles adding to 180) or 52 (assuming lines to be parallel which were not) were common wrong answers. For *b*, 94 (again assuming lines to be parallel which were not) was seen. And for *d*, 180 – 52 = 128 (assuming lines to be parallel which were not and assuming that 'corresponding' angles add to 180).

Question 8

(a) Most knew this was a reflection but some confused the *y*-axis with the *x*-axis or $x = 0$ with $y = 0$.

(b) Although 'reflection' was the common, correct, answer a number did not describe the transformation in enough detail, often omitting to state one or both of the other required elements.

(c) There were many correct translations. A few translated the left edge of the shape to –5 on the *x*-axis before translating the bottom of the shape to –3 on the *y*-axis.

Question 9

(a) The use of Pythagoras' theorem was common. However, some did not give their answer for *BD* to more than 3 significant figures as needed to show that, when rounded, their value would become 11.9.

(b) Problems occurred when candidates did not realise that *TB* was 11.9 ÷ 2. Many assumed that *SB* was 8.4 cm. Even after a correct trigonometric expression, many found difficulty in rearranging it and using their calculator to evaluate it.

(c) It was common for candidates to use their answer to **part (b)** and the correct formula to find the volume of the pyramid.

Question 10

(a) Generally, candidates evaluated the two expressions and found they were equal.

(b) The equation was solved correctly by many candidates.

(c) Many candidates struggled with factorising the expression, being unable to break it down in its component parts, $2 \times 3 \times x \times x + 2 \times x$, before extracting the common elements. Some 'cancelled' the common factors and gave an answer of $3x + 1$.

(d) It was clear that many candidates did not realise that the question required the multiplication of two linear expressions, $(3x - 1)(3x - 1)$. Common wrong answers were $9x^2 - 1$ and $9x^2 + 1$.

(e) An open circle instead of a closed circle and arrows pointing in the wrong direction were two of the common errors here.

(f) Both parts were done well. In **part (i)**, candidates wrote each fraction with a common denominator and then, usually, were able to join the two fractions. In **part (ii)**, many cancelled correctly at least once. The common error was to have an answer of $\frac{c}{2}$ instead of $\frac{c^2}{2}$.

Question 11

(a) The tree diagram was completed correctly by many of the candidates. Some worked out 1 – 0.92 in their head and got 0.8 instead of 0.08.

(b) It was common for candidates to choose the appropriate two branches of the tree diagram to combine. However, many of them added the probabilities instead of multiplying them.

Question 12

(a) Invariably a correct sketch of the quadratic curve was given. It was clear that a number of candidates did not have access to a graphic display calculator. Some of these plotted points calculated from the equation of the curve.

(b) A straight line with positive gradient was drawn by many. In a few cases this had an intercept too high on the *y*-axis.

(c) Many found the *x*-coordinate of the two points of intersection correctly. A small number of candidates gave the full coordinate of these points, ignoring the instruction in the question and the reminder on the answer line.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/33
Paper 33 (Core)

Key messages

To succeed in this paper, it is essential for candidates to have completed the full syllabus coverage. Sufficient working must be shown and full use made of all the functions of the graphics 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. Candidates must take care to read each question carefully so that they answer exactly what is required. 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) (i) Most candidates knew to multiply the numerators and the denominators to achieve the answer. A few treated the question as an addition of two fractions.

(ii) It was common to see candidates correctly using their calculator to work this out. Some thought that it could be worked out using spurious rules for indices and gave incorrect answers of 3^{-1} or 3^7.

(b) This part was well done, although a few candidates gave the prime factors as a list rather than a product.

(c) Again, the good use of a calculator often led to a correct answer although this was sometimes left as an ordinary number and not given in standard form.

(d) Many found this challenging. Answers often contained too few zeros after the decimal point.

Question 2

(a) Most parts were answered correctly. In **part (iii)**, some quoted the frequency rather than the temperature. The bar chart in **part (v)** was mostly drawn neatly and accurately.

(b) Many candidates handled this part well. In **part (ii)**, some confused mean with median and in **part (iii)**, a number of candidates found the middle value of the given list rather than an ordered list.

Question 3

(a) Most candidates could draw the next pattern, complete the table and answer the questions following about the number of black and grey tiles in subsequent patterns.

(b) It was common to see correct answers to both **part (i)** and **part (ii)**. Some still have difficulty finding the *n*th term of a sequence; $n + 6$ was a common wrong answer.

Question 4

(a) (i) Although there were a lot of correct answers to this part, it was not uncommon to see candidates evaluating $(5 \times 3)^2 - 10 \times 3$ rather than $5 \times (3^2) - 10 \times 3$.

(ii) Many candidates found it difficult to factorise the expression. It might have helped if they had broken it down into its component parts, $5 \times y \times y - 5 \times 2 \times y$, before trying to extract the common elements.

(b) Candidates' work on solving equations continues to improve with many clearly showing their method and arriving at correct answers to both **part (i)** and **part (ii)**.

Question 5

(a) The majority of attempts involved dealing with the angles in the quadrilateral formed by half of the pentagon. The 80° angle was always halved, as required, but the 90° was often missing from the calculation. Errors of using 180° or 270° as the total of the angles in a quadrilateral meant that correct answers were not seen often. Of those who used the angles in the whole pentagon, most identified the *x* and the 75 as the missing angles but, as with the quadrilateral, using the wrong total for the angles in a pentagon usually led to incorrect answers.

(b) (i) Most knew that *OP* equalling *OQ* made the triangle isosceles but few mentioned why they were equal.

(ii) It was common to see candidates correctly subtracting 128° from 180° and dividing the result by 2.

(iii) The response to this question was mixed. Some candidates did not realise that angle *PSR* was 90° and others assumed that triangle *PSR* was isosceles.

Question 6

(a) All three parts were answered well by the majority of the candidates.

(b) (i) Completing the tree diagram was often done well. Some incorrectly expected the probabilities on the second set of branches to change.

(ii) Finding the combined probability was not done well. Many added the probabilities rather than multiplying them.

Question 7

(a) (i) Common incorrect answers to the number of faces of the prism were 7, 5 and 6. It seems identifying the number of hidden faces caused a problem for some.

(ii) Many candidates did not add the lengths correctly to find the perimeter of the shaded shape. Most divided the required area into two rectangles but many then chose the wrong two numbers to multiply together to find each area. Often, cm^2 was given as the units to both area and perimeter. A few mixed up area and perimeter.

(iii) Most candidates knew to multiply their area by 8 to find the volume of the prism.

(b) The formula for the area of a triangle was well known. However, often candidates did not realise that Pythagoras' Theorem was needed to find the height of the triangle. Some, sometimes successfully, used trigonometry to find an angle in the triangle and then trigonometry again to find the height of the triangle. This method usually led to a loss of accuracy in the final answer.

Question 8

A significant number of candidates had correct answers to all three parts of this question.

(a) A common incorrect method to this standard type of ratio question was for candidates to work out 5000 ÷ 3 and 5000 ÷ 7.

(b) Some candidates worked out how much Atif gave to charity but not how much of his earnings he had left over, as required.

(c) As in **part (b)**, a number of candidates did not read the question correctly and worked out the increase and not the new total given to charity.

Question 9

(a) Most candidates knew how to reflect the triangle in the *y*-axis. A few reflected it in the *x*-axis.

(b) Many correctly rotated the triangle by 90° clockwise but used the wrong centre of rotation.

(c) An answer of translation with an incorrect vector was common. Some used more than one transformation and subsequently were not awarded any marks since the question required a **single** transformation to be described.

(d) Many had at least one of the sides of the image the wrong length. Those with a triangle of the correct size often had it in the wrong place on the grid. This indicated that they had not used (1, 1) as the centre of the enlargement.

Question 10

(a) The majority of candidates knew that a line sloping from bottom left to top right indicated a positive correlation.

(b) The majority of candidates used the line of best fit correctly to find the required *y* value.

(c) Finding the equation of the line was not well done. A few did find the gradient correctly and read off the intercept of the line on the *y*-axis.

(d) (i) Some candidates mis-read the scale when plotting points. A small number read the table incorrectly and plotted (6.8, 9) and (8, 9.4).

(ii) Many answers to this part were too vague such as ‘Move the line up’. In fact, the answer required was an explanation which implied that the line needed a steeper gradient.

Question 11

It was clear that a number of candidates did not have access to a graphic display calculator.

(a) (i) Those with a graphic display calculator correctly drew a quadratic curve with its vertex in the appropriate quadrant. Of those candidates who did not have one, some used the equation of the curve to find and plot points and often obtained a correct curve.

(ii) Again, those with a graphic display calculator performed well and could find the coordinates of the local minimum.

(b) This graph was much more difficult to get right if the candidate did not have a suitable calculator. A graphic display calculator helped candidates to draw the two branches of the graph correctly.

(c) Although many did not attempt this part, there were some who gave the correct three values.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/41
Paper 41 (Extended)

Key messages

It is important to show sufficient working 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 questions states otherwise. A few candidates were unable to gain accuracy marks through giving answers to a lower degree of accuracy.

Almost all candidates were familiar with the use of the graphic display calculator for the curve sketching question, but many did not use them for statistical questions and/or for solving equations.

General comments

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

A few questions proved very challenging and only the very best candidates were successful. Here, omission rates were slightly higher.

There was some impressive work from better candidates showing strengths in dealing with higher algebra and logarithms.

Most candidates showed all their working and set it out clearly. Answers without working were very rare but some candidates work on a few questions was a jumble of figures which made the award of part marks difficult. Time did not appear to be a problem for candidates as almost all finished the paper.

Comments on specific questions

Question 1

(a) Some candidates, who were stronger elsewhere, found difficulties with this question. There was confusion between mode, median and mean. In the calculation of the mean, a few did not multiply the number of problems by the frequency and/or divided by 6 instead of 25. However, the mean was answered better than some of the other parts. In the interquartile range the upper quartile was often incorrect. The candidates would probably have performed better if they had entered the data in their graphic display calculator. This would have enabled them to read off the correct answers.

(b) A very common error was to work with the values rather than their frequencies, leading to the calculation $\frac{360}{25}\times 7$.

(c) The same error was often repeated here leading to the calculation $\frac{4.5}{4}\times 5$.

Question 2

(a) (i) Although this was done well by many, this part proved more difficult than the others. The most common error was in being unable to deal with the square base.

(ii) This was answered very well although a few used r^2 instead of r^3.

(b) This was usually correct.

(c) The vast majority of candidates were able to find the radius of the base, but quite a number could not then go on to find the slant height.

Question 3

(a) Good sketches were produced by the majority of candidates. There were some candidates who gave a completely wrong shape and there were some who did not start at (0, 1) on the *y*-axis. The most common error was a sketch of a cosine function ignoring the absolute value.

