

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/11
Paper 11 (Core)

Key Messages

To succeed in this paper, candidates need to have completed the full Core syllabus coverage, be able to apply formulae, show all necessary working clearly and check their working for accuracy.

General comments

All working must be shown to enable candidates to access method marks if their final answer is wrong. This will also help the candidates' checking of their own work. This is vital in 2-step problems, in particular with algebra and the others towards the end of the paper. Candidates must take note of the form that is required for answers, for example, in **Questions 3** and **8**.

The questions that presented least difficulty were **Questions 1, 5, 8, 11, 12(a)** and **(b)**. Those that proved to be the most challenging were **Questions 6(b), 9(b), 9(c)** and **12(c)**. In general, candidates attempted the vast majority of questions rather than leaving them blank. Virtually all candidates attempted all parts of the first seven questions. The questions that received the most number of blank responses were **Question 9(b)**, stating the domain of a mapping and **Question 10(b)**, drawing an enlargement that was smaller than the original; both of these are demanding topics.

Comments on specific questions

Question 1

Candidates did well with this opening question. The vast majority of candidates were correct, but 50 was an occasional wrong answer.

Answer: 5

Question 2

Some candidates just wrote down the method for the question without going on to calculate the required answer. The greatest problem was that many tried to divide \$8000 by 3 or 0.03 instead of multiplying.

Answer: 240

Question 3

The most common error in part **(a)** was for candidates to give 46.9 as their answer. Other kept the digits the same but moved the decimal point. Answers such as 46.800 did not score as the extra zeros imply the number has been written correct to three decimal places. In part **(b)**, the term significant figures was confused with decimal places, as 59.9024 or 59.9023 were given.

Answers: **(a)** 46.8 **(b)** 59.90

Question 4

Candidates did well with part **(a)** with most gaining at least 2 marks. The most likely part to cause problems was the sector which was often replaced with segment. The most common error in part **(b)** was that candidates read the wrong angle from their protractor scale giving the acute angle of 77° instead of the obtuse 103° , an error which could easily have been corrected. Of those that gave an obtuse angle, only a few were not within the acceptable tolerance, but this skill at using a protractor is something that should be practised.

Answers: **(a)** Diameter, Sector, Arc **(b)** 103°

Question 5

Many candidates plotted A in the correct place with only a few plotting a point at $(2, -3)$. In a similar manner, a few candidates reversed the co-ordinates for point B . Some candidates wrote $(x = 2, y = 3)$, and there is no mark for this type of response. Part **(c)** caused more problems as some candidates had difficulties finding the midpoint of BC . Some marked a point on the line, and then tried to read the co-ordinates of their point rather than look at the whole segment to see where half-way across will be and then half-way up.

Answers: **(b)** $(2, 3)$ **(c)** $(1, 0.5)$

Question 6

Candidates found part **(a)** much more accessible than part **(b)** with many finding the size of angle ABC correctly. There are various methods that candidates could employ to find the angle without resorting to measuring the angles in the diagram which was seen occasionally. This last is never a valid method as diagrams are not drawn to scale. Marks were available for part of a correct method given. Many candidates gained one mark for part **(b)**, often for the calculation. The explanation using angles around a point equal 360° was rarely seen. Candidates need to learn angle properties so that, not only can they apply them, but can quote them in explanations.

Answers: **(a)** 120

Question 7

In this question, candidates muddled the signs and often gave answers with the values reversed. There are still candidates who use a horizontal line between the values. Sometimes the co-ordinates of both points were given so that the answer looked like a 2 by 2 matrix.

Answer: $\begin{pmatrix} -4 \\ 5 \end{pmatrix}$

Question 8

Sometimes candidates gave the answer as two fractions, one for red balls and the other for blue balls. A few gave a percentage as the answer, even though the question said to give the answer as a fraction, and this gained no credit.

Answer: $\frac{5}{6}$

Question 9

Candidates generally gained at least one mark for part **(a)** although some tried to add extra figures to the diagram such as another 4, or even a -4 , for the $(-2)^2$. Some candidates did not seem comfortable with the idea that two numbers can map to the same number in the range. Candidates did not do well with part **(b)**, in most cases they did not know how to write their answer. Occasionally, candidates gave the range instead of the domain. Nearly half of the candidates chose the correct phrase for part **(c)**.

Answers: **(b)** $0, \pm 1, \pm 2$ **(c)** many-to-one

Question 10

Drawing the reflection was handled better than the enlargement but a few candidates reflected the quadrilateral in the x -axis instead of the y -axis. The enlargement was the most challenging type in that the image was smaller than the original. Many candidates drew an enlargement that was twice the size of Q even though it did not fit on the grid, which should have been an indication that working should be checked.

Question 11

Part (a) was a slightly unusual algebra question but many candidates did well. The common error with part (b) was for candidates to use the signs incorrectly to give $5x + 3x = 9 + 7$ instead of the correct equation. Similarly in part (c), after multiplying out the bracket correctly, many wrote $16x = 28 - 20$ leading to an answer of 0.5

Answers: (a) 32 (b) (i) 8 (ii) 3

Question 12

Many candidates did well with the first two parts of this question. Finding an expression for the n th term of a sequence is challenging for candidates. Some gave the answer as $+8$ or $8n + 4$. If candidates use the formula for the n th term of sequence, they must be able to substitute correctly for a and d and then be able to simplify the result.

Answers: (b) 12, 20, 28 (c) $8n - 4$

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/12
Paper 12 (Core)

Key Messages

To succeed in this paper, candidates need to have completed the full Core syllabus coverage, be able to apply formulae, show all necessary working clearly and check their working for accuracy.

General comments

All working must be shown to enable candidates to access method marks in case their final answer is incorrect. This will also help the candidates' checking of their own work. This is vital in two-step problems, in particular with algebra questions and others towards the end of the paper.

For questions in context, candidates must check that their answers make sense, for example, the comparisons of capacity in **Question 7** and the bearings and distance calculation in **Question 12**.

The questions that presented least difficulty were **Questions 1, 2, 3, 6 and 8(a)**. Those that proved to be the most challenging were **Questions 4, 7, 11, and 12(a)**. Virtually all candidates attempted all parts of this paper. The question that showed the greatest number of blank responses was **Question 12(b)**, application of Pythagoras' Theorem.

