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 show all necessary workings clearly. Candidates should check their answers for sense and accuracy. Candidates are reminded of the need to read the questions carefully, focussing on key words or instructions.

General comments

Candidates should pay attention to how a question is phrased. Find, work out and solve indicate that calculations have to be done some working to get to the answer, for example, **Question 8(a)**, **10** and **16**. Write down is used when there is likely to be no working required.

Workings are vital in two-step problems, such as **Questions 18**, **21** and **22**. Showing workings enables candidates to access method marks in case their final answer is wrong. 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**, **5**, **7(a)** and **11**. Those that proved to be the most challenging were **Question 9** on sets, **Question 15** asymptotes, **Question 20** the range of a function, **Question 22** gradient of a line and **Question 23** area of a sector of a circle. In general, candidates attempted the majority of questions. Those that were most likely to be omitted were **Questions 15** and **20**, questions that have already been mentioned as challenging.

Comments on specific questions

Question 1

This opening question was accessible to virtually all candidates with answers of $\frac{25}{100}$ or other equivalent fractions. Very occasionally, the decimal equivalent, 0.25 was seen which did not get the mark.

Question 2

Many candidates gave two or even more multiples of 12. If a candidate gave more than two answers, all had to be correct to get the mark. The common error here was answers of two or more of the factors of 12 instead of multiples.

Question 3

This is a multiple-choice question with only three answers to choose from, *AB*, *CD* and *EF,* and the large majority got this correct. Occasionally, candidates gave answers such as *E* to *F* or *E* – *F*. Answers in these formats were not acceptable; the correct mathematical way of expressing line segments must be used.

Question 4

This conversion from centilitres to litres is one of the more complex in that often candidates forget the conversion factor. The wrong answers were mostly 1.5 or 150 litres showing that candidates did not recall how many centilitres there are in a litre. Very occasionally, candidates divided by another power of 10 or multiplied.

Question 5

Candidates did well here applying the order of operations to the given calculation correctly. There were a few who knew in which order to do the calculation but showed working such as 4 ÷ 4 = 0 then 10 – 0 = 10. As this question only had one mark candidates should check they have not made arithmetical errors as well as checking the method used. Some did the calculation incorrectly, from left to right with no consideration to the order of operations.

Question 6

This was another multiple-choice question that should not be left blank. There was an indication that there was only one number that fitted each description as the question said **the** cube number and **the** triangle number.

(a) Many gave 25 as the cube number followed by 24, 26 and 23 in order of frequently chosen.

(b) A few candidates gave two answers, 21 and 27 so did not get the mark. Some gave 27 for both answers.

Question 7

Candidates did well here with **part (a)** being the more successful.

(a) The occasional errors were to do with understanding the scale so a few gave 350 m or 330 m instead of 360 m as the distance of Suba's home to the library.

(b) Here, two readings had to be made, 32 minutes and 15 minutes, and then subtracted to find the length of time she was in the library. Some gave 15, 32, 47 (from adding) or 45 (the number at the end of the time axis).

Question 8

(a) First. candidates had to order the data and, as there were 12, the median is half-way between the 6th and 7th, 13.5 marks. Some said 21 which was the mode and it is in 6th place in the unordered list.

(b) Quite a large number of candidates were correct with the mode. Candidates who put 21 for **part (a)** did not say 21 again here. There were quite a few candidates who did not give an answer as well as many of the other numbers in the set of marks.

(c) In general, candidates were confident with what they had to do. There were a few who showed the subtraction but made arithmetic slips so could not have the mark. Candidates should be aware that saying '24 – 6' or 'from 6 to 24' is not sufficient as the range is a single number, the result of the largest number subtract the smallest.

Question 9

This has been mentioned as one of the questions that candidates found challenging. The question is asking for the prime numbers that are less than 10 but uses set notation. Although some wrote down all 4 prime numbers there were quite a few candidates who either missed a prime or gave an extra number; these candidates were awarded one mark out of the two. Some did not seem confident of either the definition of a prime or set notation so gave even numbers other than 2 or included 1. Virtually all candidates only gave numbers less than 10.

Question 10

Many candidates got both marks for the answer 21 and some got one mark as they wrote down a correct method. Wrong answers included $\frac{3}{5}$ (60 per cent as a fraction) 25 (60 – 35) and 20 because of arithmetic slips. Some showed no working at all so could not be awarded any marks.

Question 11

Candidates did well here. There were some who gave $3w$ as their answer. Also seen were w and w^2 as the answer.

Question 12

Many knew that the answer was no correlation or none. To describe correlation all that is needed is positive, negative or none. Candidates do not need to qualify the type with the strength. Also seen as answers were descriptive words such as zig-zag, high movement and unknown as well as graph, range and square. Quite a few left this question blank.

Question 13

It is useful to check the number of marks for transformation questions. In general, if there are three marks this means three pieces of information are needed so the transformation is a rotation with centre and angle (and direction required) or as in this case, an enlargement with centre and the scale factor. Quite often candidates gave the correct description and then said ‘and a translation’. Answers that mention two transformations score no marks.

Question 14

Some candidates shaded both Venn diagrams correctly. A few shaded the intersection in both diagrams. Some divided up the Venn diagram into further sections so shaded only parts of the original four regions. On the union question, candidates often missed out the intersection. Candidates need to have full understanding of set notation to be confident about answering questions like this.

Question 15

As already mentioned, this was a question that candidates found challenging and this question was the one most likely to be left blank. Those that did attempt to draw an asymptote did use a ruler. Some lines were not exactly through $y = 2$ but did show some understanding of what was required. A few drew a line that crossed the graph of the function (towards the right-hand side) and these did not gain the mark. Some translated the curve up or down the *y*-axis showing little understanding of the term asymptote.

Question 16

Here, candidates did not seem be to be confident of how to solve inequalities or how to write the answer. Some gave 5 when the full answer required was $x \leqslant 5$. Some listed individual values that x could take.

Question 17

Many candidates were correct here. Sometimes candidates gave 5 which is another common factor but not the highest common factor. A few gave a number between 70 and 80 or tried to find a multiple of 70 and 80.

Question 18

All candidates attempted this question and many were able to gain a method mark for finding the speed in m/s. The conversion to km/h proved more problematic. Some inverted the operations, only multiplied by 60 or divided by the wrong power of 10. Candidates’ work was often poorly laid out so that it was difficult for them to check for errors. Candidates appeared to try one method and then abandoned it in favour of trying another approach.

Question 19

Many candidates were able to gain one mark for a part solution for this question if not both marks. Some tried a kind of cross multiple giving the answer $24y \times 5x$ as if they were treating the multiplication sign as an equals sign.

Question 20

There were some fully complete answers as well as those that were awarded one mark for working out the smallest and largest numbers in the range but were unsure how to express their answer. There are quite a few stages of understanding that was needed here and many candidates were unable to complete the question as they were unsure of the steps needed to take to get to the answer.

Question 21

There were some good concise solutions to this similarity question. Instead of working out that as 5 is half of 10, *DG* will be half of 12 so *EF* will be 18, some candidates did not use similarity and added 5 to 12 to get 17 or added 5 + 2 (as 12 is 2 more than 10) to the 12. A few gave 15 as the answer which is *EA* not *EF*. There were a few candidates who misunderstood that this was a question on similarity so worked out the area of one of the rectangles.

Question 22

Many candidates find calculating the gradient of a line a complex part of the syllabus. Some candidates found the gradient and then went on to give the equation of the line. This further work did not get them full marks, only a method. There was no diagram to help candidates work this out which increased the difficulty level of the question. Candidates should be encouraged to draw their own sketch grid to plot the points if that is useful to them. Some did draw a grid but errors in plotting the points meant that they did not find the correct gradient. Many candidates gave a set of coordinates as their answer and others showed no working leading to their incorrect answer so it was impossible to determine what the misunderstandings were.

Question 23

This question had a diagram to help candidates visualise the context. Some candidates found the area of a whole circle with radius of 6 cm. A few candidates did not read the question carefully enough and so did not leave their answer in terms of π. Candidates who got 12π from a wrong method such as $2 \times \pi \times 6$ (the full circle's circumference) did not get any marks.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/12
Paper 12 (Core)

Key messages

Candidates need to be careful to read the question in detail and answer as indicated. Candidates need to take care to avoid numerical and algebraic errors.

General comments

Most candidates were able to make a very good attempt at all questions. Candidates appeared to have sufficient time to complete the paper and the standard of presentation was generally good with candidates setting their work out in a clear readable fashion. There were many good and excellent scripts seen. There were several reasonably straightforward questions, particularly near the beginning of the paper, giving all candidates the opportunity to show what they had learnt and understood, and some which provided more of a challenge. More work was needed to consolidate candidates' understanding of using set notation in **Question 12,** simple interest in **Question 14**, unit conversion in **Question 17** and full description of rotation as indicated in **Question 18**. The responses in answering **Question 20b** showed a generally poor understanding in probability using a Venn diagram.

Comments on specific questions

Question 1

Most candidates gave the correct answer to this question which was a straightforward start to the paper. The common wrong answers were 326.27 or 3300.0.

Question 2

This is a familiar type of question and candidates generally performed well. The rare wrong answer was 12. Some responses showed their understanding with the written statement $6^2 = 6 \times 6$ but then had 12 on the answer line. This is a careless mistake and candidates should go over the paper and correct these careless mistakes.

Question 3

This question was answered well with almost all candidates correctly drawing a ruled line of symmetry.

Question 4

This was a well answered question. Many candidates scored the mark, the most common error was choosing $\sqrt{2}$ or -0.2. Some candidates tried to list the numbers in numerical order.

Question 5

Almost all candidates gained the mark for this question demonstrating clear understanding of equivalent fractions.

Question 6

This question was easier than similar ones in previous years. Just requesting the size of the angle with no geometric reasoning, made the question accessible to all candidates and a good proportion of fully correct answers were seen.

Question 7

While many correct responses were seen, some candidates did not work out the multiplication before the subtraction and gave 28 as their final answer.

Question 8

This question tested the candidates' understanding of averages and range.

(a) This part was the most successfully answered part with candidates realising the need to find the most frequent number.

(b) There were some careless numerical mistakes in this part, with candidates demonstrating their understanding of range with the written statement $76 - 8$ followed by an incorrect answer from their subtraction.

(c) This part was well attempted with mostly correct answers, but some candidates put the numbers in order then decided to add them. Others gave what appeared to be random answers.

(d) Again, this part was well attempted, with only a few blank responses seen. Some candidates who realised that the sum of all number is required, did not gain the full marks because of their inability to process the sum or the division by 6 correctly.

Question 9

A sizeable group of candidates scored the mark for this question. Some candidates correctly worked out the correct answer but then put 25 or 3 on the answer line.

Question 10

A sizeable group of candidates scored at least one mark. Many candidates substituted $x = 7$ inside the brackets and those candidates went on to gain full marks. Others tried to expand the brackets first but ended up with some algebraic mistakes in their expansion.

Question 11

Another familiar type of question, and candidates generally performed well. Some candidates did not score the mark because they did not simplify fully and stopped at $9:12$ as their final answer.

Question 12

This question showed the lack in understanding of set notation. Most candidates were unable to answer this question correctly. The most common error was using $\cap$ and $\cup$.

Question 13

Most candidates were able to answer this question correctly. Although some candidates showed the correct method, they did not score the mark because of a numerical errors. Others divided 70 by 4 instead of multiplying.

Question 14

Although a good number of fully correct solutions were seen, this question proved demanding for many candidates. The successful candidates worked in stages, working out 1% of $4500 then multiplying their answer by 2 to find the interest for 1 year then finding the interest over 3 years. Some candidates did not read the question carefully and stopped short of finding the total investment, others used 20% interest rate in the form of multiplying by 0.2 but it was clear that many candidates did not understand the concept of simple interest.