(b) Most candidates gave the correct answers. The most common error was to include the *y*-coordinate.

(c) (i) This was also well done by many candidates. Again, a common error was to include the *y*-coordinate. Some omitted one or more solutions.

(ii) Better candidates used their solutions from **part (i)** to find the correct inequalities. Weaker candidates found it difficult. $60 < x < 300$ was fairly common.

(iii) This part proved difficult for many. The straight line was often drawn correctly but the correct shading was relatively rare.

(d) Only the better candidates succeeded with this part. Many were using the degree values 60, 300.

Question 4

(a) (i) The great majority of candidates were successful with this part. Just a few candidates used simple interest rather than compound interest.

(ii) This question was done extremely well. There were a variety of approaches. Many successfully used trial and improvement but there was also some impressive logarithm work from many. Just a few sketched graphs for the solution.

(b) This too was almost always correct.

(c) Most candidates gained some success with this part and there were many correct solutions. Some candidates found the value 1.012 correctly but could not change that to a rate of 1.2%.

Question 5

(a) (i) This was almost always correct.

(ii) This also was done extremely well with just a few finding the *x*-intercept.

(b) (i) This was also done well by most candidates. A few gave the gradient and some made numerical errors.

(ii) Most candidates could find the gradient of *AB* and many of them could go on to find the gradient of the perpendicular bisector. Many candidates used points *A* or *B* as a point on the perpendicular bisector rather than the mid-point. A significant number of candidates thought the gradient of *AB* was 4 as found in **part (a)**. There were, however, a substantial number of fully correct answers from better candidates.

Question 6

(a) This was almost always correct.

(b) This too was very well done with just a few omitting to square at some point.

(c) This was well done by many. A few did not simplify the expression correctly and a few halved the final answer or went on to solve $4 - 2x = 0$.

(d) Most knew the method of finding the inverse functions. The most common errors were sign errors.

(e) This part was found more difficult. The most common error was to find $\tan^{-1}(75)$.

Question 7

(a) (i) Although this was done fairly well, a number of candidates used unnecessarily long methods rather than the simple tangent ratio. These sometimes led to inaccuracies. A number thought the angle was 45°.

(ii) Pythagoras theorem was used well here and the answer was usually correct.

(iii) Many candidates found this part difficult. Many could not find the length of the arc, often using a radius of 6 or 12 rather than their answer to **part (ii)**. Some did not find the length of arc at all.

(iv) Most candidates could find the area of the square and also the area of triangle *AVB*. The area of the segment proved more difficult for many. Often, as in **part (iii)**, 6 or 12 was used for the radius.

(b) Only the better candidates were able to answer this part correctly, the most common incorrect answer of 165 arising from an inability to deal with the cube root and square. Some candidates did realise that a cube root was required but then forgot to square the resulting fraction. Part marks were only occasionally awarded as those who understood what was required usually went on to find the correct answer.

Question 8

(a) Most candidates did what was requested and showed detailed working out arriving at the correct solution. A very small minority of candidates either did not show the method or gave the final answer as the price of a computer.

(b) (i) This part proved very difficult for most candidates. Most did not know what was needed to show the required result which led to very little progress being made. Many solved the equation here rather than establishing the equation. Just a few candidates successfully wrote a correct algebraic equation. That said, many of those did successfully rearrange it to produce the required result. A few left their answers with 9.69 in dollars rather than converting to 969 cents.

(ii) Most candidates were successful here. Many used the formula, some used factorisation and a small minority used sketch graphs.

(iii) Many candidates, having solved the equation correctly in **part (ii)**, could not go on to use the answer here.

Question 9

(a) This proved the most difficult part of the question. Many candidates tried a trigonometry approach, usually unsuccessfully. Very few drew a North line at *C* which, when it was drawn, usually led to the correct answer.

(b) This part was usually done well. Most knew to use the formula $\frac{1}{2}bc\sin A$ and used it successfully.

(c) This part was also done well although some, having found angle *DCA*, could not go on to find angle *CAD*. Some made incorrect attempts at the cosine rule in attempting to find angle *CAD* directly.

(d) The cosine rule was known by most candidates although some did not add their answer to **part (c)** to 35 in order to find the correct angle *DAB*.

Question 10

(a) (i) This was not answered well. Many candidates forgot to shade in the intersection on the given diagram.

(ii) Only the better candidates succeeded here. Many clearly had the right idea but omitted the brackets.

(b) (i) This was almost always correct.

(ii) This was answered well by most, although there are some candidates who still appear to be confused by the n(..) notation.

(iii) This was almost always correct.

(iv) Although this was done well by many candidates, a significant number of candidates did not work with probabilities without replacement.

(v)(a) This part was less well done. Of those candidates who did work correctly with probabilities without replacement, the most common error was in assuming denominators of 20 and 19 rather than 14 and 13.

(b) Here too many candidates treated the outcomes as independent and, again, some left their denominators as 20 and 19. Even those who used the correct probabilities, often forgot to consider the reverse order of the outcomes.

Question 11

(a) (i) This was usually correct but a few gave the positive power.

(i) Although there were many correct answers, a common error was to take the negative power in the wrong direction leading to a power of –19. Those using their calculator, of course, were able to get the correct power from that.

(iii) Many candidates found this difficult as they were unable to use the standard form on their calculator. Here too, many took the negative power in the wrong direction leading to –99 as the power.

(iv) This proved difficult for all except the most able. 25×10^{2p} was achieved by some but many of them could not convert this to standard form. 10^{p^2} was relatively common.

(b) There were many correct answers, showing a good understanding of logarithms. However, weaker candidates found this very difficult.

(c) Similarly here too, strong and middle ability candidates did this well but weaker candidates struggled.

(d) Most candidates made some progress here but only the best candidates reached an acceptable final answer. Almost all reached $\log x^3$ and/or $\log w^{\frac{1}{2}}$. Many also were able to apply the rule for dividing but a substantial number wrote $\dfrac{\log x^3}{\log w^{\frac{1}{2}}}$ instead of $\log\dfrac{x^3}{w^{\frac{1}{2}}}$. It was comparatively rare to find candidates who realised that $1 = \log 10$.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/42
Paper 42 (Extended)

Key message

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

Communication and suitable accuracy are also important aspects of this examination and candidates should be encouraged to show clear methods, full working and to give answers to 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. This is either by making premature approximations in the middle of a calculation or by not giving answers correct to the specified degree of accuracy.

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

A few candidates needed more awareness of the need to show working, either when answers alone may not earn full marks or when a small error could lose a number of marks in the absence of any method seen. This is particularly noticeable in ‘show that’ style questions when working to a given accuracy. Candidates could improve their performance by taking more care in copying values from one line to the next and in reading the question. For example, giving extra transformations in a transformation questions which ask for a single transformation means that no marks will be given.

The sketching of graphs continues to improve and there was more evidence of the use of a graphics 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, percentage decrease/compound interest, factorising and simplifying, functions, cumulative frequency curves, linear and cubic sequences, Pythagoras Theorem, trigonometry and curve sketching.

Difficult topics were combined probability, understanding of mathematical language, interpretation of data from frequency diagrams, inequalities, bearings, exponential sequences, similar shapes/scale factors and mensuration.

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

Question 1

In all four parts almost all the candidates scored at least 1 mark for correctly identifying the next term in the sequences.

(a) This was generally well answered proving to be a confidence boosting first part. However, some candidates did omit the negative sign and the alternative form of $17 + (n - 1)(-3)$ sometimes had the second bracket missing resulting in the loss of 2 marks.

(b) The *n*th term was usually correctly given although a number of candidates tried to use the *n*th term of either a linear sequence or an exponential sequence.

(c) This exponential sequence was well answered with most candidates gaining full marks for a variety of acceptable answers seen.

(d) This cubic sequence was more challenging. Many candidates found the correct *n*th term while others were able to earn a method mark for finding the correct third differences of 6 without realising that this would then lead to a cubic sequence.

Question 2

In all parts of this question, it was important to realise that for example, 1 – 4% alone is not creditworthy when a final answer does not gain full marks, whereas $1-\frac{4}{100}$, or equivalent, is.

(a) Candidates did very well in this question. Many showed they could use the compound interest formula successfully, even in reverse, sometimes by using $n = -1$. The most common errors were to find 104% of 4.32, leading to 4.4928, often then rounded to the correct answer, or 4.1472 from 96% of 4.32 used.

(b) Very few errors were seen in this part. Most candidates used the compound interest formula starting from 2020 with $n = 5$, although some used it starting from 2019 with $n = 6$. A small minority adopted a year-by-year approach, which is a risky strategy as small errors can be compounded to result in an answer out of range. A few used simple interest, which resulted in no marks.

(c) There were three approaches to this part:

Year-by-year: candidates who chose this approach often switched to trial and improvement part way through, probably after realising there were many calculations to do. Some performed a lot of calculations, without showing their trials. However, they usually managed to find the correct answer and wrote down enough to score full marks.

Logarithms: these were used very successfully with all steps clearly shown.

Graphs: Rarely used but those who did showed a clear sketch with intersections labelled.

Often, after use of a valid method the most common error was to reach a correct number of years, such as 19 or 18.9, but then forget to add it to 2020 thereby losing the final mark.

Question 3

In **parts (c)** and **(d)** many candidates lost marks for not reading and implementing the instruction ‘single transformation’ adding extras which automatically scores zero.

(a) The image of the reflection was usually correct. However, a number of candidates reflected the triangle in the line $x = -1$ or $y = k$.

(b) The sketching of the translation was usually correct although a few candidates reversed the components of the vector. A minority of others earned one mark for a translation with one component correct.

(c) The description of the required single transformation was generally well answered and almost all candidates gained two marks for the rotation and the angle. The angle was nearly always given as 90° (anticlockwise) with the acceptable alternative of 270° clockwise seen on a few responses. The centre of rotation was a little more challenging but many candidates did gain full marks here.

(d) This part was more challenging; many candidates did use the correct term ‘stretch’ whilst a number of others used ‘enlargement’ with a scale factor of 2. The invariant line proved to be more challenging and candidates are advised that the word ‘invariant’ must be stated together with the required line.

Question 4

(a) The standard of curves seen was generally very high. Most candidates scored at least 2 marks for having the correct shape. However, some lost marks as they plotted the horizontal points at the mid-points of the class intervals. Some candidates drew a frequency diagram, rather than cumulative frequency diagram, plotted at the right-hand end of intervals. A small number of candidates drew blocks instead of a curve.

(b) (i) The vast majority of candidates knew that they had to use their middle value on the *y*-axis to find their median. Additionally, this mark was allowed on follow through from curves plotted in the incorrect position previously.