Comments on specific questions

Question 1

Generally, candidates coped very well with this opening question. Common incorrect answers to part **(a)** included 7 or 0.7. If candidates did not score both marks in part **(b)**, they were able to access a mark for a part solution. In part **(c)**, although all the choices were given by some candidate, the majority chose the correct answer and 25 was the least common wrong choice. Part **(d)** was most likely to be incorrect with many answering with incorrect standard form such as 30.7×10^4 .

Answers: **(a)** 70 **(b)** 17 **(c)** 23 **(d)** 3.07×10^5

Question 2

This was the best answered question on the paper. It has been a concern in previous sessions that candidates do not attempt what is, in effect, a multiple choice question.

Answer: 50 : 50

Question 3

A large majority of candidates got part **(a)** correct but some tried to apply Pythagoras' Theorem and others gave answers which were not expressions, such as $3y + 2x = x$ or $3y + 3x = 180$. Occasionally, $3x$ was written as $2x^2$. Candidates had some problems substituting the values of x and y into their answer to part **(a)**. Candidates were able to gain follow through marks in part **(b)** if they correctly used their answer to part **(a)**.

Answers: **(a)** $3x + 3y$ or $3(x + y)$ **(b)** 18

Question 4

This was a more demanding approach to finding upper and lower quartiles as it used a list of numbers rather than a cumulative frequency graph. However, there were many perfectly correct answers with full supporting workings. It is always a good start with statistics question to put the data in order and this gained a method mark even if candidates did not go on to give the correct two values. There were candidates who gave 4 and 10, the numbers in the correct positions of the un-ordered list.

Answer: UQ = 9 LQ = 6

Question 5

For part (a) many ruled lines were in the correct position but some did not use the full grid. These incorrect lines often went through (0, -2). Candidates did slightly better understanding what was required in part (b) and read the graph at the intersection of the two lines. Unfortunately, some candidates drew pairs of lines that did not intersect and then had difficulty in calculating where the lines should meet. Generally, with questions such as this, the intersection should be on the grid so if lines do not cross, that should be an indication to check work. The fact that this is only 1 mark for a pair of co-ordinates would suggest that candidates do not have to do more than read from the graph.

Answer: (b) (1, -2)

Question 6

Candidates did well with this question, although there were calculations that involved surface area of one or more faces. Many candidates gave units but these were not always of volume.

Answer: 36 cm³

Question 7

This question was the second most challenging on the paper with the vast majority of candidates only gaining one mark. This was a method mark for ordering three of the four containers with C being the flask most likely to be in the wrong place.

Answer: C D B A

Question 8

Part (a) was a complete reversal in difficulty compared to the previous question as it was the question that virtually all candidates got correct. Part (b) was more of a challenge, with incorrect answers often of the form $x + 4$, $x + 5$, $x + 6$.

Answers: (a) 6 and 8 (b) $2x + 3$

Question 9

Candidates started well, but part (c) was found difficult. For part (a), a common wrong method was to add the numerators and the denominators to give $\frac{5}{11}$. Others found the correct common denominator but did not multiply the numerators correctly. The most successful responses to part (b) showed cancelling to the answer rather than multiplying before cancelling down. In part (c), candidates had problems turning the mixed numbers into vulgar fractions or left their answer as $2 - \frac{7}{24}$.

Answers: (a) $1\frac{1}{24}$ or $\frac{25}{24}$ (b) $\frac{1}{4}$ (c) $1\frac{17}{24}$ or $\frac{41}{24}$

Question 10

Part (a) was slightly more complex than many other questions of this type as there were three terms to factorise. A few candidates worked through the question using the subtraction sign as an equals sign. Some factorised, partly or completely, and then went on to combine the terms left in the bracket. The method mark was only occasionally awarded; the large majority of candidates gained full or no marks. It was easier to gain the method mark in part (b) for seeing evidence that one bracket had been expanded correctly.

Answers: (a) $7p(q+2-t)$ (b) $8b-32a$ or $8(b-4a)$

Question 11

Although this is a topic area where many candidates have difficulty, this type of question was answered better than in previous sessions. Apart from understanding how the function transforms, candidates had to be accurate with the drawing of the curve.

Question 12

To begin this question, the information needed to be added to the diagram and then candidates needed to realise which bearing was required. The most common wrong answer was to repeat the bearing from the question or subtract 120° from 360° . Some answered with 12km, the distance between A and B. Not until candidates had marked 60° for the angle between the north line and the line AB did it become obvious that this was a right-angled triangle and Pythagoras' Theorem was required. About half the candidates got to the correct answer but some did not take the final step of square rooting 169.

Answers: (a) 300 (b) 13

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/13
Paper 13 (Core)

Key Messages

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General comments

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Comments on specific questions

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Candidates did well with this opening question. The vast majority of candidates were correct, but 50 was an occasional wrong answer.

Answer: 5

Question 2

Some candidates just wrote down the method for the question without going on to calculate the required answer. The greatest problem was that many tried to divide \$8000 by 3 or 0.03 instead of multiplying.

Answer: 240

Question 3

The most common error in part **(a)** was for candidates to give 46.9 as their answer. Other kept the digits the same but moved the decimal point. Answers such as 46.800 did not score as the extra zeros imply the number has been written correct to three decimal places. In part **(b)**, the term significant figures was confused with decimal places, as 59.9024 or 59.9023 were given.

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Question 5

Many candidates plotted A in the correct place with only a few plotting a point at $(2, -3)$. In a similar manner, a few candidates reversed the co-ordinates for point B . Some candidates wrote $(x = 2, y = 3)$, and there is no mark for this type of response. Part **(c)** caused more problems as some candidates had difficulties finding the midpoint of BC . Some marked a point on the line, and then tried to read the co-ordinates of their point rather than look at the whole segment to see where half-way across will be and then half-way up.

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Answers: **(a)** 120

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Question 10

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Answers: (b) 12, 20, 28 (c) $8n - 4$

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/21
Paper 21 (Extended)

Key message

Candidates need to ensure they can perform basic arithmetic accurately and efficiently.

Candidates must know the key values of trigonometric ratios as set out in the syllabus.

General comments

Candidates were well prepared for the paper and demonstrated a clear knowledge of the wide range of topics tested. Candidates used their time efficiently and attempted all of the questions. The majority of candidates showed clear workings and thus were able to gain many method marks. Unfortunately, arithmetic errors were common and in particular many candidates lost a significant number of marks due to their lack of ability to accurately complete relatively simple division (**Questions 4 and 9b**) or multiplication of fractions (**Question 8b**). Where candidates are trying to complete long multiplication or long division they need to be aware that they are probably taking the wrong approach (**Question 1b**) or have not spotted some common multiples (**Question 5b**). In addition, candidates need to be alert to the fact that sometimes the parts within a question are connected and they need to use their previous working to help them (**Questions 1 and 2**). The trigonometric ratios need to be learnt (**Question 2**).