Question 15

This is a familiar type of question and candidates generally performed well. Some candidates spotted that $5 \times 6 = 30$ so *x* must be 3. Others tried to solve the equation but either attempted the more complicated route of expanding the bracket or did not use the correct order of the operations.

Question 16

Most candidates were able to quote the correct formulae for the area of the rectangle but not the triangle. The most common errors where 180 cm^2 when ignoring the patio area, or having 30 cm^2 as the area of the triangle.

Question 17

As in previous years, unit conversion remains a topic to improve on. Candidates had little success with this conversion with the most common wrong answer being 460.

Question 18

This is a standard question asking for a full description of the single transformation. Although some fully correct descriptions were seen, the majority of answers were missing either the centre of rotation, the number of degrees or the direction of the rotation. Some candidates stated more than one transformation, and this did not gain any marks.

Question 19

This is a familiar question and candidates generally performed well.

(a) Numerical errors were the main cause of not awarding the mark in this part.

(b) Candidates were more successful scoring the mark in this part because they were able to communicate the rule of the given sequence.

Question 20

(a) Although this style of testing Venn diagrams has been seen before, many candidates still found it difficult to correctly complete the Venn diagram.

(b) Candidates were even less successful answering the probability in this part. The mark scheme allowed 1 mark for a follow through but many candidates did not score any marks because they considered only the number of candidates studying English and did not include the candidates studying English and maths.

Question 21

This question was well answered. Some candidates scored one mark for 2×10^k or $x \times 10^{11}$. Some candidates wrote the standard forms in ordinary numbers then worked out the division. The most common error was 4×10^{23}.

Question 22

This question was easier than in previous years. Only a few candidates did not attempt the question and many of the candidates were successful in gaining at least the special case mark.

The common method used was eliminating one variable (mainly *y*). Some candidates tried to find the values of *x* and *y* that satisfy one equation but were unsuccessful when considering only positive numbers.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/13
Paper 13 (Core)

There were too few candidates for a meaningful report to be produced.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/21
Paper 21 (Extended)

Key message

Candidates should ensure that they have developed and practised arithmetic skills that are of a level that enables them to competently and efficiently complete the questions.

General comments

Candidates were generally well prepared for the paper and demonstrated good understanding and knowledge across many of the topics tested. The standard of written work was generally good with most candidates showing clearly the steps they were following. Where a candidate restarts a question, they should ensure that working that has been replaced, and that they do not want to be considered, is crossed out.

Many candidates lost a significant number of marks because their arithmetic skills were not secure. **Questions 1** and **2** tested basic numeracy skills and a significant number of candidates could not accurately subtract, multiply or divide decimal numbers. These arithmetic skills, as well as multiplication tables, order of operations, fractions and negative number skills were needed again in the more complex **Questions 3**, **4**, **6**, **7**, **8**, **11** and **12**, which proved costly for some candidates who clearly otherwise had a high level of conceptual ability. Practising working with numbers efficiently, particularly using cancelling down, would help candidates significantly when answering questions such as **Questions 3(b)** and **6**. For example in **Question 3(b)** candidates were making errors calculating $15 \times 60 \times 60$ before dividing by 1000, rather than first simplifying to $\frac{15\times6\times6}{10}$. In **Question 6**, candidates choosing to use the longer method, $180-\frac{(30-2)\times180}{30}$, would have been more successful if they had cancelled the 30 into 180 as a first step rather than first working out 28×180.

Comments on specific questions

Question 1

(a) A good proportion of candidates answered this question correctly. However, a wide variety of arithmetic slips were seen resulting in a range of different incorrect answers. Good practice was seen by many candidates who checked their answer by adding *their* 2.982 to 0.0018 and this enabled some to find their error and correct their answer.

(b) Almost every candidate gave an answer with the figures 16 in it, but many candidates did not have the correct number of zeros with answers such as 0.16, 0.016 and 0.00016 frequently seen. Whilst most candidates used decimal multiplication others chose to worked in fractions, $\frac{4}{100}\times\frac{4}{100}$, or in standard form, $4\times10^{-2}\times4\times10^{-2}$ and were often successful.

(c) The candidates who used equivalent fractions such as $\frac{0.8}{2}$ or $\frac{8}{20}$ were usually successful in answering the question correctly. Those who tried to divide 0.2 directly into 0.08 were often out by a factor of 10 or 100, giving answers such as 4, 0.04 or 0.004. Other errors included dividing 0.08 into 0.2.

Question 2

(a) Some candidates answered this question correctly, but many did not understand either the importance of rounding or the importance of place value or both. Common wrong answers included 5200.0, 5300, 5250, and 52.

(b) Many candidates answered this question correctly. A common error was for some candidates to round the given number to 3 significant figures with 0.00306 often seen as well as answers such as 0.00, 0.0000626 and 3.06.

Question 3

(a) Almost all candidates answered this part correctly. Incorrect answers usually involved arithmetic errors with answers such as 12 and 150 seen after $\frac{300}{20}$.

(b) Many candidates took the approach of attempting to convert their 15 m/s into km/h. Candidates mostly worked in stages performing, in either order, $\times 60 \times 60$ and $\div 1000$. Errors included using 60 rather than 3600 seconds in an hour or 100 rather than 1000 metres in a kilometre or dividing by 3600 and multiplying by 1000. Other candidates built up from 300 metres in 20 seconds to 900 metres in a minute and thus 54000 metres in an hour. Candidates often made slips with the arithmetic or used, and could not simplify correctly, ambiguous tiered fractions such as $\frac{\frac{300}{20}}{1000}$ or $\frac{\frac{15}{1000}}{60 \times 60}$.

Question 4

(a) Some candidates solved the equation correctly. However, a significant number of candidates did not use order of operations and wrongly simplified $2-4(5-2x)$ to $-2(5-2x)$ and did not score. Almost all of the other errors seen involved sign errors, such as expanding the bracket incorrectly as $-20-8x$ rather than $-20+8x$, or when moving the numbers or x term to opposite sides of the equals sign. Candidates were expected to simplify $\frac{18}{8}$ to score full marks.

(b) Candidates were often able to solve the equation by recognising that the starting point was to solve both $2x-5=9$ and $2x-5=-9$. The common errors included, correctly solving $2x-5=9$ $(x=7)$ and either assuming the second solution was -7, or using $2x+5=9$ as the second equation.

Question 5

(a) Almost all candidates answered this part correctly. The most common wrong answer was zero.

(b) The majority of candidates answered this part correctly. The most common errors included $\sqrt{64}=8$, $64^{-3}=\frac{1}{4}$, $64 \div 3 = 21.\dot{3}$, or trying to evaluate 64^3.

Question 6

The most efficient method for finding the exterior angle is $\frac{360}{30} = 12$ and those using this were frequently successful. Many candidates, however, used longer methods such as $180-\frac{(30-2)\times 180}{30}$ and although they usually scored the method mark, errors with the arithmetic were common. It was common for candidates to find 12 but spoil their method by adding to, or subtracting from, 180 or 360. The most common method errors included $\frac{180}{30}$, $\frac{360}{30}$ + 180, $180-\frac{360}{30}$ and $360-\frac{(30-2)\times 180}{30}$.

Question 7

(a) This question was answered well with many candidates giving the correct answer. Some candidates scored one mark for correctly writing, for example, $4x(3a-2b)-y(2b-3a)$ but were not able to correctly complete the factorisation. Not all candidates recognised the type of expression and those not able to spot that pairs of terms could be factorised could not make any progress,

(b) This part was also answered well with many correct answers seen. Some candidates were able to score one mark for a first step such as $5x(x-2)+4(x-2)$ and others for the product of two brackets which when expanded gave $5x^2$ and either $-6x$ or -8. Some candidates attempted to use the quadratic formula to find the solutions and put these into the brackets, but they usually gave $(x-0.8)(x-2)$ which did not score. In addition, a common wrong answer was $x(5x-6)-8$.

Question 8

(a) Most candidates scored full marks on this question. Again the common errors were with arithmetic and signs with $\begin{pmatrix}32\\0\end{pmatrix}$, $\begin{pmatrix}-8\\-10\end{pmatrix}$ or $\begin{pmatrix}32\\-10\end{pmatrix}$ frequently seen. Answers with fraction lines, such as $\left(\frac{-8}{0}\right)$, were penalised.

(b) Many correct answers were seen with candidates demonstrating their understanding of the magnitude of a vector. Common arithmetic errors included $\sqrt{3^2+-4^2}$ = $\sqrt{-7}$ and $9+16=27$. Completely wrong methods included finding the gradient as -0.75, stating '3 across and 4 down', $3\times-4=-12$ and $3+(-4)=7$.

Question 9

Most candidates eliminated the fraction and gained a first method mark for $5ax=b(2x-3)$. Candidates then usually expanded the brackets but not all were able to recognise the need to collect all the *x* terms onto one side in order to factorise the *x* out. Consequently, a significant number of candidates gave answers which had *x* as a function of *x*. It was clear that many candidates did not have a clear understanding of the steps that needed to be taken and many showed a large number of steps that did not make any further progress.

Question 10

(a) Candidates were expected to recall the value of $\sin^{-1}\left(\frac{1}{2}\right)$ as 30. Some solved the equation as far as $\sin^{-1}\left(\frac{1}{2}\right)$ but went no further. Some candidates demonstrated their knowledge by showing all the exact sine, cosine and tangent values for angles of 30°, 45° and 60°, usually in a table, before selecting the correct answer. Other candidates obtained the correct answer by drawing out a suitable triangle and using Pythagoras' theorem to show that sin30° = 0.5. Incorrect answers were usually one of 45°, 60° or 90°.

(b) Success in this part depended on the knowledge to answer the previous part. Whilst some candidates could write down the values without any working, many candidates produced clear diagrams such as a graph of the sine curve, or circular diagrams to enable them to find the required angles. Common errors included finding only one value or giving only a negative value, usually $-30°$. A significant number of candidates found both values that satisfied $\sin x=-\frac{1}{2}$ but only gave one of the required answers as their final answer. Both solutions were required on the answer line to score full marks.

Question 11

Many candidates approached this question by drawing the perpendicular bisector on the diagram to help them understand the information they needed to find. Most were successful in showing $\frac{8-(-2)}{2-6}$ and almost all were able to simplify correctly to $-\frac{10}{4}$, or equivalent, although errors with the negative signs were also seen. Many evidenced the knowledge that the product of perpendicular gradients is -1 and $-\frac{10}{4}\times m=-1$ was frequently seen and again the majority were successful in reaching $\frac{2}{5}$. Candidates who found the original gradient as the decimal number -2.5, often demonstrated understanding that the perpendicular had a gradient of $\frac{1}{2.5}$ but did not have the arithmetic skills to convert this to 0.4 or $\frac{2}{5}$. Not all candidates read the question carefully, wrongly finding the perpendicular line through either *A* or *B* rather than finding and using the mid-point of *AB*.

Question 12

(a) Almost every candidate correctly wrote down the probability of choosing one green disc as $\frac{5}{12}$.

Whilst many candidates went on to correctly work out the probability of two green discs a significant number did not. Common errors included adding, rather than multiplying, the probabilities, using replacement, rather than not replacement, of the discs and errors in arithmetic, particularly when working out 12×11.

(b) Most of the candidates who completed this question correctly worked out P(G, R) + P(R, G) + P(G, G), with a minority using 1 – P(R,R). The most common error was to find one or two, but not all of P(G, R), P(R, G) and P(G, G). Again, using replacement rather than not replacement was seen. In addition, some candidates were adding fractions when they should have been multiplying and multiplying when they should have been adding. Arithmetic errors were common but, provided working could be followed, method marks were awarded.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/22
Paper 22 (Extended)

Key message

Candidates need to show all 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.

On a non-calculator paper, candidates are recommended to use exact fractions rather than conversions to inaccurate decimals.