(ii) The generous range of acceptable values meant that most candidates scored both marks here, with those that had plotted their curve in the incorrect position earlier still having the interquartile range within the allowed range. Some candidates gained a mark for either of their upper or their lower quartile correct for their curve. A common error was to see upper quartile as 120 – lower quartile as 40 = 80 and then reading off their median value again.

(c) This discriminating part was only successfully completed by the more able candidates. However, most scored at least the method mark for calculating 96, but then simply read off at 96 on the *y*-axis. Those that did manage to get 34 usually went on to score full marks. 34 could only be found from fully correct curves in **part (a)**.

Question 5

(a) (i) This part was completed very well with nearly all answers correct.

(ii) Most candidates managed to gain two marks for a fully correct explicit method. The majority chose to use the sine rule in triangle *AOB* rather than using a right-angled triangle with a side of length 5 cm. However, there was a large number of candidates who did not give an interim value for *OA* of greater accuracy than the provided 3 significant figure answer thereby losing the accuracy mark. Also, many did not show sufficient steps in their working in this ‘show that’ part losing valuable marks. A small number used an unacceptable circular approach.

(iii) This was completed very well with candidates realising that they needed to find the area of an appropriate triangle and multiply by five or ten as applicable.

(b) (i) This was also answered very well with most candidates using the reverse Pythagoras method correctly. Unfortunately some used 10 instead of 8.51 here. A few candidates mistakenly used the angle of 54° from the base in the vertical plane.

(ii) Most candidates used the given formula for the volume of a pyramid so gained at least one mark for following through from the previous two parts. However, some misread the formula as $V = \frac{1}{2}Ah$.

(iii) This was a more challenging part. However, many did realise the need to find the volume scale factor and completed their calculation successfully, with several scoring method marks on follow through from their previous answer. Some candidates square-rooted their fraction even though they had written cube root correctly. Others used the correct scale factor but with length of 8.51 or 18 instead of 10.

Question 6

(a) The standard of curve sketching is generally very good with candidates using their graphic display calculators to good effect and most gaining full marks. The most elegant graphs were seen where candidates had drawn in their asymptotes first, ensuring no overlap of the three branches. Marks that were lost were usually because of overlapping branches, the centre branch not passing through the origin or the left branch not crossing the *x*-axis.

(b) A correct pair of equations of the asymptotes was usually seen. However, some candidates used *y* instead of *x* and some only gave –1 and 2 as their final answers rather than equations.

(c) Candidates found this part difficult and some did not appear to be fully aware of what the question required. Many gave both coordinates for their answers which lost them a mark.

(d) (i) The majority of candidates answered this correctly with only a few not attempting it. Those that did not score the mark were for graphs that either passed through or above the origin or had a negative gradient.

(ii) Candidates had to be well schooled in the use of their graphic display calculators in order to find two of the values. Many candidates who correctly found all three values lost one mark for adding the *y*-coordinates here.

(iii) This was a discriminating part and only a few candidates were awarded full marks. A single mark was often given for $x > 5.16$ seen but the other inequalities proved far more difficult to obtain.

Question 7

(a) Most candidates were able to find the required gradient successfully. The vast majority of candidates then attempted to find the equation of the line using a valid method, with $y = mx + c$ being the preferred form. However, a common error was to see, for example, $10 = \frac{1}{2}(8) + c \rightarrow c = 14$ or $2 = \frac{1}{2}(-8) + c \rightarrow c = -2$. A few candidates omitted the $y =$ from their final answer.

(b) Most candidates substituted the *x*- or *y*-coordinate of the given point into their equation and verified that the other coordinate value was consistent. Some substituted both values into an equation of the form $y = \frac{1}{2}x + c$ and confirmed the value of the *y* intercept. Others considered the equality of the gradients of the lines *AN* and *NC*.

(c) Most candidates established correct solutions using the same techniques as in **part (a)**. To calculate the new gradient, some candidates used the reciprocal of their gradient from **part (a)** instead of the negative reciprocal, while others made errors in rearrangement or transcription. A common error was not substituting the coordinates of *N* (4, 8) into their $y = mx + c$, with some candidates using the coordinates of *A*, *C* or the mid-point of *AC*. Again, a few candidates omitted the $y =$ from their final answer.

(d) (i) This part was found challenging. Candidates used many elaborate approaches, instead of using the symmetry of the diagram. It was common to see only one coordinate correct. Many candidates sketched diagrams to help visualise the problem.

(ii) There were many correct answers but also other incorrect quadrilaterals such as parallelogram, square, rectangle and rhombus were seen.

(iii) This was mostly successfully answered, with the candidates using the correct application of Pythagoras' Theorem.

(iv) This part was a very challenging question. Most of the successful candidates drew a diagram to help them. Candidates who thought the shape was a rectangle usually tried to multiply, for example, *AB* by *BC* and did not calculate the length of the other diagonal. 160 was a common incorrect answer, with candidates forgetting to divide by 2 after evaluating the product of the diagonals. Some candidates used an approach involving many smaller triangles, which involved a lot more work for them. Some of these attempts did earn a method mark for finding the correct area of a relevant triangle.

Question 8

(a) Most candidates demonstrated a good understanding of the relationship between speed, distance and time, and were able to easily find the distance *AC*. Most were also able to apply the cosine rule accurately to obtain the distance *BC*. However, many candidates could not get an accurate enough final answer because of the time they substituted into their formula to get the required speed; common values used were 1.3 and 1.33. Another common mistake was to use 18 as their distance *AC*.

(b) Many candidates were able to get the final answer as 018.9° or 019°. Most candidates were able to identify and use correct values substituted into the sine rule formula. Very few candidates applied the alternative trigonometric or cosine rule methods to solve the question correctly. Common mistakes seen were to state the wrong angle as the final answer and sometimes to assume that triangle *ABC* was isosceles with angle *ACB* = angle *ABC* = 20°.

Question 9

(a) This part was almost always correctly answered.

(b) This part was also very well answered. A few candidates treated the probability incorrectly as 'with replacement' whilst some others used the incorrect product $\frac{5}{10} \times \frac{4}{9}$.

(c) This was a much more challenging question requiring a product of three fractions plus the realisation that this event could occur in six different ways. Whilst $\frac{1}{240}$ was often reached, the multiplication by 6 was not seen very often. A single method mark was awarded on many responses for the correct triple fraction product used. Some candidates who struggled with forming the correct fractions did manage to recognise that there were 6 possibilities and gained a mark.

(d) This was another challenging part requiring the strategy of multiplying 0.4^k by 0.6. Some candidates worked only with $\frac{4}{10}$ or $\frac{6}{10}$ and not the correct combination of both. Other candidates who did use $0.4^k \times 0.6$ unfortunately gave the answer 4, forgetting to add on the extra 1 for the correct final answer.

Question 10

(a) Most candidates obtained the correct answer in this straightforward part. A few candidates did not fully simplify their answer, leaving it as $x(3 + 4) - y(5 + 6)$.

(b) Most candidates obtained the correct final answer.

(c) The great majority of candidates were able to factorise this expression correctly. The most common errors occurred with the signs, particularly the often-seen partial factorisations $2a(5b+4c)+3b(5b-4c)$ or $2a(5b+4c)-3b(5b-4c)$.

(d) (i) Some very elegant and concise solutions were seen in this part by the more able candidates. This was another 'show that' part so it was vital that candidates showed all their working and intermediate steps. Most candidates expanded the brackets before eliminating the fractions. A fairly common error was a sign error when expanding $2(x - 3) - 5(2x + 1)$ writing + 5 instead of –5 for the last term. Some candidates approached the elimination of fractions by multiplying through by one denominator at a time, this often resulted in mistakes, for example, multiplying by $(x - 3)$ some wrote $\frac{2}{(x+1)} - 5 = 3(x-3)$ omitting $(x - 3)$ from the first fraction's numerator. This error was sometimes repeated when multiplying by $(2x + 1)$ arriving at $2 - 5 = 3(x - 3)(2x + 1)$.

(ii) Factorisation and the quadratic formula were used equally in responses with the occasional correct sketch of a parabola seen. Some, particularly those following the formula approach, did not clearly show their working and were a little careless in writing out the formula with the values substituted, for example, writing $–7^2$ instead of $(–7)^2$ or only giving short square root signs. A few only quoted the formula in terms of *a*, *b* and *c* and then wrote down the correct answers, losing the method marks. Occasionally candidates did not give the answer to 3 significant figures when giving $\frac{2}{3}$ as a decimal. Many candidates did not show any working. As this was required by the question, they could only score one mark for both correct answers.

Question 11

(a) This question was almost universally correct, showing that candidates were confident in evaluating functions with a given value.

(b) This part was also successfully answered by many, indicating that candidates had good grounding in composite functions. It was unusual to see $g(f(x))$ being evaluated instead of $f(g(x))$. A few candidates used $f(x)$ multiplied by $g(x)$. Common errors were to omit the '+5' when evaluating or forget to equate to 19. If candidates had a correct equation, it was rare to see an incorrect simplification, although there were several who progressed from $-6x = 12$ to $x = 2$.

(c) The inverse function was very well answered with many correct equivalent answers seen. Several scored the method mark for a correct first step but subsequently had a sign error when rearranging. However, some candidates incorrectly just wrote down the reciprocal of g(x) as their final answer.

(d) This was a challenging final question and many of the stronger candidates were able to show good manipulative skills in algebra. Most candidates were able to gain at least one mark for removing the fractions correctly, but a significant number did not know how to proceed from there. It was common amongst the incorrect responses to see an expanded bracket as $2xy + 5$ instead of $2xy + 5y$. Another common error was to see a final expression with a term in *x* in it.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/43
Paper 43 (Extended)

Key messages

A full syllabus coverage is essential. There was a minority of candidates who did not attempt whole questions suggesting a problem in this respect.

Candidates should be encouraged to show all necessary working and to give answers to an appropriate accuracy.

General comments

There were some very good scripts where candidates showed clear working. Most candidates worked to the level of accuracy required. A few did round values in their working and their final answers were inaccurate. A few candidates did not show working and only an answer was seen. This is a high risk strategy when method marks are usually available for correct working even if the final answer is incorrect. A number of candidates appeared to have little experience with the graphic display calculator.

The paper was found to be quite challenging to quite a number of candidates and the low scores attained by some candidates suggested that they may have had a more positive experience by taking the core level instead of extended.

Comments on specific questions

Question 1

(a) The translation was usually correctly drawn. A few candidates scored one mark with one correct component. Another error was to mix up the *x* and *y* components for which no mark was awarded.

(b) The description of the rotation was often correct. The quite frequent error was to give an incorrect centre. A few candidates described a combination of two transformations for which no marks were given.