Comments on specific questions

Question 1

- (a) Many candidates were able to answer this question correctly without any difficulty.
- (b) Only a minority of candidates recognised the connection between part (a) and part (b) and used the intended approach of $(164 + 36) \times (164 - 36)$. Most candidates attempted to work out 164^2 and 36^2 separately using long multiplication. Unfortunately it was rare for any of these candidates to be able to accurately calculate the answer without making an arithmetic mistake in the process. Evaluating 128^2 was also a common error.

Answers: (a) $(x + y)(x - y)$ (b) 25 600

Question 2

- (a) Most candidates were able to simplify this correctly. However, the most common wrong answer was $3\sqrt{2}$.
- (b) Whilst the majority of the candidates knew the answer was likely to be one of 30, 45, 60 or 90, only a minority chose the correct answer. Candidates must learn the basic trigonometric ratios, as set out in the syllabus.

- (c) This part required candidates to recognise the need to use their solution to part (a). The majority of candidates either started again or did not recognise the connection. Of those who used 30, only a few scored 2 marks for this part, the remainder scored 1 or 0 marks usually because they had +30 and/or -30 as part of their answer or omitted either 150 or -150.

Answers: (a) $2\sqrt{3}$ (b) 30 (c) 150, -150

Question 3

- (a) The majority of candidates answered this part correctly. Common errors included the answers 2, 4 or 12 or attempts to find the lowest common multiple. Other candidates correctly wrote the three numbers as products of their primes but were unable to arrive at the answer 8.
- (b) This part was well done with many candidates scoring 2 marks and most candidates clearly understanding the meaning of highest common factor. This was evidenced by the number of candidates who scored 1 mark for successfully writing an $x^k y^k$ product but with only one power correct.

Answers: (a) 8 (b) $x^2 y^2$

Question 4

The candidates who could complete this question without any difficulty recognised that \$20 = 160% and were able to work out $\frac{20}{1.6}$ with ease. However, a significant number were unable to work out this division and had clearly spent considerable time and effort trying out various approaches including trial and improvement. Many candidates scored no marks on this question because they did not recognise the question as being a reverse percentage and they wrongly calculated 60% or 40% of \$20.

Answer: 12.50

Question 5

- (a) The majority of candidates obtained the correct answer to this part. However, many of these candidates were unable to simply calculate 2×155 but instead used laborious methods, with a significant number of candidates obtaining the answer by long multiplication of 1.55×200 with rows of superfluous zeros.
- (b) Although some candidates were unsure which numbers to multiply or divide by, or even whether to add or subtract, a significant number of candidates were awarded the method mark for $\frac{9.3}{1.55}$. Only the most numerate candidates were able to come up with the correct answer with the majority of unsuccessful candidates having made slips in long division or errors in other methods. Some candidates did not attempt to evaluate the fraction.

Answers: (a) 310 (b) 6

Question 6

- (a) This part was answered well by many candidates. Working was clear and accurate and the majority of candidates had a good understanding of how to simplify and combine the surds.
- (b) This part was also well answered. It was pleasing to see many candidates showing clear multiplication by $\frac{(5+\sqrt{2})}{(5+\sqrt{2})}$ and hence picking up the method mark. Common errors came from errors in simplification such as denominators of 25 or 3 or omitting to multiply both parts of the numerator by 7.

Answers: (a) $2\sqrt{3}$ (b) $\frac{7(5+\sqrt{2})}{23}$

Question 7

- (a) Graphs were drawn well with many candidates scoring 5 marks for correct, continuous, ruled lines. One of the common errors was to plot $y = 1$ instead of $x = 1$.
- (b) Most candidates, who had drawn the graphs correctly, were successful in correctly locating R to satisfy the inequalities.
- (c) Some candidates answered these parts correctly but many candidates chose a wrong vertex of the triangle because they did not recognise the need to find the minimum value. A significant number of candidates did not offer any response, even when they had scored full marks in parts (a) and (b).

Answers: (a) 3 correct lines drawn (b) correct region (c)(i) 9.25 (c)(ii) (1, 8.25)

Question 8

- (a) This was answered well with many candidates inserting all of the probabilities correctly onto the diagram. Only a few candidates did not read the question carefully and made the error of replacing the discs.
- (b)(i) Many candidates identified the correct branch and worked out the probability correctly. However there were many incidents of poor multiplication, errors in simplifying the fractions. Some candidates attempted to add the probabilities rather than multiply.
- (ii) Many candidates scored full marks for this part, most of them by considering the (R, R), (R, G) and (G, R) possibilities. Only the best candidates used the more efficient solution of $1 - P(G, G)$. However, a surprising number of candidates considered only two of the (R, R), (R, G) and (G, R) possibilities. Unfortunately many answers were again spoilt by very poor arithmetic and errors in cancelling down fractions as well as adding, not multiplying, along the branches.

Answers: (a) $\frac{7}{10}, \frac{6}{9}, \frac{3}{9}, \frac{7}{9}, \frac{2}{9}$ correctly placed (b)(i) $\frac{7}{15}$ (b)(ii) $\frac{14}{15}$

Question 9

- (a) Most candidates answered this correctly. Of the candidates who did not earn the mark, the majority had made basic arithmetic slips.
- (b) Most candidates were awarded the method mark for $\frac{24}{120}$. Unfortunately, far too many candidates did not simplify this correctly because they made cancelling slips. A few candidates gave their answer as a decimal, which was not what was required by the question.

Answers: (a) 7 (b) $\frac{1}{5}$

Question 10

This question was attempted by most candidates and most were able to earn at least one mark. The best candidates produced some very eloquent solutions with excellent presentation and clear algebra. A minority of candidates were able to arrive at $4x + 3 = \pm 7$ giving the required solutions easily. However, the more common approach was to try to obtain and attempt to solve $16x^2 + 24x - 40 = 0$, an equation which some candidates successfully reached, although unfortunately many did not understand the need to put the quadratic equal to zero. Unfortunately, only a few candidates recognised that the equation could be simplified this to $2x^2 + 3x - 5 = 0$. Without this simplification, the quadratic proved difficult to factorise or too hard to solve using the quadratic formula without a calculator.