Candidates must know the key values for trigonometric ratios on this paper.

Candidates will not be required to carry out long complicated multiplications on this non-calculator paper. (see **Question 6(b)**).

General comments

Candidates were well prepared for the paper and demonstrated very good algebraic skills.

Some candidates lost marks through careless numerical slips, particularly with negative numbers and simple arithmetic operations. Candidates should make all of their working clear and not merely write a collection of numbers scattered over the page. Some candidates lost marks through incorrect simplification of a correct answer.

Comments on specific questions

Question 1

Although the majority of candidates scored this mark, a significant number of candidates were unable to deal with the place value of their answer with answers of 9, 90 and 9000 being seen.

Question 2

The majority of candidates scored both marks. The main error occurred with omissions, which could have been spotted by counting the number of numbers in their final table.

Question 3

This question was correctly answered by virtually all candidates. Some candidates incorrectly wrote $2\frac{1}{2} = \frac{5}{4}$ as they were trying to find a common denominator.

Question 4

This question was found difficult by the majority of candidates. Better candidates started with $16 \times 2 = 32$, implying that $3 \times 7 – 3 + 4$ must equal 16. By continuing to work backwards $3 \times 7 – 3$ must equal 12, leading to the correct answer of $(3 \times (7 – 3) + 4) \times 2 = 32$.

In this type of question, candidates are recommended to check their final answer carefully by expanding their brackets.

Question 5

Many candidates gave the correct answer. The common error was careless arithmetic when subtracting 115 from 180.

Question 6

(a) Nearly all candidates scored the mark for this part.

(b) The majority of candidates did not realise the connection between the two parts and started on two complicated calculations of squares, which led to numerical slips.

Candidates who used the difference of two squares in this part easily found the correct answer.

Question 7

This question was well answered by nearly all candidates. Occasionally candidates made an error with their final sign.

Question 8

Again, this question was correctly answered by virtually all candidates, demonstrating an excellent understanding of the manipulation of surds.

Question 9

This question proved to be the most challenging on the paper, although there were a number of perfect solutions. Candidates who worked with the exterior angles of a polygon were more successful than those who used the sum of the interior angles, as they were less likely to make numerical mistakes.

Question 10

(a) Although most candidates scored full marks, a significant number of candidates gave their final answer not in standard form as required by the question.

(b) The majority of candidates scored full marks. There were some slips in the subtraction of numbers which were correctly written not in standard form.

Question 11

This question was well answered by the majority of candidates, showing excellent algebraic manipulation.

Question 12

This question proved to be a good discriminator. Candidates who used the correct formula for the area of a sector were able to score 2 marks by equating to the given expression. Dealing with cancelling π proved to be more challenging for the final mark.

Question 13

Many candidates scored full marks. Some candidates did not use the mid-points of the groups and some candidates used the group width instead. The were some slips in the summation of the three values.

Question 14

Many candidates did not know the exact value of tan 30. However, they were still able to score a mark for setting up a correct equation. Some candidates used the sine rule successfully as they were able to use the exact values of sin 30 and sin 60.

Question 15

Candidates normally drew the lines $x = 2$ and $y = 3$ correctly, but many did not identify the correct region for their final answer. The most common error was omitting to include values where $y < 0$.

Question 16

This question was well answered by the majority of candidates, showing excellent algebraic skills. Some candidates did not fully factorise the numerator which meant that they were unable to cancel a common factor.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/23
Paper 23 (Extended)

There were too few candidates for a meaningful report to be produced.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/31
Paper 31 (Core)

Key messages

In order to be able to answer all the questions, the candidates must have a graphics calculator and know how to use it. The candidates should be encouraged to show all their working out especially for multi-step questions. Many marks were lost because working out was not written down. Marks were also lost when the candidates did not write their answers correct to 3 significant figures (unless otherwise specified in the question). Candidates should be familiar with correct mathematical terminology. Candidates should practice answering 'show that' question, ensuring that they show all necessary steps in their working.

General comments

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

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. Candidates also need to read the questions carefully and answer what is asked in the question.

Candidates should bring the correct equipment to the examination. Many appeared not to have a ruler with them to draw a straight line. It also appeared as if some candidates did not have a graphics calculator.

Comments on specific questions

Question 1

(a) (i) The majority of the candidates knew the square root of 36, or knew how to find it correctly.

(ii) There were many correct answers for the cube of seven. A few candidates multiplied 7 by 3.

(b) (i) Some candidates misunderstood the question and wrote 4^6 as their answer instead of just 6. A few candidates wrote 5 for their answer and some gave 4096 as the answer.

(ii) The majority of candidates knew the correct answer. Some candidates wrote 0 for the answer and some others wrote 4.

(c) Some candidates worked out the denominator and gave that as their answer. There were not many totally correct answers for this part, with some candidates not writing their answer correct to 3 decimal places as asked for in the question.

(d) (i) Not all candidates knew what standard form meant. Some candidates omitted this part and others wrote either 82 or 0.82 with an incorrect power of 10.

(ii) In this part some candidates gained one mark for working out the product and writing 1 314 000 or an equivalent form.

Question 2

(a) (i) and (ii) Nearly all candidates wrote down the correct coordinates of the two points. Only a few mixed up the *x*- and *y*-coordinates.

(b) This part was also well answered with only a couple of candidates plotting the point at (–3, 1).

(c) Many candidates knew this was a parallelogram. There were other answers given such as trapezium, rectangle, square, rhombus and quadrilateral.

(d) There were various answers given for the area of the parallelogram with a good half of the candidates working out the correct answer. Quite a number of candidates worked out the length of *BC* or *AD* using Pythagoras' theorem and then multiplied their answer by 6 as if the shape was a rectangle.

(e) The majority of the candidates reflected the shape in the line *DC* instead of the *x*-axis. Some reflected the shape in the *y*-axis and some omitted the question.

Question 3

(a) Almost all the candidates worked out the correct total number of cars.

(b) Many candidates worked out the correct number of people but 15 was also a common answer.

(c) Most candidates knew how to set up and draw a bar chart. A few candidates did not put the number of people in the car in the middle of the bar on the axis. A few only plotted the points and did not draw bars.

Question 4

(a) The majority of candidates knew that there were 12 months in a year and so worked out the correct number of months.

(b) (i) Many candidates knew how to work out the range. A few just added all the ages.

(ii) Not as many candidates managed to work out the correct mean. Quite a lot of the candidates added the years and divided by 3 and then added the months and divided by 3 and so 4.67 years 7 months was a common wrong answer. Some candidates picked up method marks though.

(c) Quite a number of candidates found the correct distance walked. Some candidates were awarded method marks for their working out.

Question 5

(a) Nearly all the candidates drew the correct two patterns. Some candidates added an extra cross to Pattern 5 and some others missed out Pattern 1.

(b) (i) Most candidates found the correct next term.

(ii) The most common answers were plus 3, + 3 and $n + 3$. A few candidates gave the nth term instead of the rule for continuing the sequence.

(c) Some candidates were unsure what to do in this part and so omitted it. Some candidates squared wrongly and wrote 9 and 36 for the answers.

(d) More candidates are now able to find correct the expression for the nth term of a sequence. The most common wrong answer was $n + 8$.

Question 6

(a) The majority of candidates managed to simplify the expression correctly. The most common wrong answer was $7y$.

(b) (i) Nearly all candidates solved the equation correctly.

(ii) Here too there were many correct answers. Only a few candidates wrote 2 for the answer.

(iii) There were many correct answers to this part as well. Only a few candidates multiplied the brackets out incorrectly or subtracted 2 from 14 instead of dividing.

(c) Showing the inequality on a number line proved difficult for the majority of the candidates. A few did not fill in the circle at 4, some drew the arrow in the wrong direction and others just put a cross at 4 or circled the diagram from 4 to 6.

(d) Most candidates factorised correctly. A few just cancelled by 5 and wrote $x + 4$ for their answer.

(e) Many candidates were awarded one mark here for writing three of the four terms correctly. Only a few did not know how to multiply out the brackets.

Question 7

(a) Many candidates found that angle C was 48°. Not all remembered what the triangle was called. Some incorrect answers were 'like sided', equilateral, scalene and a few candidates wrote an answer in their own language.

(b) The majority of candidates knew that a pentagon has 5 sides and so were awarded one mark if they showed that in their working out. Many candidates found the exterior angle rather than the interior one.

(c) (i) There were many correct answers here. Some candidates wrongly thought that *BC* and *AE* were parallel lines and wrote 34° as their answer.

(ii) Very few candidates knew how to show that *ABCD* was not a trapezium. There were two marks available and so two reasons were expected. Some candidates did mention that there were no parallel lines but did not specifically state which two lines should be parallel. Few candidates mentioned anything about individual angles. The majority wrote that the angles did not add up to 360°.

Question 8

(a) (i) Most candidates found the correct probability for this part, although a few wrote $\frac{1}{6}$ for their answer.

(ii) Few candidates found the correct probability for spinning twice. The most common answer was $\frac{2}{10}$.

(b) Many candidates were awarded three marks for this part. They found the correct probabilities for Spinner B and Spinner C and managed to convert their probabilities to percentages. However, few candidates wrote that the percentage for C was greater than the other 2 percentages and so missed out on the final mark. It is important that candidates state the result rather than assuming the examiner will interpret their work. A few candidates misunderstood the question and wrote down all the different probabilities for Spinner C only.

Question 9

(a) The majority of candidates understood how to work out ratios and gained all three marks. Of the rest, most could not gain any marks.

(b) Many candidates found the correct cost. Some found the reduction correctly and gave that as their answer.

(c) Many candidates were awarded a method mark for working out 1100 – 900. Some candidates lost marks for giving an answer of 22 per cent instead of an answer to 3 significant figures.

Question 10

(a) Many candidates scored full marks for this part. A common wrong answer was $\frac{19}{3}$.

(b) (i) The majority of candidates knew how to find the mid-point.

(ii) Fewer managed to find the correct equation for the line. Many candidates were awarded method marks for finding the correct gradient or the correct value for c (in $y = mx + c$).

Question 11

(a) Most candidates knew Pythagoras' Theorem but not all knew what to do in this question. Many candidates used the answer of 1.5 to show that $1.5^2 + 2^2 = 2.5^2$ and since this is not what the question asked, they were awarded no marks. Candidates should remember that they must not use what they are trying to show in their working.

(b) Some candidates knew how to use trigonometry and used it correctly to find the answer. A few used the wrong ratio with their trig function. An incorrect answer of 45° was quite common.

(c) (i) There were a good number of correct answers seen for the area. Many candidates were awarded a method mark for working out 2×2 but then added on a wrong area for the triangle.

(ii) Not as many correct answers were seen for the volume but most candidates knew that the answer should be cubic metres.

Question 12

(a) (i) Those candidates who knew how to use a graphics calculator managed a reasonable attempt at sketching the graph. Quite a few candidates omitted this part.

(ii) There were few correct answers to this part. The most common incorrect answer was (–3, 0).

(iii) Here also many candidates misunderstood the question and the most common incorrect answer given was (2, 20).

(b) Those who could sketch the first graph also managed to sketch the quadratic correctly.

(c) For those candidates who sketched both graphs correctly there were many correct answers for the point of intersection. A few candidates wrote the answers to 2, rather than 3, significant figures.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/32
Paper 32 (Core)

Key messages

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

General comments

Candidates continue to perform very well on this paper. They were well prepared and, in general, showed a sound understanding of the syllabus content. Presentation of work continues to improve although some candidates are still reluctant to show their working and just write down answers. An incorrect answer with no working scores zero whereas an incorrect answer with working shown may score some of the method marks available, In general, calculators were used with confidence, although it does appear that some do not have a graphics display calculator, as the syllabus requires. Candidates had sufficient time to complete the paper. Only a few did not attempt every question.

Comments on specific questions

Question 1

Candidates answered each part of this question well. Their work with money was very good.