(c) The reflection was usually correctly drawn. Errors were to reflect in the *y*-axis or in the line $y = -2$ for which one mark was given.

(d) The enlargement with a negative scale factor proved to be very challenging. Few correct answers were seen.

Question 2

(a) This straightforward calculation of a speed was generally well answered. A few candidates had problems with the units as the data given was in metres and minutes and the answer required km/h.

(b) The time from a given distance and speed was usually successfully answered.

(c) This part was much more challenging requiring candidates to find an overall time of three journeys followed by subtracting to find the time of the third journey. Only the stronger candidates realised this strategy was required and they went on to correctly find the speed of this third journey. Many candidates thought that the average speed of the three journeys was the average of the three speeds.

Question 3

(a) Most candidates correctly found the median of the 12 values.

(b) Most candidates correctly found the mean of another 12 values.

(c) The equation of the regression line was often correctly given. A few candidates lost a mark by giving the coefficient of x to only 2 significant figures. A large number of candidates did not answer this part suggesting a lack of syllabus coverage.

(d) Candidates who succeeded in **part (c)** usually succeeded in both parts. Clearly those candidates who did not answer **part (c)** were unable to answer these parts.

(e) This part required candidates to demonstrate an understanding of values within the range of given data. There were some good answers including from candidates who did not answer **parts (c)** and **(d)**.

Question 4

(a) This ratio question was generally well answered.

(b) (i) This percentage increase question was also well answered.

(ii) This reverse fraction calculation was much more challenging as candidates were probably more prepared for reverse percentage questions. One common error was to increase the given value by $\frac{2}{9}$. Another error was to divide the given value by $\frac{2}{9}$ instead of $\frac{7}{9}$.

(c) This simple interest calculation was usually correctly answered. A number of candidates gave the total value of the investment instead of only the interest.

(d) This compound interest calculation was often correctly answered. A large number of candidates gave the total value of the investment instead of only the interest.

(e) (i) This question was found to be very challenging. As it was a ‘show that’ question, candidates were simply required to give the two amounts in full and the stronger candidates were able to do this. Many candidates tried to start with parts of the equation stated in the question and many others did not attempt the question.

(ii) There were very few attempts at this part. The challenge was to find suitable y values as none were given on the diagram. The most suitable y values were from 1 to 3 and these values or values close to these were rarely seen. A number of candidates gave the answer 6, guessing that it would be halfway between the given 5 and 7 on the x-axis.

Question 5

(a) This ‘show that’ question produced mixed results. Many candidates realised that the cosine rule was required and those who used the formula for an angle were usually successful. A number who used the formula on the formula page made errors when rearranging to make the cosine the subject. Another error seen was the circular argument using the given value. A number of candidates omitted this part.

(b) This part met with more success as the question instructed candidates to use the sine rule. A few candidates treated the triangle as right-angled.

(c) The area of the triangle was also quite well done. A few candidates did not use the values available for using $\frac{1}{2}ab\sin C$ and gave themselves more work by finding another angle.

(d) This part was a challenging question with most candidates not using the areas of similar triangles. The fraction given in the question appeared to be an added complication with many candidates not realising that the sides of triangle *CDE* were half of the sides of triangle *ABC*. The majority of candidates who attempted this question worked out the lengths of the sides in triangle *CDE*.

Question 6

(a) This linear equation was usually successfully answered.

(b) This linear equation, which included brackets, was also quite successfully answered.

(c) This part involved clearing algebraic fractions to create $(3x+2)^2 = 8\times 2$. Many candidates reached this stage and decided to expand the brackets to obtain a standard quadratic equation and then solve it by factorising or using the formula. A few of the stronger candidates spotted the efficient method of $3x+2=\pm 4$.

(d) This part was answered quite well as long as the equation was rearranged into the form $ax^2+bx+c=0$ followed by use of the formula.

(e) This equation involving logarithms was a good discriminating question with good answers from the stronger candidates and other candidates either unable to use the rules of logarithms or unable to attempt the question. The realising of 1 = log10 was an obstacle for a number of candidates.

(f) This probability question required careful reading of the situation and allowed candidates to demonstrate their problem-solving ability. The actual algebra was found to be very straightforward by those candidates who stated $p=\dfrac{n}{12}$ together with $2p=\dfrac{n+6}{18}$.

Question 7

(a) A surprising number of candidates omitted this graph sketching question either because they were unfamiliar with absolute value or lacking experience of curve sketching. A common error was to omit the absolute value brackets and sketch the graph of $y=2\cos(x-45)-1$. The difficulty with being unable to produce a correct sketch is that marks in the rest of the whole question become almost impossible to achieve. However the candidates who sketched $y=2\cos(x-45)-1$ did earn some marks in later parts.

(b) Candidates with a correct sketch almost always answered this correctly.

(c) Candidates with a correct sketch almost always answered this correctly.

(d) (i) Again the candidates with good sketching skills were usually successful with this part. Many candidates did not add the straight line to their sketch. Although this was not required there was a mark available for candidates with incorrect *x* values.

(ii) Inequalities are generally challenging to candidates and only the stronger candidates succeeded here.

Question 8

(a) The simultaneous equations were usually solved correctly. A few candidates ignored the requirement to show working and gained only one of the three marks. Several candidates used the rearranging and substituting method which was found to be much more difficult with the fractions involved. The matrix method was occasionally seen. The candidates who multiplied the second equation by 2 and eliminated *y* were the most successful.

(b) (i) The value of the function was almost always correct.

(ii) The compound function was also well answered with only a few candidates thinking that f(f(x) was a product.

(iii) The solving of the equation from the compound function proved to be more challenging and this was largely due to the algebraic fraction involved. Most candidates reached $\frac{1}{2(3x+1)-3}=\frac{1}{5}$ but only a few realised that this led to $2(3x+1)-3=5$ which was then easily solved.

Question 9

(a) (i) This straightforward probability question was usually correctly answered. A small number of candidates used the number of girls as the denominator instead of the total number of students.

(ii) This straightforward probability question was usually correctly answered. A small number of candidates used the number of boys as the denominator instead of the total number of students.

(b) This part required the number of girls as the denominator and was generally successfully answered.

(c) (i) This part was much more challenging as a product of three fractions was required and then this product had to be multiplied by 6. This proved to be too challenging for almost all candidates.

(ii) This part was even more discriminating and only the stronger candidates were able to attempt it. Four products of three fractions were required. A few candidates did show one or two of the products to earn some credit.

Question 10

(a) This circle property question was often well answered. A surprising number of candidates omitted this question.

(b) This isosceles triangle question was also usually well answered.

(c) This circle property question was often well answered. As in **part (a)**, a surprising number of candidates omitted this question.

(d) This part was much more discriminating involving the use of the angle in an alternate segment together with angles in a triangle. Only a few candidates gained full marks.

Question 11

(a) The volume of water in the shape of a cuboid was usually correctly answered.

(b) This part was found to be challenging indicating difficulties many candidates have with mensuration questions. Errors were seen in the use of the volume of the sphere even though the formula is given on the formula page of the paper. The stronger candidates did add the volume of the sphere to the volume of the water and then correctly divided this total by the area of the base of the cuboid.

(c) (i) This part required the candidates to decide on how 15 cubes would fit inside the cuboid. Only a few candidates realised that this was not a volume calculation. These candidates did realise that the cubes would fit in a five by three arrangement so divided 20 by 3 and 34 by 5 to work out which size cube would fit along both sides.

(ii) This part was similar to **part (b)** and more candidates did apply a correct method even if they had an incorrect answer to **part (c)(i)**.

Question 12

This final question proved to be another discriminating challenge. The stronger candidates added information to the diagram and were able to break the problem into the use of right-angled triangle trigonometry and

Pythagoras. The whole question depended on using $AB^2 + BC^2 = 200$ with $AB = BC$, leading to $AB = BC = 10$. Method marks were given for correct use of trigonometry or Pythagoras in triangle *BCD*. A number of candidates did not attempt this question suggesting a lack of experience in longer unstructured questions.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/51
Paper 51 (Core)

Key messages

To do well in investigations, candidates need to read carefully the information given in the stem of questions, not just at the beginning of the investigation. In this investigation, the patterns in the number sequences changed alongside the 'rules' for the winning lines. From these patterns they needed to develop algebraic expressions that could be used to solve problems.

General comments

The candidates who did well on this paper were able to find and follow patterns in number sequences and to formulate these patterns into algebraic expressions.

They also communicated well by drawing neat, tidy diagrams that showed clearly how they were reaching their answers.

Their working-out in terms of drawing on grids, if carefully done, not only helped them to the correct answers but also scored communication marks.

Comments on specific questions

Question 1

Candidates showed that they read and understood the outline of this investigation by correctly showing the other winning lines, one on each diagram. Most of them drew circles connected by dashed lines as shown in the stem.

Question 2

(a) The answer of 10 was reached by most candidates who showed, between them, various ways that they reached this total. The communication mark was most often awarded for diagrams showing 4 horizontal or 4 vertical and 2 diagonal lines with many supporting this by writing 4, 4 and 2.

(b) Following on from **part (a)** most candidates were able to find the answer of 12, again mostly by drawing the lines on the grid. At this point some of the drawings began to lack some care with the lines being rather haphazard, sometimes very faint or not always reaching all cells they should have covered. The better candidates showed careful communication throughout the paper.

(c) Most candidates saw the pattern and gave the correct answer to this straightforward question.

Question 3

(a) Candidates needed to complete the table using their results from previous questions to help them. The 6 by 6 and 7 by 7 rows were completed accurately and most of the candidates also completed the 20 by 20 row correctly. A few candidates thought they had to complete the gaps between the 7 by 7 row and the 20 by 20 row. Candidates should be shown that in tables the dashed vertical lines represent several missing rows that do not need completion.

(b) An ‘expression in terms of *n*’ was required and the correct expression was commonly seen. Some candidates need to understand what ‘in terms of *n*’ means, as they showed by their answer that they thought this meant ‘n =’. Others turned their expression into an equation by writing, for example, T = or x =. Although not necessary for this answer, candidates should also know how to simplify an expression so that they give their answer as $2n$ rather than $n + n$.

(c) Many candidates noticed that the total was always even was a simple reason to give. Others went beyond this to subtract the 2 diagonal lines and show that since the horizontal and vertical lines must be the same this would not work because these would be decimal not whole numbers. Candidates should practice how to write out clear answers giving reasons.

(d) Good communication was the key to earning full marks for this question. Many candidates showed that $\sqrt{324}$ was 18 which was necessary for the first mark. Invariably candidates correctly showed the substitution of their 18 into their expression to earn the second communication mark.