Answer: 1, -2.5

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/22
Paper 22 (Extended)

Key message

Candidates need to show all of their working. Incorrect answers without working cannot be given credit, whereas partial credit can be awarded if a correct method is shown. Candidates need to have the correct mathematical equipment to ensure that pie charts are drawn accurately.

General comments

Candidates were reasonably well prepared for the paper and demonstrated very good algebraic skills. Many candidates found working with numbers expressed as a product of prime factors difficult, and extra practice would be beneficial. Many candidates lost marks through careless numerical slips. Candidates should make all of their working clear, ensuring it is organised, and not merely a collection of numbers scattered over the page. This enables Examiners to award method marks. Candidates should always leave their answers in their simplest form, as specified on the front cover of the paper. However, many candidates lost marks through incorrect simplification of a correct answer.

Comments on specific questions

Question 1

Many candidates scored full marks, but there was a significant minority who made a simple numerical slip of $6 - - 1 = 5$.

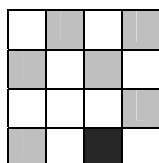
Answers: (a) C plotted at $(5, -1)$ (b) $\begin{pmatrix} 0 \\ 7 \end{pmatrix}$

Question 2

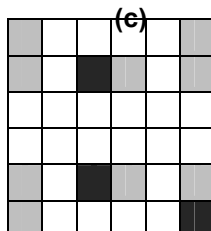
- (a) Candidates showed a good understanding of line symmetry.
- (b) The majority of candidates were successful, although there were a significant number of candidates who produced a pattern with only one line of symmetry.
- (c) Although there were many correct solutions, candidates found the concept of rotational symmetry more challenging than reflective symmetry.

Answers:

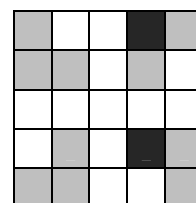
(a)



(b)



(c)



Question 3

Many candidates tried to complete this question using percentages, even after totalling the frequency to 180. These candidates invariably failed to score all of the accuracy marks.

Question 4

- (a) The majority of candidates had $\sqrt{0.3}$ as the smallest value, although the other numbers in the list were normally in the correct order. However, many candidates did not appear to know that $\sqrt{0.3}$ is greater than 0.3.
- (b) This part was well answered. Candidates were able to express all the numbers as a multiple of $\sqrt{5}$.

Answers: (a) 0.29, 0.3, 33%, $\frac{1}{3}$, $\sqrt{0.3}$ (b) $\frac{\sqrt{5}}{2}$, $\frac{5}{\sqrt{5}}$, $2\sqrt{5}$, $(\sqrt{5})^3$

Question 5

- (a) The instructions 'expand and simplify' caused a problem with many candidates. Some candidates having expanded correctly, and having the correct answer, went on with further working and lost the final mark.
- (b) This part produced better answers with many candidates scoring full marks. There were some slips on the initial expansion and some candidates failed to simplify a correct expansion.

Answers: (a) $6x^3 + 10x^3y$ (b) $2a^2 - 7ab + 6b^2$

Question 6

This question proved to be the most challenging on the paper. Many candidates could not handle numbers expressed in this form.

- (a) (i) Many candidates simply multiplied out the factors and gave their answer as $\sqrt{2025}$.
- (ii) This part had more correct answers but, again, there were many attempts that expanded both the numerator and the denominator and then tried, unsuccessfully, to cancel.
- (b) This part proved to be too demanding for all but the best of candidates. Many candidates had little understanding of HCF and LCM and it was not uncommon for candidates to expand all of the factorised numbers and then start to look for factors.

Answers: (a)(i) 45 (ii) $\frac{4}{3}$ (b)(i) $3^2 \times 5^2$ (ii) $2^2 \times 3^3 \times 5^3 \times 7$

Question 7

- (a) Candidates needed to read the question carefully in order to ensure that they answer in the correct form. The answers were needed to be written as decimals to score full marks. Many candidates left their answers as fractions, and some candidates divided the number of throws by the number of sixes.
- (b) Although there were many correct answers, a significant number of candidates thought that the relative frequency being the highest value was the correct answer.
- (c) This part was well answered.

Answers: (a) 0.3 0.25 0.3 0.4 (b) More throws (c) 640

Question 8

- (a) This part was answered correctly by many of the candidates. The errors occurred when candidates interpreted the question as inversely proportional.
- (b) Nearly all candidates were able to score 1 mark, but there were very few fully correct solutions. Candidates were unable to rearrange the expression correctly as they merely moved the square root to the other side of the equation.

Answers: (a) $y = \frac{5\sqrt{x}}{2}$ (b) $\frac{4}{25}$

Question 9

- (a) The majority of candidates scored full marks. Some candidates expanded the two numbers, added and then wrote their answer in standard form.
- (b) This part proved to be more challenging. Many candidates scored the first mark by obtaining 13.8×10^{-11} , but they were unable to convert this correctly into standard form.

Answers: (a) 4.9×10^{-5} (b) 1.38×10^{-10}

Question 10

Although this question was the most demanding on the paper there were many fully correct solutions. Candidates were able to demonstrate their excellent algebraic skills. Some candidates lost 1 mark through careless arithmetic.

Answer: $\frac{x-1}{(x+2)(2x+3)}$

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/23
Paper 23 (Extended)

Key message

Candidates need to show all of their working. Incorrect answers without working cannot be given credit, whereas partial credit can be awarded if a correct method is shown. Candidates must know the key values of trigonometric ratios as set out in the syllabus.

General comments

Candidates were reasonably well prepared for the paper and demonstrated very good algebraic skills. However, many candidates lost marks through careless numerical slips, particularly with negative numbers and simple arithmetic operations. Candidates should make all of their working clear, ensuring it is organised, and not merely a collection of numbers scattered over the page. This enables Examiners to award method marks. This is particularly true when solving geometric problems.

Comments on specific questions

Question 1

Although many candidates scored full marks, there was a significant minority who lost the final mark as a result of careless numerical work.

Answer: 5.6

Question 2

- (a) The majority of candidates scored full marks for this basic standard form question.
- (b) This part proved to be a good discriminator. Candidates struggled to convert the numbers into the same power of 10. Some candidates expanded both numbers, added, and then converted back to standard form, with varying degrees of success.