An error did occur in **part (b)(i)** where the answer given was sometimes the amount spent, $9, rather than the number of roses bought, 6.

Question 2

(a) The bar chart drawn was invariably correct.

(b) Some wrote the frequency of the modal value rather than the shirt size.

(c) A number used the frequency for size XXL rather than that for size XL.

(d) Many did not understand the term ‘relative frequency’. Consequently, many divided the frequencies by 100 instead of dividing by 200.

(e) The probability was often correctly given as a fraction, decimal or percentage.

Question 3

(a) to (e) Some pleasing number work was seen in the first five parts of this question. Some candidates, however, did not give all the factors of 50 in **part (b)** and others confused significant figures and decimal places and gave an answer to 2 decimal places in **part (e)**.

(f) (i) Most candidates saw that the values were going down by 7 each time and managed to work out the next two terms of the sequence.

(ii) Although many went on to find a correct formula for the *n*th term of the sequence, a number thought $n - 7$ was the answer.

Question 4

(a) to (c) Coordinate work was well understood with many fully correct answers to these parts.

(d) The correct answer, $y = 1$, was given by a majority of candidates. There were those candidates who saw the phrase 'equation of the line' and thought they were looking for something in the form $y = mx + c$. This often led them into incorrect calculations.

(e) Many correct drawings were seen for the reflection. A number reflected in the line $x = -\frac{1}{2}$.

(f) The translation caused more of a problem with many not interpreting the vector correctly. Some, however, found the vertical move correctly but not the horizontal move.

Question 5

(a) The majority found the perimeter correctly. Some mistook perimeter for area and others found half of the perimeter, just using the figures given in the diagram.

(b) Many correct answers used the 'false area method', dividing the total area of the sheet of card by the area of one sign. Very few used a method involving the edge lengths of the sheet and the edge lengths of one sign.

(c) Although many correctly worked out the area of the circle, only a few went on to find the shaded area correctly. Candidates often mixed area and perimeter terms.

(d) The dimensions of the enlarged rectangle were usually found correctly.

Question 6

(a) Most candidates found this part challenging. Some confused the direction of the move of the graph. Many had the image as a completely different shape to the given graph. Some better candidates counted squares rather than units on the axes in their translations.

(b) This part was much better answered, with many correct answers to both parts. There are still candidates who do not have, or do not know how to use, a graphics display calculator. Some candidates had an inaccurate answer for the local minimum, presumably using the trace facility on their calculator.

Question 7

(a) Both probabilities were usually correct here.

(b) In **part (i)**, many candidates added the probabilities instead of multiplying them. Most knew to multiply their answer to **part (i)** by 360 to find the answer to **part (ii)**.

Question 8

(a) There were many fully correct answers to this part.

(b) The choices for the first two angle facts were usually correct. The final two parts, however, caused problems and there were many incorrect 'guesses'.

Question 9

(a) (i) The majority of candidates showed a good knowledge of the trigonometric ratios and correctly found the value of *x*.

(ii) The meaning of 'bearing' was less well known. A number of candidates found 180 – *x* while others thought that it was a length and often gave 5 as the answer.

(b) (i) Many correctly got as far as 1.75 for the time and then put 1 hour 75 minutes or 2 hours 15 minutes.

(ii) Most correctly added their time in **part (i)** onto 13 20. However, it was common to see this as a 12-hour clock time without the 'pm' given.

Question 10

(a) Many answers with sign errors were seen, which led to many incorrect solutions.

(b) There were a number of correct answers here. A common incorrect answer of 5*y* occurred when candidates were unable to deal with the negative sign in front of the second bracket.

(c) Although a number of candidates found all three common factors, many only found one or two.

(d) and (e) Many correctly dealt with this question involving powers of numbers.

(f) This part was done quite well, although answers in **parts (ii)** and **(iii)** were often not given in their simplest form.

Question 11

(a) Although candidates found the median and lower quartile well, many did not find the interquartile range.

(b) Many candidates made good attempts at the first two parts, finding the frequencies from the graph and then correctly choosing the modal class. A significant number still find the mean of a grouped frequency table very challenging. Of those who made a reasonable attempt, a number used the end value in each group rather than the middle value.

Question 12

Although this was the last question on the paper, candidates still made an excellent show of answering each part. Most coped well with the first two parts. However, in **parts (c)** and **(d)** some candidates confused the 12 cm and the 13 cm in the two formulae.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/33
Paper 33 (Core)

There were too few candidates for a meaningful report to be produced.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/41
Paper 41 (Extended)

Key messages

Put sufficient working in to gain method marks.

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 lost marks through giving answers too inaccurately. When the question says show an answer is a value correct to, for example, 3 significant figures, it is necessary to find the value to at least 4 significant figures first.

Take notice of the mark value attached to each question. If the question is worth only two or three marks it is unlikely that very lengthy working will be required. This is particularly true with trigonometry questions where over-complicated methods are often seen.

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

General comments

The paper proved accessible to all the candidates with no candidates scoring very low marks and omission rates were extremely low. There were a number of very high scores and there was much impressive work from a number of candidates.

Whilst most candidates displayed knowledge of the use of a graphics display calculator, some still are plotting points when a sketch graph is required.

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) This question was answered extremely well.

(b) This too was well answered. However, 42.9 was a common incorrect answer, deriving from using the number of ticket prices as frequency leading to 8600×22 etc. A few found the mean of the numbers of tickets sold.

(c) (i) Most candidates used their graphical calculators successfully in find the regression equation.

(ii) Most substituted correctly to estimate the number of tickets sold but a significant number did not round the answer to a whole number.

Question 2

(a) This was usually correct. A few mixed up the x and y movements or translated in the wrong direction.

(b) This was done well. Almost all recognised that the inverse was a translation, but a few gave the wrong vector.

(c) Although this was usually correct, a significant number rotated about the wrong centre.

(d) This was less well done, probably due to the distance between the object and the mirror line. Common errors were to reflect in the y-axis or the line $y = -x$.

(e) Almost all of those who had a correct image D were able to give the correct transformation.

Question 3

(a) This was almost always done correctly.

(b) This was done very well. Almost all recognised that the series was quadratic and most gave the correct nth term.

(c) Almost all found the correct next term and most of them gave the correct nth term.

(d) Most found the correct next term. As expected, the nth term proved more difficult. Many had the right idea but omitted brackets in their expression, for example, writing $2\times-2^{n-1}$ instead of $2\times(-2)^{n-1}$.

Question 4

(a) Although many did this well, a significant number of candidates made errors in either the mid-interval values or the complete method. Common errors were to use 45, 65 and 85 for the last three mid-interval values, dividing the total of the frequencies by seven and using the ends or the widths of the intervals. Many used written out methods rather than the statistics functions on their calculator.

(b) This was almost always correct.

(c) This was very well done with an impressive standard of plotting and curve drawing seen.

(d) (i) The vast majority of candidates were able to read off the median correctly.

(ii) This was slightly less well done with a number giving the lower quartile as the interquartile range.

(e) This proved more demanding. Most worked out 35% of 300 correctly but many read off at 105 rather than 195.

Question 5

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

(ii) This also was usually correct.

(b) Although this was usually correct, a few worked out f(7).

(c) Almost all understood the idea of a composite function and there were very few errors.

(d) This was less well done. Some omitted brackets, others made sign errors in the expansion of the brackets. A few multiplied by 2h(x) instead of adding. However, most of the better candidates reached the correct answer.

(e) This was well done although a few made sign errors in rearranging $y = 3 - x$.

(f) (i) The sketch was usually correct. A few did it by plotting points and some did not notice the scale and drew a very narrow parabola.

(ii) Although this was normally correct, a few gave the answer $x = 0$ instead of $y = 0$.

(iii) The straight line was usually correct. Again, some plotted rather than sketched.

(iv) This proved slightly easier than previous similar questions. Most obtained the right values for the intersection, but some made errors in the inequality signs. A few used algebraic methods rather than their graphical calculator.

Question 6

(a) (i) Most candidates did this well. However, a significant number used compound interest rather than simple interest and a few gave the interest rather than the total amount.

(ii) Again, this was fairly well done although, here too, a number used compound interest. A significant number used $10 000 as the interest instead of the total amount.

(b) (i) This was very well done although a few used 6.5% rather than 4%.

(ii) Work on this type of question is much improved and the majority of the candidates reached the correct answer. There was a mix of methods using either numerical calculations or logs. A number of candidates omitted working.

(c) Many candidates did not know what sketches to draw. Often attempts were very unclear with axes and graphs unlabelled. It was expected that candidates would draw $y = 5000(1.04)^x$ and $y = 5000 + 5000 \times 0.065x$ but many drew two straight lines or two curves and it was unclear what their graphs represented. Many did reach the correct answer from other methods.

Question 7

(a) Most candidates chose the equating coefficients method whilst others used the substitution method. Both were usually successful with just a few making sign or numerical errors.

(b) All three parts were done extremely well with very few incorrect answers.

(c) Only the best candidates achieved the correct final answer. Most candidates knew the rule that $a\log b = \log b^a$. and many knew $\log p - \log q = \log (p \div q)$. The problem arose in having to handle two subtractions. As a result, many candidates ended up with an unacceptable final answer.

Question 8

(a) This was done well with very few incorrect answers.

(b) This, also, was done well although many candidates left the answer as $\frac{0}{4}$ rather than simplifying it to zero.

(c) Most reached a denominator of 24 but few obtained a fully correct answer. Many candidates showed little evidence of more complex probability in the final three parts. A few drew a table of outcomes and this would have enabled them to do all three parts.

(d) In addition to the problems over probability, there was confusion over which numbers were prime.

(e) This part proved slightly more successful with candidates able to list most of the outcomes that had a sum which was a multiple of 3. However, many omitted some or included extras.

Question 9

(a) Although many did this well, a large number of candidates over-complicated it, using trigonometry to find *BF* and then *FE* when a simple Pythagoras calculation on triangle *AFE* would have proved much easier. This also often led to inaccuracy in the final answer.

(b) (i) Here too, long methods were often used, for example, $\frac{1}{2}bc\sin A$ on triangle *BFE* rather than $\frac{1}{2}$ base × height on triangle *BFE*. This also sometimes led to inaccuracy and also the omission of part of the area.

(ii) The most common error here was to use the area scale factor rather than finding its square root for the linear scale factor.

(c) Here too, long methods involving sine rule or cosine rule were often used to find angle *BFE*. This led to some omitting to add angle *AFB* to reach the final answer. Most success was gained by those using the simple tangent ratio.

Question 10

(a) All parts of this were answered well by most candidates. The least well done was **part (i)** which required the alternate segment theorem.

(b) Most candidates could find *AB*, but some found finding *AD* or *BD* difficult. Some of the better candidates did not plan their strategy as well as they might have done and worked out both lengths *AD* and *BD* when they could more easily have used *AB* with just one of them. Many candidates did not make the best use of the diagram in deciding a course of action.

Question 11

(a) Most candidates gave an acceptable sketch in this part and, of those who did not, many were still able to give the required answer. Here too, many candidates did not label their sketches clearly. Those who sketched $y = 5^x - 10$ or $y = 10 - 5^x$ often did not make it clear that that was their intention.

(b) Almost all candidates chose to do this by an algebraic method rather than using curve sketching. Most were able to reach the correct three term quadratic equation although some made errors in the expansion of the brackets. Almost all used the formula to solve the quadratic equation and these were usually successful. The most common error was to only give the positive root correct to two significant figures.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/42
Paper 42 (Extended)

Key message

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

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

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

General comments

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

A few candidates needed more awareness of the need to show working, either when answers alone may not earn full marks or when a small error could lose a number of marks in the absence of any method seen. This is particularly noticeable in 'show that' style questions when working to a given accuracy. There could be some improvements in the following areas:

- Handwriting, particularly with numbers.
- Candidates should not overwrite answers as this makes them difficult to read.
- Care in copying values from one line to the next.
- Care in reading the question.