Question 4

(a) The investigation changed direction slightly for **Question 4**. Candidates should be encouraged to read and reread the introduction to a question to make sure that they fully understand what changes may have taken place. At this stage it also became very important that the diagrams were clear because the winning lines overlapped in some cells. Candidates should be encouraged to draw their diagrams in pencil so that they can not only change them if they need to but when satisfied that they have the correct result they can easily tidy them up.

(b) Many candidates managed to find the 4 diagonals in one direction and understood to double this for both directions. Some miscounted, often because their diagrams were not very clear. It is important not only to understand the changes in the investigation but to be able to translate these into useful diagrams.

(c) Again the question asked the candidates to copy their results from previous questions to help them spot the patterns. Many of them used these patterns to help them answer the general case for the *n* by *n* row. Candidates were not asked to simplify their total for the general case and many did well by showing their addition without simplifying it. This is a good example of good communication shown by these candidates.

(d) Many candidates found this use of the investigation results to solve a problem to be challenging. Candidates who did not know the square numbers, however, were able to work them out. Many of them extended the total column from the table to find that a 7 by 7 grid had a total of 36. Candidates need to be aware that at least some of their working may be counted for communication and so they should try to write out their thoughts in an organised way. Some candidates used the very simple route of equating their total for the *n* by *n* row to 36 to establish *n* was 7. Very few tried 49, a square number less than 50, realising it is odd.

Question 5

(a) It is important to read carefully all the information given and to study the diagrams carefully. With only two lines of values given, candidates need to understand that this is not enough on which to base a pattern. They needed to use the grid to work out the winning lines for at least the 2 by 4 row and then to use it again to check that what they thought was true for the 2 by 5 row was, in fact, correct. Some candidates found it challenging to create the expressions for the 2 by *w* row.

(b) Most candidates attempted this question and with much testing and trial and improvement many reached a correct answer. The simple method of equating their total expression for the 2 by *w* row to 111 was little used.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/52
Paper 52 (Core)

Key messages

A good working knowledge of sequences and expressions proved to be very useful for this paper, as was clarity and care in drawings. Candidates who knew how to work with common differences had a good basis with which to answer several of the questions. The diagrams needed to be well thought out and sensibly drawn to avoid missing any squares.

General comments

Writing expressions when asked and not equations benefitted candidates when they worked on subsequent questions which needed them to use the expressions. Using patterns as well as common differences led to fewer, if any, mistakes being made. Use of a pencil for drawing was undeniably beneficial. The ability to erase mistakes and try again enabled candidates to gain communication marks as well as answer marks.

Comments on specific questions

Question 1

Most candidates had no difficulty with this question. Candidates should expect the first question to be very straightforward; some probably thought it was more difficult than it was. Candidates also need to take care with their handwriting so that, for example, *L* is not confused with 1.

Question 2

(a) Candidates were able to divide one of the rectangles into 8 unit squares and also many drew the correct lines on the other rectangles to show the 3 two-by-two squares. Candidates need to be aware that the question is most likely to follow the stem very closely, so if they had looked carefully at the length 3 rectangles that were drawn in the stem, they would have known what to do. The two-by-two square in the middle was often missed.

(b) (i) The pattern was an increase of 3 which could be shown by 3 common differences of 3 or diagrams drawn on the grid. Candidates should be encouraged to show as much communication as possible. In this case, if their diagrams were not clear they could still have been awarded the communication mark for the 3 differences written alongside the total numbers in the table.

(ii) Candidates answered this question well and showed good communication. Of the possible ways of finding the answer of 23, the most common was to extend the sequence in the table in **part (b)(i)**.

(c) Many candidates showed that 30 did not fit into the sequence that they were using in **Question 2**. This was the simplest way to show how they decided. Candidates need to make sure that they have added a decision, 'Yes' or 'No' to their answer and that their calculations do support this decision. For example, candidates who said 'No, it goes up in 3s' have given a reason rather than shown working, and also needed to add to this that the sequence starts at 5, for it to be correct.

(d) (i) This was the first of 4 questions that asked for an expression, in terms of *L*. The basic 3*L* as part of the answer showed that candidates are familiar with this type of sequence. In the main they also showed that they understood the phrase 'in terms of *L*'. Some of them made this into an equation by adding, for example, L =, T = or x =. Candidates need to understand the difference between an expression and an equation.

(ii) For good communication candidates showed the substitution of 170 into the expression they had written in **part (i)**, which led them to a correct value for their expression. Those who had difficulty had used 'L =' in their previous answer.

Question 3

(a) Clear diagrams were essential to show all 20 squares. Candidates should be encouraged to use a pencil for drawing so that errors can be erased easily. Once they are sure of their answer they can always use pen to emphasise it. The common squares to be missed were the 2 two-by-two squares in the middle and one or both of the three-by-three squares. The allocation of 4 marks (and 6 grids) for this question should have implied to candidates that this question was not straightforward and would require much thought.

(b) (i) Many candidates quickly spotted the pattern of increasing by 6 and showed this by writing 3 common differences at the side of the total numbers in the table. Some tried to work out the numbers by drawings on the grid. This is where organised, careful diagrams were really necessary, to make sure that no squares were missed.

(ii) The same points as in **Question 2(d)(i)** about finding an expression are valid here. The 6 was not quite as common in the answers as the 3 had been. Candidates need to understand how to find basic expressions for all linear number sequences. Various equations were also seen instead of expressions.

Question 4

(a) Candidates read and understood the new method shown in the stem of this question. This was evident from the large number who set out their response following the example given. Just a few only reached a total of 29, missing the final step of 1 × 1. When candidates are told to show that something is true they should be prepared to make sure that they reach the answer given, and they should check very carefully if they do not.

(b) (i) In this question candidates did not have enough information on the pattern to use common differences to find the missing numbers. Most candidates used the method given in **part (a)** to calculate at least the 40. This earned them a communication mark and enabled them to complete the table correctly.

(ii) This expression was based entirely on the total values found in **part (b)(i)**. Candidates who used the common difference of 10 were mostly successful. Candidates should be encouraged to write everything down even if they feel they have not reached the final answer, for example, $10L$ was sufficient for 1 of the 2 marks in this case.

Question 5

(a) Candidates familiar with number sequences were able to spot the triangular number pattern for the coefficients of L. A good knowledge of special number sequences like this one, Fibonacci etc. was very useful. The pattern in the constants proved to be more challenging. Some candidates did notice the difference of 25 between 10 and 35 and used the second differences to build up to their answer. Candidates need to be aware of different methods to use patterns to find missing values or expressions.

(b) It is important that candidates know that they should attempt all questions. Each of the first three expressions that they had found in **part (a)** led to a rectangle length that worked for a total of 50 squares. So at least one mark could have been gained for communication by writing the expression equal to 50. A second mark was available for any one of the correct rectangle's dimensions.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/53
Paper 53 (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.

Candidates should always follow any instructions to use a previous part. Such instructions are intended to aid the candidate.

General comments

Candidates need to be made aware that the later parts of the investigation are built on the earlier parts. Therefore they need to remember, and often use, what they have discovered earlier on in the investigation in latter parts.

In particular, candidates need to practice going from observations of patterns to algebraic expressions. For example, adding the x and y coordinates of P together gives the coordinates of Q. Therefore, if P is (a, b) then Q is $(a + b, a + b)$.

Candidates also need to remember that the investigation could call on any mathematics from the curriculum they have studied. It is about combining and applying what they have previously learnt. In this case, areas and properties of shapes with number patterns and algebraic methods.

Comments on specific questions

Question 1

The question required areas of squares to be calculated and written inside the shapes. Nearly all candidates could do this correctly.

Question 2

(a) The formula for the area of a triangle was given and candidates had to show how to use it to get the given answer. Nearly all candidates could do this correctly.

(b) The question required the area of two triangles to be calculated and written inside the shape. For full marks, the candidates had to show use of the formula given in **part (a)** when working these out. Again, nearly all candidates did this correctly.

Question 3

(a) The question required candidates to recall their knowledge of the properties of a rhombus. The expected response was that all the sides were of the same length. Some candidates were able to express this clearly.

(b)(i) Most candidates were able to find the area of the square around the rhombus. For two marks a simple communication of 7 × 7 needed to be shown.

(ii) Candidates needed to fill in information from earlier questions onto the grid. Most could do this correctly.

(iii) To get the mark, candidates had to use earlier answers to show the area of the rhombus was 21. With show that questions, candidates must include all stages of their working. For example, 4 + 4 = 8 and 5 + 5 + 5 + 5 = 20, rather than going straight to 8 + 20 = 28 or 49 – 28 = 21, without a detailed explanation of where the 28 came from.

Question 4

Many candidates calculated the correct area. Successful candidates were able to apply the method from **Question 3** in enough detail to get the three communication marks as well.

Question 5

(a) This question required the fourth vertex of a rhombus to be found. The majority of candidates were able to do this correctly.

(b) Many candidates calculated the correct area. Successful candidates were able to apply the method from **Question 3** in enough detail to get the three communication marks as well. However, many candidates did not show sufficient detail to gain the communication marks.

Question 6

This question required candidates to spot number patterns and evaluate expressions in indices correctly. It was answered very well.

Question 7

Candidates found the whole of this question a challenging end to the paper and many could make little progress.

(a) (i) This question required patterns to be spotted in the table and generalised into algebraic expressions. Candidates found this difficult and only a minority were able to do this successfully.

(ii) This question required patterns to be spotted in the table and generalised into algebraic expressions. Again, candidates found this difficult, but more candidates were successful with this part than with **part (i)**.

(b) (i) This question required candidates to identify all the conditions that needed to be met. They then needed to find an algebraic equation that they could solve. The solutions to this equation could then be used to find the set of possible areas of the rhombus. Only a minority of candidates were able to do this successfully.

(ii) A few candidates were able to recognise that the conditions would make a square. To get the communication mark they needed to state or show on a sketch what the coordinates would be.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/61
Paper 61 (Extended)

Key messages

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

General comments

Candidates generally found the initial stages of both the investigation and the modelling task to be accessible. The later questions in both proved challenging for many, particularly **Questions 3(b)**, **4, 6** and **7**.

Many candidates presented their work in an orderly way and used correct mathematical form, including writing a model with a subject rather than just as an expression. In order to improve, other candidates need to understand that their working must be clear and correctly expressed.

Methods stated usually needed to be detailed enough to communicate understanding to earn full credit. This could be achieved in a variety of ways: using diagrams and equations or sequences in the investigation or graphs and calculations, for example, in the modelling task. Any simple process that formed part of the solution should have been communicated. The level of communication was generally very good in the investigation task, with many candidates making use of the grids they were given. Communication was also reasonably good in the modelling task, particularly in **Question 5**.