Answers: (a) 6.3×10^{-3} (b) 5.94

Question 3

There were many fully correct answers to this question. The common mistake was to make a numerical slip in part (b).

Answers: (a) 23 (b) 35 (c) 972

Question 4

- (a) Although there were many correct answers, a significant number of candidates were unable to square the two terms successfully.

- (b) There were some excellent solutions, where the candidate clearly demonstrated the correct algebraic techniques. Many candidates were unable to perform the three operations required in the correct order.

Answers: (a) $36x^2 - 4y^2$ (b) $\sqrt{\frac{A + 4y^2}{36}}$ or $\frac{1}{6}\sqrt{A + (2y)^2}$

Question 5

- (a) This part was well answered. Candidates clearly now know this rule.
- (b) This part discriminated well between candidates. Although there were many correct answers, there were equal numbers of candidates with the answers of $3y^3$ or $6y^9$.

Answers: (a) 1 (b) $3y^9$

Question 6

- (a) This part was answered better than part (b). Candidates were able to demonstrate their geometric knowledge and many fully correct answers were seen.
- (b) Many candidates did not know the alternate segment theorem, but candidates were able to realise the connection between v and w .

Answers: (a) $x = 32^\circ$ $y = 32^\circ$ (b) $v = 25^\circ$ $w = 65^\circ$

Question 7

This question was answered correctly by many of the candidates. The errors occurred when candidates interpreted the question as inversely proportional.

Answer: 90

Question 8

- (a) This part proved to be challenging. Candidates could not evaluate $3\sqrt{2} \times 2\sqrt{3}$ correctly, although the other three terms in the expansion were normally correct.
- (b) This part was answered correctly by nearly all of the candidates.

Answers: (a) $10 - \sqrt{2}$ (b) $2\sqrt{5}$

Question 9

- (a) This part was well answered. Candidates realised that this transformation was a stretch.
- (b) Although candidates knew that this transformation was a translation, there were equal numbers of correct answers and answers that were a translation in the wrong direction along the x -axis.

Question 10

Many candidates scored full marks. Not taking the square root after correctly applying Pythagoras Theorem was the most common mistake.

Answer: $\frac{2\sqrt{2}}{3}$

Question 11

This question was a good discriminator. Many candidates did not know set notation and, as a result, were unable to score any marks. It is essential that candidates are familiar with all symbols used in set theory.

Answers: (a) \cup (b) \cap (c) \in or $\{e\} \subset$ (d) \cup

Question 12

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

(b) This part proved to be challenging, with candidates giving their answer as any of $12 - x$, $x + 12$ or $\frac{-12}{x}$, as well as the correct answer.

Answers: (a) 3 (b) $\frac{12}{x}$

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/31
Paper 31 (Core)

Key Messages

To succeed in this paper, it is essential for candidates to have completed full syllabus coverage, to show clear working when necessary in the working space provided and to give their answers to a suitable degree of accuracy.

General Comments

Overall, this paper proved accessible to most of the candidates. They appeared to have sufficient time to complete the paper and the majority were able to tackle most of the questions.

Candidates should remember that the instructions in the rubric are important, particularly with regard to accuracy and to the value of π .

If answers are exact, then the exact answer must be given in full. If they are not exact, then the final answer should be given correct to 3 significant figures, or to one decimal place in the case of angles. Too frequently, answers are only given correct to one or two significant figures, whether rounded or truncated, and these will not earn the marks. Furthermore, if an answer is obtained and is then needed for a further calculation, candidates should use its most accurate value, preferably by using the calculator memory.

When π is needed, the calculator value or 3.142 should be used. The values 3.14 or $\frac{22}{7}$ will not give sufficiently accurate answers.

Comments on Specific Questions

Question 1

In some candidates this question revealed a lack of knowledge of the vocabulary used.

- (a) Most candidates identified 25 as the square number in the list.
- (b) Nearly all the candidates identified 21 as the multiple of 7.
- (c) Many candidates chose 22 as the factor of 66, although 26 was also occasionally selected.
- (d) Some candidates could not recognise 27 as the only cube in the list.
- (e) A surprising number of candidates could not identify 23 as the prime number, and some even offered an even number from the list of numbers.

Answers: (a) 25 (b) 21 (c) 22 (d) 27 (e) 23

Question 2

This question was answered well by the majority of the candidates.

- (a) (b) Most candidate substituted the given values correctly and obtained the required answers.
- (c) This rearrangement was carried out well by the more able candidates, while others made sign errors or other mistakes.

Answers: (a) 13.7 (b) 3.5 (c) $q = \frac{r - 2p}{3}$

Question 3

There was a mixed response to this question.

- (a) Nearly all the candidates found the next two terms of the sequence correctly.
- (b) Most candidates were able to find the square root of 60, although some either gave the answer to the nearest whole number or wrongly corrected the answer to 7.8. Those who had written down the full calculator answer were able to gain a part mark.
- (c) Although there were many correct answers, they were not always written in the simplest form. There were also candidates who appeared not to know how to express a decimal as a fraction, but offered answers such as $\frac{1}{28}$.
- (d) Once again there were two types of answer. Those candidates who understood what to do had no difficulty in answering correctly. A common, incorrect, approach was to divide 504 in turn by 7 and by 2, obtaining the frequent incorrect answer of 72 : 252.
- (e) Many candidates were able to put at least three of these four numbers in the correct order, with $\frac{1}{8}$ being the number most frequently in the wrong position. A few candidates ordered the numbers in decreasing order with the largest number first in spite of the clear instruction.

Answers: (a) 21, 17 (b) 7.7 (c) $\frac{7}{25}$ (d) 392 : 112 (e) 0.11, $\frac{1}{8}$, 1.3×10^{-1} , 14%

Question 4

This was a straightforward question which required knowledge of the properties of a rectangle (right angles and parallel sides) and of the sum of angles on a straight line, and most candidates successfully found all three required angles.

Answers: (a) 70 (b) 20 (c) 110

Question 5

The first two parts of this question were well answered by nearly all candidates, while the final part caused the most difficulty.

- (a) Nearly all the candidates counted up the missing table values correctly.
- (b) All the candidates completed the bar chart correctly from their table, with a large majority drawing very neat bars with ruled lines.
- (c) (i) The range was found successfully by a large number of candidates. A few candidates gave the answer as $37 - 43$ or $34 < x < 43$, forgetting that, in statistics, the range is a single number, found by subtracting the smallest from the largest value under consideration.