The sketching of graphs does continue to improve and there was more evidence of the use of a graphics calculator supported by working, which is in the spirit of the syllabus. There was however 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 included transformations, linear functions, trigonometry, pie charts, curve sketching and quadratic equations.

Difficult topics were compound functions, 3D spatial awareness for Pythagoras and trigonometry, inverse proportionality, division of fractions in algebra, similar triangles and speed/distance/time problems.

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

Comments on specific questions:

Question 1

(a) This percentage question was well answered. Candidates proved to be able to interpret the information correctly. One error occasionally seen was to add the cost of the $6\frac{1}{2}$ hours work to the total cost. Another, more surprising, common error was to misread the $6\frac{1}{2}$ hours as 6 hours.

(b) This reverse percentage question was also well answered. Incorrect answers were usually the result of finding 24% of $396.80 and subtracting, thereby not treating the question as reverse percentage.

(c) Candidates appear to have become more familiar with this type of question which asks for the number of times it takes for a percentage increase or decrease to reach a certain value. Different methods were seen and many candidates earned full marks. The use of logarithms was probably the most popular method although the graphical approach was seen more often than in previous years. A few candidates used trial and improvement, some even starting at day 1 and showing every day until day 23.

An area of concern was the number of candidates who did not show any working. This is a very risky strategy when four marks are involved. A small number of candidates treated the question as a simple interest type.

Question 2

(a) (i) The vast majority of candidates scored full marks on this question. The two most common errors that occurred were either using the wrong centre or applying a clockwise rotation.

(ii) Most candidates scored two marks for stretch and the correct scale factor of 2. The most common errors were either the omission of the word invariant or more often stating the *x*-axis as invariant. Other errors that occasionally occurred were the use of enlargement or a scale factor of 3. Only a few candidates lost all the available marks for using more than one transformation.

(b) The most common error was a reflection rather than a translation. Candidates that drew an unlabelled square or just a cross rather than, for example, a triangle seemed to make this error. If translation was recognised then usually full marks were gained.

Question 3

(a) and **(b)** were generally answered very well with most candidates gaining both marks.

(c) This part was well answered by the majority of candidates who recognised that the range could not be 80 kg given that 60 kg was not included in the lowest class boundary. The most common mistake was to try to explain why the range could not be calculated without the actual values. Others incorrectly used the mid-points of the intervals in their reasoning.

(d) Most candidates scored at least two marks here for calculating and accurately drawing two correct sectors on their pie chart. The less able candidates picked up at least the B mark for correct labels on their sectors. Those that chose to use percentages were generally not very successful.

Question 4

(a) Most responses scored full marks in this part; those who did not usually scored one mark for the middle section. The graphs were mostly neatly drawn without feathering or very thick lines. Some candidates got the wrong curvature for the outer branches or used a ruler to draw them. Occasionally some omitted the outer branches and just drew the middle section. Some sketched the original parabola without the modulus function and then reflected the entire curve about the *x*-axis but did not indicate which parts of their sketch they wanted to be marked.

(b) Generally, only the more able candidates scored both marks here. The most common error was to attempt to find f(6) rather than solving f(x) = 6, resulting in incorrect answers of 26 or – 26. Another common error was to miss two of the solutions, either giving ± 2 or ± 4 or 2 and 4 as their final answers with sometimes the negative solutions crossed out on the answer line.

(c) A discriminating part with only the stronger candidates gaining full marks. Incorrectly combining solutions did result in some candidates losing marks for giving $-2 > x > -4$ or $2 > x > 4$.

The most common error was to try to combine $x < -4$ and $x > 4$ by giving the answer $-4 > x > 4$.

(d) Most candidates scored at least one mark for this question. Common errors included giving the answers $k = 3.16$ and/or $k = -3.16$, also $k = 10$ and $k = 11, 12, 13, 14$ seen on several scripts.

Question 5

(a) This 'show that' question required candidates to give an answer that rounded to 22.36. Almost all candidates gave a correct Pythagoras statement but often lost a mark by only showing 22.36 and not working to at least 3 decimal places.

(b) The same comment applies to this part with candidates showing a correct method but not giving their answer to show that it rounded to 14.28. The most efficient method was to use the tangent ratio as this did not depend on the answer to **part (a)**. Many candidates used the sine rule in this right-angle triangle.

(c) This part required the use of the sine trigonometric ratio in a right-angle triangle and it was usually answered correctly.

(d) This part required the use of the cosine rule and was very well answered. A few candidates appeared be unfamiliar with the formula page in the question paper and they started with $\cos x = \dfrac{b^2 + c^2 - a^2}{2bc}$ instead of the explicit version for a^2.

(e) This part was much more challenging and discriminating. Candidates needed to be aware of the three-dimensional situation and that the angle required was in the sloping triangle and not the sum of two angles in different triangles leading to the often seen incorrect answer of 118.4 degrees. This question required the cosine rule again but for an angle and the stronger candidates earned full marks. Some candidates correctly used $a^2 = b^2 + c^2 - 2bc\cos A$ but when rearranging to make $\cos A$ the subject they lost the negative sign in their working. There was a small number of candidates who wrongly anticipated that this part would involve the sine rule since **part (d)** used the cosine rule.

Question 6

(a) A few candidates had difficulty reading the horizontal scale correctly.

(i) Usually correct. A few candidates just found the middle of the time scale giving the answer 31.5.

(ii) Well answered. Nearly all candidates realised what they had to do. As they had to find two values from the graph there were more errors with many candidates scoring one mark for either the upper or lower quartile correct.

(iii) Other than reading the scale incorrectly, the most common error was reading the cumulative frequency at 80 giving an answer of 31.9. The majority of candidates realised that they had to read from 128 on the y-axis. Most calculated and showed 128 thus obtaining at least one mark.

(b) Even without a follow through from **part (a)** candidates managed to score well on this part. The answers to **parts (i)** and **(ii)** were sometimes reversed.

Question 7

(a) This was answered very well by nearly all candidates, although a few had the answer inverted. Some scripts had added the units to their answers without penalty.

(b) A majority of candidates were able to form the correct equation and make good progress towards clearing the fractions. As this was a 'show that' part, mistakes were usually omissions rather than errors. Many candidates were able to multiply throughout by $x\,(x - 40)$ convincingly.

(c) There were a large number of correct solutions but also a minority who could not use the quadratic formula correctly. Many who found the correct speeds were unable to identify which one they should be working with and gave the answer 7h 23 min or 7h 38 min. Some other candidates did not remember to use $\frac{200}{x}$ to complete the question. Very few solutions lost the final mark for not giving their final answer correct to the nearest minute.

Question 8

(a) (i) The main problem with this 'show that' part was leaving the 4 in the equation at the start and arriving at $k = 1$. Most candidates started with $0.05 = \frac{k}{\sqrt{25}}$ and found $k = \frac{1}{4}$ earning the method mark. However, some of these were then unable to transform that into $y = \frac{1}{4\sqrt{x}}$. A small minority started with the alternative valid method of $0.05 = \frac{1}{k\sqrt{25}}$ and had little difficulty in establishing the given $y = \frac{1}{4\sqrt{x}}$. A small number omitted to write the equation after finding k and hence lost the final mark.

(ii) This was almost always correct. The most common error that was seen was due to candidates' dislike of working with fractions giving their answer as a decimal but only to 2 significant figures. Usually this was not a problem as they had previously written $\frac{1}{12}$ in their working.

(iii) Most candidates got this completely correct with the most popular form seen as $\frac{1}{16y^2}$. Those who did not score full marks appeared to know what to do but not how to do it; for example, writing $\frac{1}{y} \div 4$ but not developing that into $\frac{1}{4y}$, but rather to $\frac{\frac{1}{y}}{4}$ which they interpreted as $\frac{1}{\left(\frac{4}{y}\right)}$.

(iv) In the majority of responses this part was correct, although those that did not gain the mark took the square root of $\frac{1}{2}$ instead of squaring it.

(b) Many candidates who attempted this part knew the correct approach but for $(2p)^3$ they wrote $2p^3$. Unfortunately, this led them to an incorrect answer of 12. Some who did get $8p^3$ then went on to multiply 24 by 8 rather than dividing by it, losing the final mark.

Question 9

(a) This part asked for the curved surface area of a cone and was very well answered by most candidates. Most candidates realised that Pythagoras was required to find the sloping height. A few candidates did use the vertical height and a few added the area of the circle. As the question was in context, a decimal answer was required so a final answer of 65π only gained the two method marks.

(b) (i) In this part candidates had to apply the principle of similar triangles and to find a value that rounded to 3.33. This was expected to be one of the most challenging parts of the paper and it proved to be the case. There were some very good solutions from the stronger candidates, usually using

$\frac{r}{5} = \frac{12-r}{13}$. Some candidates used tangents from a point to obtain a length of 8 in one of the similar triangles. As this was a 'show that' question evidence for this value of 8 was needed.

Many candidates who reached $18r = 60$ did not show that the answer rounded to 3.33. Some candidates used the 3.33 as a circular argument in their working and some attempted to use trigonometry. Several candidates did not attempt this part of the question.

(ii) To find the volume of the water in the cup was much more straightforward and most candidates were successful. One error seen occasionally was use of the answer to **part (a)**, which was an area. The most common error seen was to ignore the volume of the sphere and to assume that the volume of water was the volume of the cone. Most candidates gained at least one method mark for finding the volume of a sphere or a cone, although the powers of the radius were often incorrect in their formulae or working.

Question 10

(a) Very few errors were seen in this part. There was a mixture of correct answers given as decimals and fractions.

(b) (i) Overall a well answered part. A few candidates divided rather than multiplied the two correct probabilities, for example, $\frac{0.05}{0.6} + \frac{0.25}{0.4}$ or $\frac{0.6}{0.05} + \frac{0.4}{0.25}$, some others ignored the first branch just giving 0.25 + 0.05. Additionally, some valid answers were given as percentages here.

(ii) Usually the same candidates divided rather than multiplied or ignored the first branches as above. Few candidates used their answer to **part (b)(i)**.

(c) Candidates found this part one of the most discriminating questions on the paper, with even the stronger candidates often only gaining a single method mark. It was common to see multiplication by 4 not 'to the power' of 4, for example, $0.6 \times 0.7 = 0.42$ then 0.42×4 or $0.42 \times \frac{4}{5}$. Other errors were adding or ignoring the 0.3 altogether.

Question 11

(a) In this part even the stronger candidates found it diffiuclt to show, although there were a few who were successful in using a ratio theorem method. Those that used the vector *AP* as $\frac{3}{5}$ of vector *AB*, or similar, were the most straightforward to follow. Some found $\frac{2}{5}$ of 5 = 2 and –1 + 2 = 1 for the *y*-coordinate of *P* but then found $\frac{2}{5}$ of 10 = 4 and used that as the *x*-coordinate of *P* and omitted $8 - 4 = 4$. Others used the given answer (4, 1) as a circular argument to work with the ratio of *AP* : *PB* or tried to find the equation of *AB* or its mid-point.

(b) By contrast this part was answered very well. Almost all candidates worked with the correct gradients and substituted into their $y = mx + c$ using the coordinates for *P*. The most common slip was to find the perpendicular bisector rather than the line through *P*.

(c) As long as **part (b)** was correct this was also answered well as there was no follow through here. The main error here was usually to substitute for *x* and *y* and prove that $c = –7$ which was not allowed.

(d) (i) Most candidates approached this well and were able to achieve the correct answer provided they did not use $10^2 + 3^2$ or $10^2 – 5^2$. Several did not give the answer in surd form as required.