Most candidates stated appropriate units. Occasionally, candidates stated units as part of the models used in the modelling task. This was condoned on this occasion but candidates should know when the statement of units is and is not appropriate, rather than just stating them at every point.

Comments on specific questions

Section A Investigation: Winning Lines

Question 1

(a) This was designed to be a simple introduction to the task and was very well answered.

Most candidates found the correct number of winning lines. A good number of candidates communicated successfully either using diagrams or using a combination of diagrams and calculations or labelling. Some candidates did not fully communicate and drew diagrams that matched the example given, with one line of each type shown. This was not condoned without additional information such as stating 4, 4 and 2. Diagrams with circles only were also not credited as it was not possible to determine the candidate's clear intention from these.

A few candidates drew all the horizontals and verticals but omitted to communicate the diagonals.

(b) The majority of candidates were able to indicate the correct number of winning lines in this part. Some drew diagrams but many simply gave the answer, as they had deduced the pattern of horizontal, vertical and diagonal winning lines.

(c) Many excellent responses were seen to this part of the question. Many candidates simply wrote $2n + 2$ as the pattern was perfectly clear to them at this stage. This gained full marks. A few candidates wrote $n + n + 2$. These gained only partial credit as the question required the expression to be in its simplest form. A common partially correct response was $2n + 6$. This arose when candidates worked with the sequence 8, 10, 12 and considered the first value to represent $n = 1$. The weakest responses were either numerical, commonly 14, or something without merit such as $n – 1$, or included a term in n^2.

Question 2

(a) A good proportion of candidates earned both the mark for completing the table and the communication mark for a diagram showing either all the horizontal or all the vertical winning lines for this case. A few candidates had an error in the table. The errors most commonly seen were incorrectly totalling 6, 6, and 8, or omitting this altogether, or the doubling of the number of horizontal and vertical lines. Again, a few diagrams consisted only of circles and these could not be credited. Occasionally, candidates did not use the grids at all. Other diagrams were incomplete, with only one or two of each type of winning line drawn. Candidates may improve if they are aware that they need to communicate in full and that partial communication is much less likely to be credited.

(b) Again a good proportion of candidates earned both the mark for completing the table and the communication mark which was awarded here for the correct communication of a set of diagonal winning lines. A small number of candidates were unable to sum 8, 8 and 8 correctly. Diagrams that were lines and circles or lines only were much easier to understand than those consisting of circles grouped by ringing them. A few candidates drew extra winning lines that were shorter than required and this was not condoned. Candidates who drew diagrams that consisted of grids full of dots or dashes only may have improved if they had considered whether their diagram was *clear* communication, as required.

(c) Candidates needed to complete a table which was intended to help them generalise the patterns they had developed in the earlier parts of the question using algebra. Many candidates answered this part completely correctly. A few candidates were able to complete the row for the 5 by 5 grid but not the n by n grid. A very small number of candidates were credited for the row for the n by n grid but had made an error in the row for the 5 by 5 grid.

(d) Fewer candidates offered correct answers supported by full communication of method in this part of the question. Two communication marks were available. Candidates could earn these either by forming and solving suitable equations or by extending the sequence of totals and communicating grid sizes with the new terms. Both of these approaches were commonly seen. A reasonable number of candidates equated $4n + 8$ to a square number less than 50. This earned the first communication mark. If they then solved the equation and showed two steps in their solution they were awarded a second communication mark. Many candidates using this approach earned both marks. Some candidates gained the first mark but not the second as they wrote the answer down immediately after writing down the equation. Some candidates misinterpreted the question and found the integer value of n that gave the number of winning lines equal to the largest possible integer less than 50. These candidates were not awarded the first communication mark, but were often able to earn the second mark. The answer 10 by 10 was common in this case. Candidates who chose to extend the totals in the table were also often successful in earning the two communication marks. Using this method, the first communication mark was awarded for extending the totals from the table to 32 and then 36. The second communication mark was awarded for indicating the grid size in some way with these two totals. Occasionally the grid sizes were omitted. A few candidates wrote only $4(7) + 8 = 36$ and stated 7 on the answer line. Whilst this was awarded the mark for the correct answer, it was not sufficient as communication as the use of the value 7 was not justified. The weakest responses stated the answer 10 by 10 without evidence of any method or stated 7 by 7 from consideration only of $7^2 = 49$, which was from an incorrect method and so not credited.

Question 3

(a) In this part of the question the grid size had a fixed height of 2 squares. Candidates needed to complete a table in order to help them understand the new relationships between the numbers of different winning lines. Many candidates were able to complete the numerical entries for the 2 by 4 and 2 by 5 grid sizes. A reasonable proportion of candidates were able to complete the row for the 2 by w grid size. Candidates who related each value in the row to the value of w were the most successful. Candidates who looked at the columns of values for each of horizontal, vertical and diagonal, often stated $2w$, $2w$ and $5w + 1$ for the entries needed. This was from incorrectly considering the first value in each column to represent $n = 1$. Some candidates stated expressions in n or a mixture of n and w. This was not condoned.

(b) (i) A variety of reasons were acceptable. Candidates needed to make the link between the number of columns and there being no possibility of more than one winning line in a column. The most concise way of doing this was to say that there was exactly one winning line in each column. Some candidates observed that the height was the same as the number of **O**s but did not relate this to the width in any way. Explanations were not allowed to contain contradictions or statements that were clearly wrong. It was common for candidates to only comment on the case where the height was fixed as 2 and this was not accepted as the comment needed to be about the general case in this part of the question. It was also common for candidates to comment on why vertical winning lines existed rather than the number of winning lines being w. In these cases candidates tended to suggest that this was always the case when w is greater than or equal to n or similar.

(ii) Candidates found this part of the question, and the rest of the investigation task from this point onwards, to be very challenging. Many candidates drew diagrams and attempted to make the algebra fit the results they had found. This was rarely successful. A better approach was to try to understand how the number of horizontal winning lines related to the dimensions of the grid. Those few candidates who were successful often started with a single horizontal row and established that each row had one initial line with the remaining extra lines being equal to the difference between the number of columns and the number of rows. The most common incorrect answers seen were $n(w – n)$ and $n(w – 1)$. The weakest responses offered numerical rather than algebraic answers.

(iii) In this part, candidates needed to deduce an expression for the number of diagonals and form a sum to represent the total number of winning lines using the information from the two previous parts of the question. Many candidates made no attempt to answer and correct expressions were very rare. Those candidates who did attempt to answer often simply doubled their answer to **part (ii)** and then added w.

(iv) Correct answers in this part were dependent on candidates having the correct expression in **part (iii).** For this reason, fully correct answers were not common. A few candidates were able to earn method marks for the correct substitution of $w = 2n$ into their expression, providing their expression was algebraic in n and w. Often, however, the expression used was too simple to be credited or to be credited more than the first of the two method marks available. It was clear that some candidates were working back from the expression in n that they were given and attempting to figure out earlier results. This approach is not advised and simply wasted candidates' time. The weakest responses offered solutions of $n^2 + 5n + 2 = 0$. This was clearly not what was required and these candidates perhaps needed to read the question a little more carefully.

Question 4

(a) Again, whilst fully correct and well-communicated answers were seen for this part of the question, they were relatively rare. A successful approach seen on occasion was to recall that a square grid always had 8 diagonals for a winning line of $n – 1$ **O**s and then deduce the expression for the extra winning lines generated by the extra columns was always the difference in the dimensions multiplied by 4. Many candidates were able to earn the communication mark available for a diagram of suitable dimension with a complete set of diagonals shown.

(b) Many candidates made some attempt to answer this question, although few correct answers were seen and there were fewer solutions that fully communicated accurate method. The correct answer, 7, was not credited if it was from wrong working. A few candidates earned this mark only, for the answer 7 without any supporting method. There were two communication marks available in this part of the question and these could be earned either using the algebra from the previous question or establishing and justifying the linear sequence of totals 24, 34, 44, 54 using the information found in **Question 2(b)** as a starting point. Candidates who used the algebraic approach were able to access both marks as long as their expression for the number of diagonal winning lines was algebraic in both n and w. Those whose expressions did not meet that criterion were able to access one of the two communication marks available using this method. For the first communication mark, candidates were expected to form an equation by summing the three expressions from **part (a)** and equating to 54. It was this step that was dependent on their answer to **part (a)** being algebraic in both n and w. For the second communication mark, candidates were expected to substitute $n = 4$ and solve for the value of w. Candidates who used the sequence of totals earned both communication marks if they gave the sequence and fully justified it either with diagrams or by indicating the linear pattern for the *nth* term as $10n – 16$ or showed the generation of the values 34 and 44 using $10w – 16$. If the sequence was stated without justification, one communication mark was available. Similarly, one communication mark was available for evidence of linearity without the sequence being given or very clearly implied from their working. The candidates who used this approach often earned at least one of the two communication marks for relating this question to the earlier part of the task as the sequence was quite straight-forward.

Section B Modelling: The Speed of Sound

Question 5

(a) Candidates answered this part of the question very well with many earning all three marks available. The line that was the best fit for this data was the straight line through the points given. It was expected that candidates draw this line with a ruler. Candidates who did not use a ruler or whose lines were not within tolerance of each plot earned two of the three marks available. A few of the lines drawn had a far greater gradient than was acceptable and were not credited, although these candidates usually earned a mark for at least three correct plots. Some candidates only plotted points and made no attempt to draw any line. Almost all candidates made an attempt to answer.

(b) A good proportion of candidates were able to find and state the correct model for S in terms of T. Some candidates omitted the subject of the model '$S =$' and were only partially credited. A few candidates stated their model in terms of y and x and this was also only partially credited. A common incorrect response was to state $10 + T = 6 + S$ or similar. The weakest responses were purely numerical answers.

(c) (i) This part of the question was very well answered. Candidates could now either use their model, or more reliably, use their graph to find the value of S when $T = 27$ or carry out a linear interpolation using the table. A communication mark was available for demonstrating this. Many candidates earned this mark and the mark for the correct answer, 347 or 347.2. A good number of candidates showed the substitution of $T = 27$ into their model. Candidates who were attempting to use the graph were generally very successful. A few other candidates needed to understand that the mark they made needed to be on the graph itself rather than on the T-axis. Some candidates made marks that were very insignificant. It is advisable to use a small cross which is clear rather than a small dot which was sometimes lost in the thickness of the line drawn. Candidates who used interpolation needed to make sure that they showed how they found their values. Sometimes they omitted key parts of their calculations, such as adding 343.

(ii) Again, this part of the question was very well answered with a good proportion of candidates earning both the communication mark available and the mark for the answer. Communication was commonly given for multiplication of their answer to the previous part of the question by five. Almost all candidates were able to convert the distance in metres they had found to kilometres. The weakest responses usually divided 347 by 5 or attempted to use the 27 in a spurious way.