- (ii) Once again, there were many correct answers, a few spoiled by the inclusion of the number 8 on the answer line.
- (iii) This part was less well answered with many candidates choosing the centre of the table and writing 40 or 4.
- (iv) While the better candidates had no difficulty in calculating the correct answer, others tried a variety of wrong approaches such as adding the frequencies in their table and dividing this sum by 7.
- (d) In this part, there was also a distinct difference in the type of answer offered. Many had the correct answer although some candidates included in their probability the number of packets containing 40 raisins. Some candidates gave their answers as a decimal or a percentage, but should remember that in such cases 3 significant figures must be given. A few candidates gave answers in the form of a ratio; this is not correct for probability and earned no marks.

Answers: (a) 8, 7, 4, 2 (b) heights 8, 7, 4, 2 (c)(i) 6 (ii) 38 (iii) 39 (iv) 39.4 (d) $\frac{8}{30}$

Question 6

Most of this question was answered well.

- (a)(b) Nearly all the candidates correctly calculated Rana's weekly earnings and the amount she had left.
- (c) With some rare exceptions, candidates were able to calculate the 10 % Rana gave to charity and the amount she saved each week.
- (d) Many candidates made errors in this part, either multiplying their answer to part (c)(ii) by 52 instead of 46, or by starting again with her weekly earnings.

Answers: (a) 1750 (b) 450 (c)(i) 45 (ii) 405 (d) 18630

Question 7

This proved to be a challenging question for many candidates.

- (a) Nearly all candidates obtained the correct answer to this simple start to the question.
- (b) Although many candidates evaluated this answer correctly, there were a large number who were unsure of what to do, many trying to involve the number 4 in their calculation.
- (c) It was clear here that a majority of candidates did not understand the word "bias" in this context, with many of them answering as if they thought it meant "fair". Hence, some answers gave a correct reason but preceded it with the word "No". Many candidates made reference to the fact that the probability of throwing any number is $\frac{1}{6}$, although the pie chart for this particular die obviously contradicted this. Some candidates incorrectly talked about the size of the faces of a die.

Answers: (a) 120 (b) 20 (c) yes, correct reason

Question 8

- (a) Many candidates who gave the right answer here felt unnecessarily that they needed to embellish it with other descriptive terms. However, a number wrote words such as moderate but omitted the essential word positive. A few candidates felt that the scatter diagram showed negative correlation.
- (b) The mean point was plotted accurately by most candidates.
- (c) Many candidates drew a suitable line, most passing through the point they had just plotted, but there were some which just missed the mean point. A line of best fit should be ruled and candidates must be dissuaded from drawing freehand lines here. There is still a small number of

candidates who join up all the individual plots and an even smaller number who draw a curve down to the origin.

- (d) A large number of candidates gave answers within the required range, but there was significant evidence of many candidates misreading the vertical scale, whether from a correct or a wrong line of best fit.

Answers: (a) positive (d) 75 ± 2

Question 9

The two parts of this question differentiated significantly between the candidates. While nearly all did well in part (a), dealing with the time conversion in part (b) proved to be more challenging for many.

- (a) Nearly all candidates obtained the correct answer.
- (b) Although many candidates used the correct method here, what they did with their answer of 10.9777... varied considerably. Among the better candidates, the correct answer, or 10h 58 min or 11 h, were common. Weaker candidates, however, treated their answer as 10 hours and 98 min, with the result that an answer of 11 h 38 min appeared frequently. There were a few candidates who did not divide the distance by the speed.

Answers: (a) 76 (b) 10 h 59 min

Question 10

The probability part of this question was well answered but this was not the case for the other parts.

- (a) Most candidates obtained a mark for writing 3 in the intersection, but forgot that these 3 were now also in sets S and A and so wrote 8 and 7 in the outer parts of these sets.
- (b) Nearly all candidates earned a part mark for calculating this value for their Venn diagram but only the few who answered part (a) correctly were able to earn full marks.
- (c) There was a surprisingly large number of incorrect answers here, from isosceles or right-angled triangle to circle. Although the word square was a frequent correct answer, a few candidates felt that the word was not sufficient and needed embellishments such as "equilateral".
- (d) There was a wide variety in the shading, with only about half the candidates shading the correct region.

Answers: (b) 8 (c) square, equilateral triangle or regular polygon

Question 11

- (a) Most candidates wrote down the equation correctly.
- (b) There were a number of good answers with the correct values obtained for d and for s . Some candidates made errors in eliminating one of the variables from the simultaneous equations. However, many candidates ignored the first equation that was given in the question and attempted to find d and s from just a single equation, usually by dividing 1850 by 9.

Answers: (a) $5d + 4s = 1850$ (b) $d = 250$, $s = 150$

Question 12

This question again differentiated between candidates with many obtaining both answers easily and others unable to do so.

- (a) For those candidates who realised they must use Pythagoras' theorem, this was an easy question. Others simply added the two given sides or found the area of the triangle.

- (b) Candidates were expected to use trigonometry in the right-angled triangle to obtain the result and those who did, whether using the given sides or the one they found in part (a), found the angle without any difficulty. A few could go no further than stating $\tan = \frac{6}{11}$ and some simply guessed at an answer, frequently 45°

Answers: (a) 12.5 (b) 28.6°

Question 13

There were many occasions in this question where candidates made simple errors.

- (a) Those candidates who knew and used the formula for the area of a trapezium found this part very straightforward. For the majority who split the cross-section into a rectangle and two triangles (the expected method), the difficulty lay in realising that the base of each triangle was 5 mm and not 10 mm. A small number treated the cross-section as a rectangle using either 30 mm or 40 mm.
- (b) The most common error here was in using 18 mm for the width of the two side rectangles. Although some candidates realised that this was not the case, few showed their working in using Pythagoras' theorem to obtain the correct length of 18.68... and many reached a wrong result by again using 10 mm instead of 5 mm for the base of the triangle.
- Some candidates did not include all the sides of the prism in their calculation.
- (c) Many candidates used the total surface area instead of the area of the cross-section to find the volume of the prism.
- (d) Although correct answers were seen, many candidates gave the wrong answer here, often dividing by 10 or 100, or occasionally multiplying by some power of 10.
- (e) Many candidates did not know what was required here and offered no answer. Those who understood that they must divide the volume of the prism, in cubic centimetres, by the area of the circular cross-section of the cylinder often used a corrected value of 12.6 for this area and lost the accuracy of their answer.