(ii) Another discriminating part in which some worked most efficiently with the lengths in surd form. Those who worked with decimal equivalents more often than not gave their first answer as 25 so were not penalised. Those that did not find the length of *AP* were left struggling with the cosine rule which was not always completed successfully which meant they did not score. A more successful approach, though one rarely used, was to find the area of the rectangle containing *ABC* and subtract the areas of the 3 unwanted triangles. A common mistake was to work out the area of the wrong triangle altogether, by joining horizontal and vertical lines from *B* and *A* respectively to the point (–2, –1) which unfortunately also gave the correct answer of 25, but was not credited.

Question 12

(a) This was mostly all correct but some responses were seen with 2 – 12 = 10.

(b) This was generally well answered but some candidates evaluated g(4) rather than solving g(x) = 4.

(c) Mostly a well answered part, although occasionally a candidate simply swapped the *x* and *y* giving their answer as 2 – 3*y* or 2 – 3f(x). Of those who did not score full marks many scored one for a correct first step. Usually, it was a sign error that caused them to lose the final mark. A few simply wrote down the reciprocal of the function: $\frac{1}{(2-3x)}$.

(d) Most responses scored at least the method mark in this part, although when multiplying out the bracket some found –9*x* rather than +9*x* as the final term in the denominator.

(e) Most candidates scored at least the M or the B mark here and many went on to gain full marks. Several different errors were seen including omission of the –5 term in the numerator, incorrectly expanding the brackets, attempting to factorise a correct answer and cancelling (2 – 3*x*) within a correct expression. Candidates were more likely to expand the brackets correctly if they wrote them as (2 – 3*x*)(2 – 3*x*) rather than $(2-3x)^2$.

Question 13

(a) A good standard of sketches was seen, with most candidates scoring at least two marks. Marks were generally lost for feathered or very thick lines and excessive curl back or overlapping asymptotes. Only a few candidates were unable to set their calculator zone correctly.

(b) This was answered well by most candidates but some lost the marks writing down just the *x* values, rather than the full equations.

(c) Generally, a well answered part with most scoring full marks. Some responses lost a mark for including the *y*-coordinates and occasionally the positive value was only given to 2 significant figures.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/43
Paper 43 (Extended)

There were too few candidates for a meaningful report to be produced.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/51
Paper 51 (Core)

Key messages

To do well on this paper candidates needed to communicate with carefully drawn diagrams and by showing their method or working-out for each step. Some examples of these are in the specific question comments. The good diagrams not only earned the candidate communication marks but helped to clarify what was happening as the square turned.

General comments

Investigations often involve the use of sequences to identify patterns. Many of the candidates knew how to find the *n*th term and used this knowledge successfully. All candidates should be encouraged to write down the common differences they find, no matter how simple or straightforward.

Comments on specific questions

Question 1

(a) The candidates were asked to draw the square in positions 4, 5 and 6. Most of them did draw 3 more squares and the majority placed a cross, or at least some mark, at the centre of square, so gaining a communication mark as well.

(b) The candidates were able to write down the correct *x*-coordinates for the next 3 squares and most found the *n*th term for this sequence. There was no mark for communication in this question. Candidates should be encouraged to set out their working, like common differences, even for the simplest of sequences.

(c) Many candidates gained a communication mark for showing the substitution of 92 into their *n*th term found in **part (b)** as well as a mark for the correct answer. Candidates who had an incorrect answer in **part (b)** still gained a communication mark for showing this substitution.

(d) (i)(a) Candidates should make use of diagrams at every available opportunity. By adding radii, arcs and squares to this diagram, some candidates realised that one arc was a quarter of a circle, leading them to the correct answer of 4.

(b) When the candidates had drawn on the diagram to find the 4 rolls their diagram also showed that the square was now in position 5.

(ii)(a) Not many candidates saw the connection here between the Pythagoras formula, given in the box, to the circle radius. Some of those with good diagrams above **part (i)(a)** did choose this rather than the circumference of a circle formula. Of these, $1^2 + 1^2$ was seen more often than $0.5^2 + 0.5^2$. It is important for candidates to learn that if they are to show a value is correct when the value is given to 3 decimal places, then they must show working to at least 4 decimal places. For example, $\sqrt{0.5}$ = 0.707 was not enough; this needed to be $\sqrt{0.5}$ = 0.7071, at the very least, with 0.707 following this.

(b) There was some good working for this part with good use of the circumference formula. Many candidates chose to divide by 2 instead of 4.

Question 2

(a) Most candidates found the correct numerical values for this table and many also found the *n*th term. Most gained another communication mark for drawing further squares on the diagram or at least marking a further 3 centres. Some were awarded this mark for showing 3 common differences of 2 either in their working or connecting their values in the table. Drawing or extending diagrams is helpful both for visualising the problem as well as communicating thoughts. In the same way, at least 3 common differences should always be shown.

(b) This time the question asked for both coordinates rather than just the *x*-coordinate. There was a communication mark for showing the substitution of 35 into their *n*th term as well as marks for the correct coordinates, in the right order. Candidates, who showed their working, again achieved marks even if their answer was incorrect.

Question 3

(a) The marks available for this question followed a similar pattern to those for **Question 2(a)**. The numerical values were a little more difficult here and candidates should be advised to check and recheck their calculations, even the simplest ones. As before, showing common differences or drawing squares or marking centres was each enough to gain the communication mark. The *n*th term was also a little trickier. Candidates should be encouraged to look out for patterns between questions as well as within one question.

(b) The same pattern followed for answering this question. Even what appear to be simple calculations should be checked.

Question 4

It is a good idea to collect information together at some stage in an investigation. As is often the case, this question was actually the method for this collection of evidence. Candidates were asked to write in their answers for the *n*th term found in each of the previous four situations. By following patterns in their answers they were expected to complete the *n*th term for a square of side 5 cm and then for a square of side *w* cm. Candidates should be encouraged not only to look for patterns, but to show how they are looking; for example by writing down any differences and common differences that they find.

Question 5

There were several different methods for finding the value of *w*. Those candidates who had an answer for the *n*th term using *w* in **Question 4** followed a correct path by substituting 120 for *n*. Of these with the correct *n*th term only a few could follow through with correct algebra to solve this equation. The next step for most candidates, after $120w - \frac{w}{2} = 2151$, was to multiply only the 2151 by 2, giving $120w - w = 4302$. The importance of learning correct algebraic steps should be emphasised.

Other methods such as 2151 ÷ 120 were also acceptable and were commonly used by those candidates who had previously been unable to find the correct *n*th term.

Question 6

(a) At the beginning of this question many candidates found the correct solutions for *k* and *a*. Only a few confused the two values, showing most were able to connect the previous parts of this investigation to a new situation.

(b) Those who did not use a diagram started to muddle their values at this point.

(c) Again, the answers to this question indicated that some candidates had not thought this through or maybe had not checked their thoughts a second time. It is essential to check answers even when it seems very simple or straightforward.

Question 7

A diagram was needed to establish what is happening. Many candidates drew enough to gain a communication mark as well. Some found it difficult to explain or did not realise that the original top left corner became the centre of rotation.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/52
Paper 52 (Core)

Key messages

Candidates need to set out their methods clearly, including drawing if needed, as this will greatly help in gaining them marks for communication.

General comments

Candidates should be encouraged to communicate their methods by drawing solutions and being equipped to do so. They should also be well-versed in the use of their calculators, especially using brackets as a way of entering compound calculations (such as the square of negative numbers) and thus avoiding maths errors on their calculators and stopping them from completing questions.

Comments on specific questions

Question 1

(a) Most candidates answered this question well, but the last line was a source of error for many.

(b) Those who erred in the last line of the previous question often had this incorrect. A significant number did not communicate the '.5' element of the answer.

Question 2

(a)/(b) Both parts were quite well answered, but many did not take the hint (suggested by the circle on the diagram) that would have helped enormously in both parts, in their answers and to gain communication marks.

Question 3

(a) This question was found difficult by many candidates as an incorrect answer to **Question 2 (b)** meant they missed the '$1^2 + 2^2 = 5$' required.

(b) Many candidates evaluated one point correctly but did not realise there were others, thus lost marks. They needed to identify three points (and use Pythagoras) to get the full marks.

(c) Most candidates marked the points given but then did not find others. Again, drawing a circle (as suggested earlier in the paper) would have given them a good solution. Any attempt at a circle gained a communication mark and usually helped towards gaining the other marks.

Question 4

(a) (i) A significant number did not realise that they were being asked about the triangle and the lengths of its sides and launched into explanations about hexagons.

(ii) Candidates found this part challenging. Many did not draw the line and did not recognise that as it was linked to **part (i)** in that the angle was 60° halved.

(b) (i) This part was quite well answered but by not taking the opportunity to draw on the diagram, many candidates lost out on some marks.

(ii) Many did not understand the question, resulting in answers like (3*b*, 2*a*) and so on.

(c) Many candidates attempted this question but were unsuccessful as they could not correctly square a negative number using a calculator. In general, they omitted to use brackets and thus the negative sign was not squared, just the number. This resulted in a negative under the root and so they could not get a result. Some successfully substituted and if they also drew and measured the line, they scored well.

Many lost the opportunity to simply draw and measure the line, instead concentrating on the formula only.

Question 5

(a) Despite the presence of circles already on the diagram, about half of the candidates made no attempt to draw any kind of circle for the next layer and so could not be awarded the communication mark. Despite this, most candidates successfully completed the table.

(b) This was generally well answered, with the majority of candidates describing the pattern correctly.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/53
Paper 53 (Core)

There were too few candidates for a meaningful report to be produced.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/61
Paper 61 (Extended)

Key messages

In order to do well in this examination, candidates need to give full and logical solutions showing clear method to justify their answers. When grids are provided, communication opportunities for diagrams often arise. When using the method of differences to communicate method, at least three common differences are required. Communication of method steps must be done explicitly and nothing must be implied. For example, if a step in a solution is to divide both sides of an equation by 0.3, then that should be clearly seen. Communication marks are not implied by the result of the division or by writing, for example, (÷ 0.3) at the end of the equation. All necessary steps must be explicitly seen for the mark to be given.

When candidates are asked to show that a result is correct to a certain number of significant figures, their penultimate step should always be to write down a value that has a greater accuracy, so that they are able to demonstrate the rounding and complete the question.

It is expected that candidates will use the π key on their calculator in calculations for circle areas and circumferences. The use of approximate values such as 3.14 results in a loss of accuracy.

General comments

A good number of candidates scored well and found both **part A** and **part B** accessible. The later questions in each part proved challenging for some, particularly **Questions 6(c)**, **9(c)** and **9(d)**.

Many candidates presented their work neatly, clearly and with correct mathematical form. In order to improve, other candidates need to understand that their working must be clear and detailed enough to communicate their understanding.

The level of communication was generally good, although better candidates sometimes omitted to communicate in the early questions in **part A** and weaker candidates often miscommunicated method in **Questions 5** and **6(c)**. Most candidates stated units. Occasionally, candidates stated units as part of the model in **Question 9(c)**. 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. Freehand drawings were accepted as diagrams although candidates are generally expected to use a ruler and pencil for these.

Comments on specific questions

Part A Investigation: Rolling square

The first five questions considered the coordinates of the centre of a square as it rolled along the *x*-axis. Candidates needed to understand how the centre changed as the length of the side of the square increased. Many candidates clearly understood this part of the task.

Question 1

(a) This was designed to be a simple introduction to the task and was usually well answered. A small number of candidates omitted the third square or did not draw one or more of the vertical lines for the squares and this was not condoned.

(b) This part of the question was also well answered. Most candidates were able to complete the table correctly. A small number of candidates gave a value rather than an algebraic expression for position *n*.

(c) There were two marks available for this question and so an opportunity to communicate method arose. Many candidates did write 92 – 0.5, communicating their method successfully. Those candidates who were unable to write the algebra correctly in **part (b)** were usually able to use the clear pattern in the sequence correctly to communicate here. A good number of candidates did not take the opportunity to communicate their method and simply stated the answer.