Question 6

(a) The simplest way to answer the question was to find the five constant differences of 0.25 and to indicate in some way that these were the same. Some candidates did this successfully. A few candidates did not show that all five differences were the same and were partially credited if they found three or four differences or if they found two differences and made a statement about them. A similar approach was taken with gradient calculations, although these were less commonly attempted. Quite a few candidates did not answer the question and, rather than showing the relationship was linear, they assumed it was and found the gradient using two points and stated the equation of the line. This alone was not sufficient. Drawing a sketch to show that a straight line resulted from plotting the points was of no value in this part of the question as, although it demonstrated the linear nature of the relationship, it did not justify it.

(b) (i) Candidates were more successful in this part with very many able to state a calculation that justified the given relationship. A few candidates misread the 0.0125 as 0.125. Some candidates were unsure how to answer. This was especially the case if they had found the linear equation connecting S and H in **part (a)**. A few candidates made no attempt to answer.

(ii) Candidates found this part of the question to be somewhat challenging. Better responses stated a correct model using all the information required. Some good responses could not be credited as they had not used the information that when $T = 0$ and $H = 0$, $S = 331.37$. Instead they used 331 for the constant term in the model and this was not accepted. The weakest responses confused the variables and a commonly offered incorrect response was $331.37 = x + y\,(0) + z\,(0)$.

(c) Again candidates found this part of the question to be challenging and the accuracy of responses was variable. Two communication marks were available and a good number of candidates earned at least one of these. Some candidates used the model they had generated in the previous part of the question to find the speed when $T = 20$ and $H = 63$. Some candidates misinterpreted the value of H and incorrectly substituted 0.63. Other candidates made good use of the information about the increase in speed in the table at the start of **Question 6** and were able to gain a communication mark for a calculation such as 343.37 + 0.0125(63) or 344.12 + 0.0125(3). A good proportion of candidates earned a second communication mark for stating a distance ÷ speed calculation with the quantities in appropriate units. The final two marks were for an answer that was found from correct working. Candidates who found an answer in the acceptable range and were using the 343 from the table in **Question 5**, rather than the 343.37 from the table in **Question 6**, were penalised. A few candidates who were accurate with one time only, were able to earn a mark for that time. Some candidates needed to take more care when rounding their decimals as errors were sometimes seen. A few candidates made no attempt to answer.

Question 7

(a) This part of the question was fairly well answered. A reasonable number of candidates were able to find the value of the constant k. Some candidates concluded with the statement $k = \sqrt[40]{14.42}$, and these may have improved if they had reread the question. Some candidates arrived at the point $k^{40} = 14.42$ in their solution and were unable to find the value of k from that. A few attempted logarithms but few of these made progress beyond $\log_k 14.42 = 40$. A few candidates were confused by the H and some formed equations with H only on the left-hand side and this was maintained in their answer. Candidates should have been alerted to their error as the question required a value of k correct to 3 decimal places, not an expression in H. A few candidates needed to take a little more care reading the question as a misreading of 0.0412 as 0.412 was seen a few times. A few candidates tried to incorporate 0.0125 into their equation or chose the incorrect expression for I from the table and made no progress.

(b) Many candidates made no attempt to answer this part of the question. Correct models, whilst they were seen, were rare. Some candidates did not replace the term in H with the new model for I, they added it to what they had in **Question 6(b)(ii)**. Other candidates omitted the term in T. Many attempts, when they were made, had few or no terms in common with the correct model.

(c) Many candidates made no attempt to answer this part of the question. Candidates who had a model with an exponential term were able to gain credit here and a few of them did so. A small number of excellent graphs were seen. It was clear that a few candidates did not have the axes adjusted correctly on their calculator so the graph they were seeing was not of the full shape and the values they marked on the vertical axis also indicated this. Graphs that were approximately the correct shape, with disproportionate straight and curved sections, could gain partial credit. A communication mark was available for either marking the vertical intercept or indicating a value at the vertical tick mark that was between 500 and 1000 and consistent with their graph. Candidates with linear models who drew straight lines could still earn the communication mark if they marked the vertical intercept, for example, which a few did.

(d) This, again, was a question that candidates found to be quite challenging. Some excellent responses were seen from the candidates who had an appropriate model in **part (b)**. A good number of these were able to find a correct speed, communicated a correct distance ÷ speed calculation with a change of unit and were able to convert the time they found, usually a number of seconds, into a time of day. A few candidates gave the number of seconds as the answer or were unable to convert to a time of day to the nearest second, successfully. Those without an appropriate model could still earn the two communication marks available for using a speed that they generated in a distance ÷ speed calculation with a change of unit. A reasonable number of candidates were able to access these marks. A few candidates earned a mark for use of a correct unit conversion, commonly kilometres to metres or seconds to minutes. The weakest responses used the 12 18 in a spurious way as a time, found a speed using it and then used that to re-find a time, in a circular argument. Others calculated values such as 25% of 45, completely misunderstanding the question and the units involved. Many candidates made no attempt to answer.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/62
Paper 62 (Extended)

Key messages

Centres should ensure that all candidates have the use of a graphic display calculator during the examination, are familiar with the list of tasks that are expected (Page 6 of the syllabus) and are aware that, if they use unlisted graphic calculator applications, they will get no credit for that work.

An important component of this paper is the candidate's ability to communicate their mathematics in a manner that clearly demonstrates understanding. While some candidates show this in abundance, some are not fully taking the opportunity to gain communication marks. This happens when the complete process is not clearly shown or valuable working is erased, crossed out or never put to paper. In particular, candidates should always show the numbers used in any substitution they make.

General comments

Completion of the various sequences in tabular form was very well done, and only very few candidates could not find formulae for these sequences.

Excellent graph drawing was seen with many candidates showing a very good representation of a complex function. In this connection, the reading of the minimum point was normally accurate.

Many candidates' work was well presented and organised and could be followed easily. This often facilitates the awarding of communication and partial marks.

Comments on specific questions

Section A Investigation: Squares in Rectangles

Question 1

Nearly all candidates answered this question for the number of squares in a 1 by *L* rectangle.

Question 2

(a) The majority of candidates were successful in showing the 11 squares in a 2 by 4 rectangle. The most common error was not showing the middle 2 by 2 square in its correct position.

(b) (i) Increasing the length of the rectangle by 1 adds an additional 3 squares. More candidates could have gained the communication mark for indicating differences of 3 in the table. Those who showed differences sometimes only showed 1 or 2 differences. Some gained that mark by drawing diagrams showing all 14 squares. A common error when drawing these diagrams was to repeat some 2 by 2 squares so that a total of 14 could be reached.

(ii) The large majority of candidates were successful in finding the expression for the number of squares in a 2 by *L* rectangle. There were some candidates who found the formula for the sequence 3, 5, 8, 11, 14, which was not the same since the first term here had $n = 2$ and not 1.

(iii) Substituting 170 correctly into the formula from the previous part caused little difficulty. Communication of that substitution was usually awarded**.** A few candidates used 170 as the number of squares and attempted to find the length.

Question 3

(a) This question for the 3 by 4 rectangle was similar to **Question 2(a)** but with more challenge in showing all 20 squares. In particular, for drawing the six 2 by 2 squares, candidates needed a systematic method. Various systems were used but many resulted in repeating a 2 by 2 square in the same position as used in another of the diagrams.

(b) (i) This question corresponded to **Question 2(b)(i)**, but, with 38 squares to find, only a few candidates gained communication from diagrams showing 21, 12 and 5 squares of each size. Only a minority of candidates showed 3 differences of 6 in the table but preferred to attempt multiple diagrams, so the communication mark was rarely awarded.

(ii) The counterpart to this question was **Question 2(b)(ii)** and the same comments apply.

Question 4

(a) Candidates had to analyse a table of expressions for the number of squares in a w by L rectangle and so deduce the expression for the 5 by L rectangle. The majority of candidates correctly found that 15 was the next term in the sequence of L coefficients 1, 3, 6, 10 and gained a communication mark for indicating differences of 2, 3 and 4. Sometimes these appeared as $2L$, $3L$ and so on. Similarly, for the constant terms 0, –1, –4, –10, the next term could be found by using differences of –1, –3, –6, –10. Although these were in fact just the negative of the given coefficients of L, it was harder for the candidates to spot, and several omitted the constant or gave a wrong value.

(b) (i) A common error in finding the general expression for 1, 3, 6, 10, 15, 20 was in assuming, rather than justifying, that this was a quadratic sequence. This should be done by showing that at least three second differences are constant. Many correct answers were seen for the expression, the usual method being to note that a common second difference of 1 gave $\frac{1}{2}w^2$ for the start of the expression. Some candidates used the form $aw^2 + bw + c$ for the expression and constructed 3 equations in 3 unknowns, a more time-consuming method.

(ii) For the general expression for the constants 0, –1, –4, –10, –20, –35 candidates were told it had cubic form. Using this, many candidates were able to show a third difference of –1 which allowed them to reach the required answer quickly. Many candidates legitimately considered the constants being 0, 1, 4, 10, 20, 35 as numbers to subtract. These candidates did not always remember that the negative sign had to be introduced when writing their final expression.

Candidates who had incorrect values in the table in **part (a)** often made little progress here and often did not attempt the questions in **part (i)** and **part (ii)**.

Given the form of the cubic, another successful method was to substitute two sets of values from the table into the given expression. Choosing $w = 2$ and $w = 3$ was a popular choice even although $w = 1$ and $w = 2$ gave much simpler equations. This was probably because in the expression for $w = 1$ the constant 0 is not seen. A small number of candidates used incorrect constants in these equations.

There was evidence of candidates using cubic regression, a calculator function that is not permitted, These candidates were unable to score the communication marks.

A small number of candidates wrote decimal coefficients which were therefore inaccurate.

(iii) A communication mark was awarded for showing the substitution of 10 into both of the expressions found in **part (i)** and **part (ii)**, even if those expressions were incorrect. Several candidates only substituted 10 into one of the expressions and only the better candidates managed to answer this last question in the investigation correctly. Some, who had the correct expression for the negative constant, subtracted it instead of adding, giving 770 instead of 440. For those who had been unsuccessful in finding the expression in **part (i)** and **part (ii)**, there was still an opportunity to extend the table from **part (a)** by 4 lines giving $28L - 56$, $36L - 84$, $45L - 120$ and the required $55L - 165$. Only a few candidates used this method which made use of the original information.

Section B Modelling: Cardboard Boxes

Question 5

(a) Candidates had to confirm that the internal dimensions were 1 cm less than the external ones. The large majority managed this successfully. The most common error was to interpret the question as having something to do with area or volume for which the internal dimensions had been given. Some candidates gave extended explanations which often did not gain the marks.