Answers: (a) 630 (b) 9850 (c) 50400 (d) 50.4 (e) 4.01

Question 14

This was a question which tested the most able of candidates.

- (a) Most candidates tried to use trigonometry using the sides of 8 cm and 12 cm instead of dropping a perpendicular to form a right-angled triangle. There was a certain amount of guessing at an answer, frequently of 120° .
- (b) A number of candidates gained marks here as they used the angle properties of a circle to reach an answer from their response to part (a).
- (c) As in part (b), marks were available here for those who correctly used their answer to part (a) to find the fraction of the circumference required. A surprising number, however, chose to use the formula for the area of a circle instead of the circumference.

Answers: (a) 97.2° (b) 48.6° (c) 13.6

Question 15

This question required the use of the graphics calculator and a number of candidates showed some proficiency in its use to produce their sketch, although the questions relating to the curve were less well answered.

- (a) There were some good sketches of approximately the expected shape. A number of candidates drew only the section of the curve for $x < 1$. The quality of the sketching varied considerably, with

the best being excellent but others very poor. A few attempted to plot a selection of points with limited success.

- (b) The majority of candidates were unable to find the position of the local minimum point, offering a variety of wrong answers.
- (c) Many candidates did not appear to understand what an asymptote is, with many answers giving an equation in y rather than in x .
- (d) This time there were answers involving x instead of y or $f(x)$, suggesting a degree of confusion about the meaning of the term “range” in this context. There was again a variety of wrong answers and, although some candidates did write the number 3, it was frequently on its own rather than in a correct statement.
- (e) Most candidates drew a line with approximately the correct gradient although its intersection with the y -axis was occasionally 0 or negative.
- (f) A number of candidates were able to find the points of intersection of the two functions, although both the co-ordinates of the points were sometimes given instead of only the x co-ordinates as required. Answers were only rarely given correct to 3 significant figures.

Answers: (b) (2, 7) (c) $x = 1$ (d) $f(x) \leq 3$ (f) 0.423, 1.58

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/32
Paper 32 (Core)

Key Messages

To succeed in this paper, it is essential for candidates to have completed full syllabus coverage, to show clear working when necessary in the working space provided and to give their answers to a suitable level of accuracy.

General Comments

Overall, this paper proved accessible to most of the candidates. They appeared to have sufficient time to complete the paper and the majority were able to tackle most of the questions.

Candidates should remember that the instructions in the rubric are important, particularly with regard to accuracy and to the value of π .

If answers are exact, then the exact answer must be given in full. If they are not exact, then the final answer should be given correct to 3 significant figures. Too frequently, answers are only given correct to one or two significant figures, whether rounded or truncated, and these will not earn the marks. Furthermore, if an answer is obtained and is then needed for a further calculation, candidates should use its most accurate value, preferably by using the calculator memory.

When π is needed, the calculator value or 3.142 should be used. Using the values 3.14 or $\frac{22}{7}$ will not give sufficiently accurate answers.

Comments on Specific Questions

Question 1

This question was well answered by the majority of the candidates.

- (a) This was usually correct, but with 250 and 300 appearing occasionally.
- (b) Nearly all candidates knew that 49 was the correct answer. Those who also wrote 7^2 were not penalised but 7^2 alone was not a sufficient answer.
- (c) Most candidates wrote the answer 1 but the % sign was also an essential part of the answer.
- (d) Some candidates omitted the 1 or 18 or both. A few extra wrong factors such as 4 were occasionally included.
- (e) There was confusion among some candidates about the meaning of the lowest common multiple and 2 and 96 were offered as answers.
- (f) Most candidates successfully cancelled the fraction to its lowest terms.
- (g) This part was done well with most candidates evaluating the required percentage correctly.

- (h) Most candidates selected a correct number from within the given range. Candidates who offered more than one answer were only penalised if one of their numbers was not a prime number. Very occasionally a candidate wrote down a prime number which was not in the range 10 to 20.

Answers: (a) 200 (b) 49 (c) 1% (d) 1, 2, 3, 6, 9, 18 (e) 24 (f) $\frac{2}{3}$ (g) 16.8 (h) 11, 13, 17 or 19

Question 2

- (a) Most candidates recognised a square, sometimes embellishing it with an unnecessary adjective such as equilateral. A few thought that shape A was a rectangle. There were a number of answers for shape B including trapezium and rectangle. The words isosceles and triangle were both required for the name of shape C, but many candidates offered only one of the two.

Spelling was not penalised as long as the name was recognisable, but candidates should be encouraged to learn the correct spelling of mathematical terms.

- (b) The lines of symmetry for the square were usually correct, although some candidates forgot the diagonals. The triangle was usually done well also, but many candidates drew at least one line of symmetry on the parallelogram.
- (c) The meaning of “order of rotational symmetry” was clearly understood by many, although the answers were not always all correct. A number of candidates wrote 0 for shape B or C.

Answers: (a) square, parallelogram, isosceles triangle (c) 4, 2, 1

Question 3

Most candidates answered both parts well, showing that angle properties were well understood, and wrong answers usually arose from errors in arithmetic rather than from a lack of understanding.

Answers: (a) $p = 39$, $q = 83$, $r = 58$, $s = 83$ (b) $c = 66$, $d = 114$, $e = 66$

Question 4

Many candidates coped well with most of this algebra question.

- (a) Substitution was carried out efficiently and only a few candidates were unable to deal with subtracting a negative value.
- (b) Only a weak minority gave the incorrect answer of 2 here, usually because they cancelled the numbers on opposite sides of the equal sign.
- (c) The simultaneous equations were the least well answered part of the question. A common error was to subtract the two equations instead of adding them. Other candidates did not see that y could be eliminated without further multiplication of one or both of the equations by some number.

Answers: (a) 6.9 (b) 18 (c) $x = 4$, $y = -6$

Question 5

Confusion between x and y were often the cause of difficulty in this question.

- (a) Many candidates reflected the kite in the y -axis.
- (b) A few candidates rotated the kite in a clockwise direction, others used the wrong centre for the rotation. Only a few candidates drew a distorted shape of the kite.
- (c) Most of the errors in this part arose from inefficient counting or from using the vector $\begin{pmatrix} -7 \\ -6 \end{pmatrix}$.

Question 6

Most candidates answered this question well.