Question 2

(a) A good number of candidates earned all three marks. Those candidates who were unable to write the correct algebraic expression for position *n* in **Question 1** generally were also unable to produce the correct expression here but were usually able to earn a mark for the correct numerical sequence in the table. A communication mark was available and was often gained through drawing at least three more squares or marking three more centres on the grid provided. Other candidates gained communication by showing at least three differences of 2 for the numerical sequence in the table. A few candidates communicated in part but drew insufficient squares or centres on the grid or only indicated one or two constant differences. Some good candidates would have improved if they appreciated the need to communicate, as a few simply completed the table without justification. Other candidates wrote equations based on differences without the justification of having shown the differences to be constant first, which was not credited.

(b) Again, a good number of candidates stated the correct point. Some candidates found the *x*-coordinate correctly but were unable to state the *y*-coordinate correctly. Commonly 2 or 0 was offered or, on occasion, 35. Weaker candidates sometimes reversed the values.

Question 3

Again, three marks were available for this question and a good number of candidates earned all the marks. Candidates who found the algebra challenging in the previous questions continued to do so. A grid was provided for candidates which enabled them to communicate method using diagrams. More candidates earned the communication mark available in this question than had done in **Question 2**, possibly because the *x*-coordinate was not an integer. Commonly credit was given for drawing diagrams, although some candidates did write at least three constant differences of 3.

Question 4

In this question, candidates needed to consider the patterns in the sequence of algebraic expressions for the *x*-coordinate of each square in position *n*. Many candidates correctly produced the correct expressions for the squares with sides 4 cm and 5 cm. It was clear that many candidates had observed patterns connecting the side of the square to the expression for the *x*-coordinate for position *n* as they made comments alongside the table such as '*n* times the side take away half of the side'. Some were able to write a fully correct expression for the square with side *w* cm. However, many candidates struggled with the introduction of another variable. These were often able to deduce either *wn* or $\pm\frac{w}{2}$ but not a fully correct expression.

Common errors were $w-\frac{w}{2}$, $wn-\frac{n}{2}$, $wn-\frac{w}{n}$, $wn+\frac{w}{2}$, $wn+\frac{n}{2}$ and $n+\frac{n}{2}$. Candidates with numerical answers for position *n* in previous questions continued with that pattern. Candidates rarely took the opportunity to communicate by indicating constant differences to confirm the pattern in the coefficients of *n* or the constants.

Question 5

To gain full credit for this question, candidates needed to communicate a correct and complete method as well as stating the correct answer, 18. Two communication marks were available. Some candidates successfully used the algebraic expression they had found in **Question 4** and formed an equation such as $120w-\frac{w}{2}=2151$. This was good communication. These candidates often went on to collect the terms on the left-hand side correctly, earning the second communication mark for $119.5w = 2151$. Some candidates made an order of operations error and divided by 120 incorrectly to arrive at $w - \frac{w}{2} = \frac{2151}{120}$ or attempted to double the equation but did not double all the terms, for example, $120w - w = 4302$. These errors were not condoned and the second communication mark was not awarded. A small number of candidates earned the second communication mark by drawing a sketch-graph of two appropriate linear functions or by using trial and improvement. Some candidates seem to have tabulated values on their calculator but many only wrote down the trial that gave the answer 18. This was not credited for communication. Candidates who choose to use trials should know that at least 3 correct trials should be seen for this to possibly earn a communication mark. Many candidates who used a sketch-graph or trials omitted to state the equation they were trying to solve and missed a communication opportunity. A few candidates did not use the algebra of the previous question and estimated the position of the centre using $\frac{2151}{120} = 17.925$ which, they then deduced, meant the centre had to be 18. This was credited for one of the 2 communication marks.

Question 6

In this question, candidates were no longer considering the centre of the squares as the side-length varied. Instead, they were investigating the positions of a corner of a 2 cm square as it rolled along the *x*-axis. In this instance, the corner of the square eventually became the centre of the rotation.

(a) Good candidates understood that when the corner *A* became the centre of rotation, the *x*-coordinate of *A* did not change for that position. These candidates started to complete the table correctly using 6 and were then able to deduce that in every set of 4 positions, the 3rd and 4th positions were the same. Mostly, these candidates completed the table correctly. A few candidates misinterpreted exactly when the *x*-coordinate repeated and these started with 8. Those who made use of the diagram/grid were often more successful. Some candidates found the thinking needed in this part quite challenging. These candidates commonly stated the *x*-coordinate in position 4 as 7 or made no attempt to answer.

(b) Many candidates were able to complete the table and earn all five marks available. A few candidates made numerical errors and others struggled with the algebra. Some candidates were confused by the positions and treated them as being *a* in all four cases. This often resulted in the expressions for positions $4a - 1$ and $4a - 2$ being stated as $2a$ and the position $4a - 3$ being stated as $2a - 2$. Weaker candidates often made no attempt to answer.

(c) Many candidates attempted to communicate a method in this part of the question. Two communication marks were available. A good number of candidates realised the need to check whether 523 was a multiple of 4. Good candidates then went on from there and either found an integer value for *a* directly from $\frac{524}{4}$ or $\frac{520}{4}$ rounded their non-integer value or solved an equation such as $4a - 1 = 523$ to arrive at $a = 131$ or 130. The second communication mark was then earned for substituting the integer value that had been derived for *a* correctly into their expression for $8a - 2$, for example, providing the work was of equivalent difficulty. Many candidates were unable to earn this mark not having an expression of the correct form in **part (b)**. A few candidates used $a = 523$, which was not condoned. Some candidates did not use the algebra from the previous part of the question and, instead, concentrated on the patterns in the table. Candidates who used this approach could gain communication marks by indicating that 523 was in position $4a - 1$ and then showing that all that was needed was to double 523. A small number of candidates were credited for this approach. Many candidates found the *x*-coordinate as 1046. Not all of these were able to conclude that the *y*-coordinate was 0. Some candidates were commenting that the *y*-coordinate was 0 or 2, but not choosing a value or choosing 2. Some candidates made no real progress or no attempt to answer.

Part B Modelling: Wind turbines

Question 7

(a) Many good, fully correct answers were seen. A communication mark was available and this was more commonly awarded when candidates stated correct units on the answer line. A few, generally weaker, solutions involved the area rather than considering distances. Some candidates treated the blades as being the diameter of the region swept out, rather than the radius. These candidates needed to look at the diagram more carefully to ensure they understood the situation.

(b) (i) A good number of candidates earned all three marks for this part. A few candidates rounded their answer to the nearest integer and lost accuracy but were rewarded for correct method. A communication mark was available for showing a calculation for finding either of the areas needed for the solution. Many candidates wrote one or both of the area calculations and communication here was generally good. The candidates who thought the blade was the diameter tended to continue with this misconception, although some credit was given for this. A few candidates found the percentage of the area of the soccer pitch that was not covered by the wind turbine and a very small number worked out $\frac{1}{3}$ of the correct percentage. Some of these candidates may have benefitted if they had reread the question or read the question and considered the diagram more carefully.

(ii) Some excellent answers were seen. Again, there were some rounding issues with 489.3, instead of 489.4, seen a few times. Those candidates who, in **part (b)(i)**, found the area not covered by the blades tended to repeat this error in thinking. From weaker candidates, a common incorrect answer was to find 489% and then state the answer 100% as more than the whole pitch was covered. This was a misunderstanding of what was being asked and was not ignored.

Question 8

(a) Very few errors were made when plotting the points. Most candidates were sufficiently careful and accurate.

(b) In this part, candidates needed to use the information given to find a constant *c* and complete the model given. A good number communicated how they found *c*, earning the one communication mark available. Many candidates omitted to write down the model. Some seemed confused by the variety of values that they found if they substituted more than one pair of values into the given form of the model. Some of these candidates averaged the different values of *c* that they had found, which was accepted.

(c) A reasonable number of candidates earned a mark for a reasonable answer. A communication mark was available for those who used their model, as instructed. Some candidates omitted the division step and it was common for candidates to write, for example, $1200 = 0.3b^2$ then $4000 = b^2$ without showing the division step. This was not condoned as communication. The step $\frac{1200}{0.3} = b^2$ needed to be seen. An alternative way to earn the communication mark was to square root the left-hand side of this equation, but the division also had to be seen in this case. Some candidates ignored their model or did not have a model to work with. These candidates often gained a mark for a reasonable answer found from the table or graph.

Question 9

(a) (i) This part of the task was very well answered with a good number earning all three marks. A few candidates confused the number of turns and the number of seconds. Most worked in seconds rather than minutes. Most earned the one communication mark for stating units and many others earned it for showing a correct calculation. Candidates communicated well with many giving both the calculations and the units.

(ii) A good number of candidates used a correct method in this part but commonly candidates earned two out of the three marks available. Many candidates omitted to show a decimal value to more than 3 significant figures and so lost the third mark. Most candidates knew the correct formula for the circumference of a circle, although a few used the area. A few candidates misinterpreted the information and divided 27 by 14.1. Presentation was often variable in this question. A few candidates clearly were working with the answer in mind and adjusted their values to ensure they arrived at 14.1. This was not always done correctly. A few candidates were credited for $\frac{2\pi \times 27}{14.1} = 12.03...$ although, again, most candidates doing this wrote $\frac{2\pi \times 27}{14.1} = 12$ and were penalised for not showing a more accurate decimal. Some candidates did not use accurate values of π or prematurely rounded the value 169.646. These generally resulted in inaccurate answers, when seen.

(b) This was fairly well answered with most candidates adopting the same approach that they used in **part (a)(ii)**. A few candidates were not sufficiently accurate, again often through using an approximation for π or prematurely rounding.

(c) Many candidates were able to produce a correct unsimplified form of the model. Few candidates simplified correctly and also had S as the subject, both of which were required for full marks. Some candidates confused t with time and a common incorrect answer was $\frac{2\pi L}{t}$.

(d) Candidates could either use a correct form of the model or a method such as finding the number of seconds and then the number of degrees per second, not relying on the model being correct. Many candidates were able to find the correct number of degrees per second. A few spoilt their answers by then giving their final answer as the number of seconds. They may have been confused by t but rereading the question should have alerted them to their error. A communication mark was available in this part but few candidates earned it. Most candidates substituted the values 72 and 107 into the model correctly. As in **Question 8(c)** they needed to show all the steps explicitly to rearrange this to find the value of t. A correct step was generally not implied from a working decimal value without clear evidence to show what process had been carried out to find that decimal. As some candidates took several steps to complete this process, they often omitted to show at least one of the steps explicitly and could not be credited for communication. Candidates who did not combine values but instead gave calculations such as $\frac{180\times72}{107\pi}$ were more successful in gaining this mark. Candidates who did not use the model but worked out the number of seconds and then the number of degrees per second often did earn the communication mark as they usually showed all parts of their method clearly.

Question 10

(a) Good responses indicated that the wind speeds were equal. Some candidates commented that the turbine would not be moving. These responses were not about the wind speeds and could not be credited. Other candidates incorrectly commented that there was no wind or that u and v were both 0.

(b) Some excellent graphs were drawn. Some candidates were very skilful and the graphs drawn were neat and clear. Good use of the graphics display calculator was evident. A few candidates drew graphs of the correct shape which did not quite meet one or other or both of the axes. Some candidates would have done better if they had marked 0.5 on the vertical axis as, on occasion, the E-intercept was not sufficiently accurate to be credited. Weaker solutions started either at the origin or at 1 or were straight lines or hyperbolae, for example. It may be the case that some of these candidates needed to adjust the view settings on the calculator to be able to see the graph correctly. Other candidates were clearly tabulating values and plotting points. This is not expected when the instruction is 'Sketch'. The resulting graphs were often a poor shape.