(b) Most candidates were successful in writing an expression for the capacity of the box, although the 2-dimensional answer $(L - 1)(H - 1)$ was seen several times.

The question said *Write down…*, a command that indicates no working is required or expected. A significant number of candidates elected to multiply out the three brackets, which often led to errors in the final answer.

The difference between a formula and an expression is not clear to many. In this question a formula for C was required and so an equation with C as the subject was necessary. The lack of $C =$ in the answer cost many candidates a mark.

(c) A large number of candidates gave the correct formula for the reduced capacity when the base was thicker. Nearly all candidates realised that something should be done with the extra thickness of 0.5 cm. A common error was to subtract 0.5 from the previous capacity or from the length rather than the height. Some candidates reduced the height by 2 cm. Candidates had more difficulty interpreting this information in three dimensions and sometimes both the length and height would be changed. Those candidates who multiplied out the brackets correctly made unnecessary difficulties for themselves later in the paper. An unusual, but correct variant, was $C = (L-1)^2(H-1) - \frac{1}{2}(L-1)^2$.

(d) (i) In this question candidates had to use their formula for the capacity when given information about the height and base area. Many correct answers were seen, the main loss of one mark being due to an incorrect formula in **part (c)**. Most candidates were very clear in showing what was substituted into the formula and so gained a communication mark.

(ii) A very large number of candidates showed they knew how to find the volume and subtract the capacity from the previous part. This was a chance for communication that only a few did not use. The main omission was incorrect or missing units of cm^3, for which a second communication mark was awarded.

Question 6

(a) Some very good explanations were seen. Clear and full explanation is often an integral part of any *Show that…* question, alongside the use of correct mathematics. Details were necessary to score full marks. For example, most candidates could have gained 1 mark by indicating that the area of each square was L^2 and the area of each rectangle was HL, there being plenty of space on the net to show this. For the extra piece of side $L - 1$ it was essential to give evidence as to why $L^2 - 2L + 1$ should be added to the areas of the 2 squares and 4 rectangles. So writing $(L-1)^2$ or $(L-1)(L-1)$ was expected as part of the complete reasoning. A number of candidates omitted doing this.

(b) (i) This question was answered well by the large majority. A few candidates interpreted *expression* as meaning *equation* and $L^2H = 12\,500$ was seen a few times. A small number wrote L in terms of H.

(ii) This was another question that was answered well by substituting the expression from the previous part into the formula given in **part (a)**. Some candidates started by assuming $4HL = \frac{50\,000}{L}$ and tried to work this round to a correct statement, which was not as successful.

(iii) The graph was very well drawn by a large majority of candidates with minimum and endpoints appearing in approximately the correct positions. There are candidates who do not use a graphic display calculator for drawing a graph although it is a requirement for this paper. Those candidates marked off a scale and tried their best to plot points accurately. Such candidates understandably ran into time problems as well as occasionally producing graphs of the wrong shape caused by inaccurate plots on plain paper. Graphs of the wrong shape did not score any marks.

(iv) While most candidates gave accurate values for the coordinates of the minimum, candidates without access to a graphic display calculator were in great difficulty for what should have been a straightforward question. There were some candidates who, possibly from a table of values, took an inaccurate $L = 20$ for the minimum, which resulted in an error for the area A.

On the other hand, while not penalised this time, it is worth noting that excessive accuracy is not realistic for modelling a cardboard box. An answer to the nearest millimetre of length and nearest $10\,\text{cm}^2$ in area is the maximum accuracy one should expect for the answers.

One error that was noted was to give 3660 as 3.66E3, using the calculator form and not standard form.

(v) The common error, made by a large number of candidates, was to consider the box without its extra piece, as was the case in **Question 5(b**). But from **Question 5(c)** onwards and in the stem for **Question 6**, there is an extra piece of cardboard. Otherwise, this question, finding the area of cardboard, was in the main answered well. Most candidates preferred to show the substitution of $\sqrt[3]{12500} = 23.2\ldots$ in the given formula. More efficiently, candidates could have read the answer straight from the graphic display calculator where the function had already been entered to get its graph.

(vi) Comparing the heights of Box A and Box B required finding the height of Box A using the length found in **part (iv)**. The most efficient method to find the height was to divide the volume by the area of the square base. Others chose to substitute the information from the minimum point into the four-term formula provided in **Question 6(b)(ii)**. While correct, this method was much more prone to error. By this time some candidates had run into time problems and left this question blank. Those who attempted it often earned 2 of the 3 marks for showing how to calculate the height and find its measurement. A loss of one mark was seen very often in that candidates forgot to state which box had the greater height, as required in the question.

Several candidates divided the minimum total area by the area of the square base at that minimum, confusing the area of all the surfaces with volume.

(vii) This was another question where good candidates lost a mark by not stating that box A had the greater capacity. Accuracy was important in this question since the capacities of Box A and Box B are very close to each other. So the formula for capacity, first seen in **Question 5(c)**, had to be correct for marks to be gained. Several candidates used the formula from **Question 5(b)** rather than **Question 5(c).**

Those candidates, who had multiplied out the brackets in **Question 5(c)**, were at a disadvantage either through an error in their previous algebra or because of having to evaluate six terms.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/63
Paper 63 (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. This includes when candidates use their graphic display calculator to find the answer to a question, they must still communicate how they did their mathematics, for example by including a sketch.

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, in general, 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 in latter parts of ***Section A***.

Several questions in ***Section B*** were not 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 to remain mindful of the context of the modelling throughout ***Section B***. In this paper, it is about memory retention and nobody can remember more than all of it which is 1, or less than none of it which would be zero. So models giving values of R greater than one or less than zero are not valid.

Comments on specific questions

Section A Investigation: Area of a Parallelogram

Question 1

The question required the area of a rectangle to be calculated and written inside the shape. Nearly all candidates could do this correctly.

Question 2

The question required the area of two triangles to be calculated and written inside the shapes. For full marks, the candidate needed to show usage of the formula for the area of a triangle.

Question 3

(a) The question required candidates to calculate the area of the surrounding rectangle. Most candidates could do this.

(b) (i) Candidates needed to fill in information from earlier questions onto the grid. Most could do this correctly.

(ii) To get the mark, candidates had to use earlier answers to show the area of the parallelogram was 28. With show that questions, candidates must include all stages of their working. E.g. 2 + 2 = 4, 3 + 3 = 6 and 5 + 5 = 10 then 4 + 6 + 10 = 20 rather than going straight to 48 — 20 = 28 with no explanation of where the 20 came from.

Question 4

Many candidates calculated the correct area. Successful candidates were able to apply the method from **Question 3** in enough detail to also be awarded the three communication marks.

Question 5

(a) This question required the fourth vertex of a parallelogram to be found. The majority of candidates were able to do this correctly.

(b) Many candidates calculated the correct area. Successful candidates were able to apply the method from **Question 3** in enough detail to get the two communication marks as well.

Question 6

(a) This question required candidates to spot number patterns in a table. It was answered well by most candidates, but only those confident with using negative numbers achieved full marks.

(b) Both parts of this question required patterns to be spotted in the table and generalised into algebraic expressions. Many candidates were able to do this.

Question 7

This question required candidates to use their generalised algebraic expressions from **Question 6(b)** to find some of the possible points satisfying the given conditions. Only a minority of candidates were able to do this.

Question 8

(a) This question required candidates to illustrate that a parallelogram consisted of two congruent triangles. A simple sketch was required but it had to have a diagonal line to indicate the two triangles. Nearly all candidates were able to do this.

(b) This question required candidates to use the statement given in **Question 8(a)** to double the area of the triangle to 50 and then combine the information given in the question with their algebraic expression from **Question 6(b)(ii)** and find the possible solutions. Very few candidates were able to find these solutions.

Section B Modelling: Forgetting Curves

Question 9

This question required an understanding of negative indices and only a minority of candidates were able to do this.

Question 10

(a) Candidates were required to sketch two graphs. Some candidates were able to produce suitable sketches. Successful candidates showed intersections with the R-axis and behaviour at $d = 5$. Candidates who used their graphic display calculator needed to make sure that they were using the correct scale.

(b) This question required substitution into a formula involving indices. Most candidates were able to find the required value. However, to obtain full marks, candidates needed to show the subtraction they did to find the difference and many did not do this.

(c) (i) Successful candidates realised that they were being asked to work out the equation of a straight line and used the information given to find two points on the line to use.

(ii) Candidates were asked to comment on the validity of the straight line model after more than ten days. Only a minority of candidates realised that after ten days the model would give negative values for *R* which is impossible as you cannot remember less than zero of what you have learnt. It is also important to be clear from the answer that the model will be invalid.

Question 11

(a) (i) Candidates were asked to write down why $p = 5$ after 4 days. The command words 'write down' meant that they did not need to work anything out just explain it. A simple answer of 'because $1 + 4 = 5$' was sufficient. Repeating the wording of the question using 'increases by 1' was not. Some candidates were able to do this.

(ii) This question required the candidates to use their knowledge of functions to show what the retention was after 4 days. For show that questions, candidates must start at a different point and arrive at what they are asking to be shown and not the other way round. Very few were able to do this correctly.

(b) This question required an understanding of the rules of negative indices. Some candidates were able to find that $d = 9$. For both marks, they had to show that this was because of equating the powers of two.

Question 12

(a) Most candidates were able to complete this table correctly. Successful candidates knew that 20 minutes was exactly $\frac{1}{3}$ of an hour and did not put 0.3.

(b) Two points needed to be plotted accurately to gain this mark. Most candidates did this well. Some needed to remember to look carefully at the scales on the axes when plotting points.

(c) (i) Candidates were required to read the information from a table and make two equations. Many were able to do this successfully. Candidates should use the points they were told to use and not the ones they had evaluated themselves.

(ii) Candidates were required to solve two simultaneous equations. A few successful candidates were able to evaluate powers of 2 which made those equations simpler to solve.

(iii) This question required a graph to be sketched. Very few candidates attempted this.

(iv) A simple statement about validity of the model was required. For example, 'the model is invalid after 3 hours'. Very few candidates were able to describe this validity as they had not sketched it in **part (iii)**.

(d) (i) Candidates needed to apply their knowledge of logs and fractions to algebraically explain why the model was not valid for the given interval. Only a small minority of candidates were able to do this.

(ii) This question required the substitution of two values into an algebraic fraction and then for it to be solved. For maximum marks, candidates needed to sketch relevant graphs or show algebraic working as well as solving it.

(iii) Candidates needed to substitute their value of *k* from **part (ii)** into the model using the number of hours in a month and show how close this was to the experimental result in the table. This was found very difficult by the majority of candidates.