(c) (d) Candidates were expected to use their graphics display calculator to read the maximum point and interpret the values. Some did this but were not sufficiently accurate, with 0.3 and 59 or 60 seen regularly. Some used 0.3 and substituted it into the model for E to get the answer for **part (d)**. This resulted in a lot of extra work which usually gained no credit as it was not sufficiently accurate. In **part (d)**, a few candidates may have improved if they had read the question more carefully as they gave their answer as a fraction and not as a percentage as the question demanded.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/62
Paper 62 (Extended)

Key messages

In this paper candidates are often asked to justify or show a general result. Generalisation in an investigation requires going from the numerical to the algebraic so justifying general results cannot be done by substituting numbers. Likewise in modelling one should not base general conclusions about the suitability of a model on a particular value.

The difference between discrete and continuous data was important for interpretation about models of rate of flow.

Solving complex equations can always be shown using a graphics display calculator by giving a sketch with appropriate points of intersection.

Candidates are advised to make effective use the working space given and not start explanations on the final answer line which may force them to continue below that line.

General comments

Candidates were generally well prepared for questions related to proportionality, the suitability of models, probability and the manipulation of exponential equations.

It was evident that many had also understood the importance of showing their working. This was important as nearly a quarter of the marks were for good communication.

There were very many good sketches of graphs seen. Most used an appropriate scale on the graphic display calculator. When sketching graphs candidates should choose an appropriate scale that allows the curve to fill the graph area provided. Thinking mathematically about the model often suggests what that scale should be.

Comments on specific questions

Part A Investigation: Nearest neighbours

Question 1

Most candidates gained full marks for writing all three 2nd nearest neighbours to (0, 0). A few candidates gave only one or two of the required points and occasionally points with a coordinate of 2 were seen.

Question 2

Nearly all candidates wrote $1^2 + 1^2$ to show their calculation. A further mark was awarded to the few candidates who showed where these figures came from. Most did this by drawing a right-angled triangle and showing the dimensions. Some candidates used the distance formula for the distance between two points and a few mentioned Pythagoras.

Candidates are advised not to write statements such as $1^2 + 1^2 = \sqrt{2}$.

Question 3

(a) The large majority were able to find the required number of nearest neighbours and their distance from the origin. In general, the number of nearest neighbours is either 4 or 8, the most common error being to place these numbers in the wrong cells on the bottom row of the table

(b) Most candidates were clear in their minds that d^2 was not directly proportional to n.

There were very many different approaches explaining why this was so, the most common being to find a constant of proportionality from a pair of values for d^2 and n. Many chose to find a second constant and indicate that this was different from the first. Others preferred to substitute their constant and a value from the table and show that this gave a different value, from that in the table, for the corresponding variable.

Some others observed that d^2 did not increase steadily and showed this by evaluating the differences in d^2 in the table.

The simplest approach was to observe, from the first pair of values in the table, that $d^2 = n$. Further inspection of the first two rows of the table confirms that this does not hold true.

The most common error was to find two different constants of proportionality but to make no further comment. Several candidates squared the d^2 values instead of reading them directly from the table.

(c) Many candidates found all the 8 nearest neighbours that were $\sqrt{20}$ from the origin.

Several candidates spent some time examining all the integer additions that gave 20. The better candidates looked first at square numbers and found that $2^2 + 4^2 = 20$. A statement like this was rewarded with a mark for communication. The most common error was to find only half of the 8 points. A few candidates tried to work with equations like $x^2 + x^2 = 20$.

Question 4

For the rectangular grid most candidates correctly wrote that there were 4 nearest neighbours and calculated $d^2 = 8$. Some wrote that d^2 was 7, by taking the mid-value between 5 and 9. Very few candidates gained the mark for communication by showing that the correct answer of 8 came from $2^2 + 2^2$.

Question 5

(a) (i) This question introduced axes on an isometric grid. Many candidates found it difficult to relate to this new coordinate system and continued to think in terms of rectangular axes. More attention to the coordinates of the points that were given on the diagram might have helped understanding.

(ii) This question tested reading along isometric gridlines to find a point (a, 4) that was an integer distance from the origin. Those who still thought in terms of the rectangular axes considered $\sqrt{a^2 + 4^2}$ for the integer distance. The large majority of candidates realised that (0, 4) was suitable, being on an axis. Fewer noticed that (–4, 4) was also suitable. Some candidates gave the points, rather than just values of a, for their answer.

(b) (i) Many different appropriate calculations involving 60° were seen, showing why the angle was 120°. The few who wanted to use trigonometry were unsuccessful in this. A small number thought that the ratio of the sides of a triangle equalled the ratio of the angles. Some incorrectly asserted there were angles of 30° in the triangle.

(ii) Most candidates found the length of the side of the triangle by using the cosine rule on the triangle on the facing page. Other candidates showed that this length was $\sqrt{7}$ by using right-angled triangles and Pythagoras twice. Both methods gained a mark for communication. A common incorrect answer was $\sqrt{5}$, found by treating (1, 2) as a point on a set of rectangular axes.

(c) In this question the cosine rule led to the given general result. There were several candidates who correctly used the right letters and then substituted the value of cos 120°.

A very common error was to choose a point, often (1, 2), and show that the given formula worked for this one point.

(d) It was a minority of candidates who scored full marks in this question**.** It required close inspection of the grid to find the next nearest points. Using a pair of compasses would have aided insight into the spread of points on the grid.

With nearest neighbours very close to each other many candidates chose (3, 1) instead of the nearer (2, 2). The better candidates gave the coordinates of the point that they then used in the given formula and so were rewarded with a communication mark. Candidates are encouraged to annotate diagrams and, in this case, indicating the coordinates of the point they selected to work with was also important in terms of communication.

(e) The most common method was to find distances from the origin that were close to $\sqrt{14}$.

Many candidates gained credit for finding $\sqrt{13}$ as the closest that was less than $\sqrt{14}$.

For distances close to, but above $\sqrt{14}$, $\sqrt{19}$ and $\sqrt{21}$ were often given. A few candidates noticed from the grid that the point (4, 0) gave a distance, $\sqrt{16}$, that was even closer to $\sqrt{14}$ and was the next nearest neighbour to those points that were $\sqrt{13}$ from the origin.

Rather than trying out integers, some candidates reasoned algebraically, taking the equation

$a^2 + b^2 + ab = 14$ and solving it as a quadratic in b for particular values of a. This approach was more difficult and frequently missed out some values of a.

A few candidates, who were highly skilled in algebra, wrote the equation $a^2 + b^2 + ab = 14$ as a quadratic in a and, using the quadratic formula, showed why a solution for a in terms of b was not possible.

Part B Modelling: High river flow

Question 6

(a) When finding or calculating a measurement in a real-life situation, candidates should realise that an improper fraction is not sufficient. Many left $\frac{25}{3}$ as the answer to calculating the return period for high flow. Others gave the answer correctly as 8.33 years with one or two writing 8 years 4 months.

A frequent wrong answer was $\frac{2}{3}$ which happened when candidates interpreted *each year* as meaning *in one year*.

(b) The answer here was the reciprocal of the answer in **part (a)**. Many candidates wrote this with a numerator of 1 and a decimal on the denominator. Although normally not an acceptable way of writing a fraction it was allowed because the introductory example suggested that there should be a 1 on the numerator. An answer greater than 1 for a probability implies that candidates need to check their working or their answer to **part (a)**.

Question 7

(a) (i) Nearly all candidates wrote $1 - p$, which is the correct answer for the event not occurring.

(ii) The large majority of candidates found the probability of the event not occurring in 10 years by taking the 10th power of their answer in **part (i)**. A few wrote $1 - p^{10}$.

(iii) The good candidates used words like *complementary* to describe the fact that events not occurring and those occurring at least once combine to give all possible events. Most described how subtraction from the whole gave events that occurred at least once. Many had difficulty expressing their ideas clearly.

(b) (i) The majority of graphs seen represented the function well. The successful candidates knew that probabilities did not exceed 1 and therefore used a window from 0 to 1 on the vertical axis. This scale showed the convex nature of the graph well. Candidates who used a vertical scale from 0 to 10 or more, sometimes decided the shape was a straight line as its convex nature was hard to discern on the calculator. Candidates are advised to ensure that their graph makes use of the given space by choosing an appropriate scale. A large number of candidates did not indicate a scale for the vertical axis and so did not gain a mark for communication.

(ii) Most candidates gave the correct answer when the probability was 50%. Few communicated how this could be found by drawing the line $y = 0.5$ on their graph. Those who were confident using logarithms showed an algebraic way to find the solution. A communication mark was awarded for one of these methods. A small number of candidates did not notice that the probability was slightly more than 50% when $x = 17$ and so gave an answer of 18.

Question 8

(a) The majority of candidates favoured substituting $F = 2$ and $p = 0.99$ from the table to get $k = 0.005$.

Some then found another value for *k* in a similar way. Others substituted their *k,* and either *F* or *p* from the table, to get another value for *F* or *p*. Both methods showed that the formula was not suitable.

Candidates are advised in such cases to complete any calculations and give single numerical values. Some candidates indicated what to do but followed that up with insufficient numerical evidence.

(b) Most candidates evaluated *c* by taking pairs of values from the first rows of the table. This was sufficient evidence to show that the model was not suitable. As in **part (a)** some candidates did not complete the necessary calculations to give the required numerical evidence.

(c) (i) The large majority of candidates plotted the points accurately, with only a few not being precise enough. An accuracy of a quarter of a square was expected. Some candidates confused 0.01 with 0.1, and 0.02 with 0.2. A significant number did not answer this question.

(ii) Most candidates understood the concept of what determines a good model. A number of candidates assumed that the data were discrete and did not account for the suitability of the function other than for the values in the table. Because of this the most common error was to give a lower limit of 16 000 for when the model was not good. As the function is clearly negative for 15 000 this should also have been included in the range of answers. One error was to write a list of values rather than a continuous range.

Question 9

(a) Many correct answers, using several different approaches, were seen. Essentially candidates had to show in their writing that they knew that 1^a was equal to 1, and that 3^{-1} gave $\frac{1}{3}$. Candidates had more success in the second of these. Several did not write out their argument in clear logical steps. This was especially true of those candidates who started by stating what had to be shown and wrote $3^{-\left(\frac{F}{b}\right)^a} = \frac{1}{3}$ as the first step in a series of equations. Some candidates equated both *F* and *b* to 1 and so did not work with the necessary general result.

(b) In this question a large number of correct answers were seen. Candidates had to look back and observe that $\frac{1}{3}$ was closest to 0.26 in the table on a previous page. The most common omission was not mentioning 0.26 but just referring to 8, which had been given in the question.

(c) (i) Much good graph work was seen with most drawing graphs with clear common intersection points. A large majority of candidates understood the importance, especially in a diagram having four graphs, of labelling these graphs. Less common was a scale on the vertical axis, the intercept at 1 being an important point.

Many candidates took much care in drawing an accurate representation of what their graphic display calculator showed. There were still some diagrams where several graphs were not close enough to the horizontal axis.

(ii) Most candidates found (8, 0.33) for one point of intersection, even when this was not evident from how they had drawn the diagram. A few wrote (8, 0.3) which was not enough accuracy for points read from a graphic display calculator.

With more careful reading of the question some candidates would have noticed that it asked for *points of intersection* and so a second point, namely (0, 1), was also necessary.

(iii) Many candidates correctly said that, as *a* increased, the graph was steeper or became higher between 6000 and 8000. Some described the shape of the graph but not how it changed with increasing *a*. A few candidates wrote that the gradient increased, which, because it was negative, contradicted the fact that the curve was getting steeper.

(iv) A variety of answers for the best *a* were seen, with several candidates concentrating on the shape of the graph rather than on its closeness to the data given in the table. Some insufficient reasons were given for the choice of *a*, such as commenting on the graph's proximity to a particular point rather than considering the whole data set.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/63
Paper 63 (Extended)

There were too few candidates for a meaningful report to be produced.