- (a) Except for some errors in dividing by 5 or a rearrangement of the order of the numbers, this was done very well.
- (b) Again, with the exception of arithmetic errors or the omission in their calculation of one or sometimes two terms, most candidates obtained the correct result.
- (c) Nearly all the candidates found the required percentage. A few gave an answer of 11, and this could not be awarded the mark if 10.7 was not also shown.

Answers: (a) 4 : 7 : 5 : 3 (b) \$161 (c) 10.7%

Question 7

- (a) Nearly all of the candidates were able to find the amount correctly.
- (b) Dealing with time efficiently was the problem for candidates in this part of the question. Many candidates know that they must divide the distance by the time to obtain the answer. Thus $12 \div 90$ frequently gave 0.13 as an answer. Sometimes this truncated value was multiplied by 60, giving an inaccurate answer. Those who realised that they should convert the time to hours sometimes wrote 1.30 for 1 hour and 30 minutes which also led to a wrong answer. The better candidates knew or calculated that 90 minutes are equal to 1.5 hours and so obtained the exact answer.

Answers: (a) \$99 (b) 8 km/h

Question 8

- (a) Almost all the candidates correctly wrote down the next two terms of the sequence.
- (b) A very common wrong answer here was $n + 7$. A few candidates found the correct answer but expressed it in a more complicated form such as $12 + 7n - 7$.

Answers: (a) 40, 47 (b) $7n + 5$

Question 9

This was one of the questions that differentiated well between the candidates.

- (a) This was well answered by most candidates.
- (b) The better candidates understood that the denominator for the probabilities for the second fruit would be 10 and not 11, and they also worked out the right numerators. Others usually repeated the fractions $\frac{6}{11}$ and $\frac{5}{11}$ in all three pairs of branches. Some candidates did not write fractions here at all but integers such as 6, 5. Candidates who used decimals or percentages were fortunate that, for the second fruit branches, these were exact numbers but many lost the marks for the first fruit branches if they only wrote their decimals correct to 2 significant figures.
- (c) Most candidates correctly multiplied their probabilities for selecting an orange each time. A few incorrectly added these probabilities.

Answers: (a) $\frac{6}{11}$ (c) $\frac{30}{110}$

Question 10

For this question, candidates need to use their graphics calculators, and from the evidence most of them were able to use at least some of the functions satisfactorily.

- (a) Most candidates entered the function correctly and set the ranges for x and y accurately. Some of the sketches were very good but there were also some very inaccurate-looking parabolas.
- (b) A number of candidates found the required values of x but too often these were given correct to 2 or even 1 significant figure.
- (c) Similarly to part (b), although a number of candidates had clearly found the right values, these were not given sufficiently accurately. In particular, the y co-ordinate of the local minimum point was an exact value and very few candidates gave this value in full.
- (d) Most candidates were able to sketch the straight line.
- (e) A number of candidates knew that they must find the points of intersection of the two functions, but some gave the co-ordinates of the points. Since the question was set as an equation in x , only the values of x were required.

Answers: (b) $-1.11, 3.61$ (c) $(1.25, -11.125)$ (e) $-1, 2.5$

Question 11

This was another question which challenged some of the candidates. One approach taken by some was to subtract the square and circle areas, which they could easily find, from the given area of 418 square centimetres, and then manipulate their working so as to end up with 418 again. This method gained no credit.

What was required was to find the sum of the areas of the rectangle and the triangle and subtract the area of the circle. Most candidates earned marks for the areas of the circle and the rectangle. In order to find the area of the triangle, its height was needed and this had to be found using Pythagoras' Theorem.

Candidates also had to remember to show their final answer to a greater degree of accuracy in order to demonstrate that the answer to 3 significant figures was 418. Some neat solutions were seen.

Question 12

Some candidates did not distinguish between simple and compound interest and used the same method in both parts of this question.

- (a) Most candidates who used the simple interest formula correctly found the interest earned. However a large number forgot that the question asked for the total amount at the end of 6 years and neglected to add the interest to the principal.
- (b) Those candidates who used the correct compound interest formula usually obtained the result with little trouble. However, there were those who remembered the formula imperfectly which led to completely wrong answers. A significant number worked out the interest year by year, and these were successful as long as they kept the accuracy of their figures. It was not clear in some of these cases if candidates were making the best use of their calculators.

Answers: (a) \$60 200 (c) \$58 154

Question 13

This was a well-answered question in nearly all cases.

- (a) The seven letters were positioned correctly in the Venn diagram by nearly all candidates, with only a minority placing A in both sets, sometimes as well as in the intersection.

(b)(c) The correct probabilities were written, nearly always in fraction form.

Answers: **(b)** $\frac{1}{7}$ **(c)** $\frac{2}{7}$

Question 14

More than half of the candidates were able to answer most parts of this question satisfactorily but there were some common errors.

- (a)** Many candidate gave the correct answer 5 but 5.5 and 3 were also seen.
- (b)** This was less well answered and, when no working was shown, there was sometimes no way of knowing where the error lay. Answers of 27.3 revealed that the candidate had used the upper end of each interval instead of the mid-value. With two marks available for this question, there was a method mark to be awarded for candidates with the wrong answer but showing some working, and some candidates earned this mark for showing a product of a mid-value and its associated frequency.
- (c)** Many candidates successfully completed the table, but a number of weaker attempts increased the frequency by 6 each time.
- (d)** Plotting of the points was carried out efficiently except for a few candidates who did not take account of the scale on the vertical axis. Nearly all completed the cumulative frequency curve using their plotted points.
- (e)(i)** The median was read off successfully in most cases.
- (ii)(iii)** Many of the weaker candidates worked out $\frac{1}{4}$ and $\frac{3}{4}$ of 30 and wrote these results down as their answers to these two parts, instead of reading off the masses associated with these frequencies.

Answers: **(a)** 5 **(b)** 22.3 kg **(c)** 14, 21, 27 **(e)(i)** 21.5 kg **(ii)** 12 kg **(iii)** 32.5 kg

Question 15

- (a)** Most candidates plotted the point correctly. There were a few who did not, making inconsistent errors, for instance plotting *A* correctly but *B* at (1, 3).
- (b)** The majority of candidates read off the gradient correctly.
- (c)** This was well answered by the abler candidates. However a significant number of candidates did not know what was required here and omitted to answer this part. Many of the others gave the equation of the line segment *AB* instead of the line parallel to it.

Answers: **(b)** $\frac{6}{4}$ **(c)** $y = \frac{6}{4}x$

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/33
Paper 33 (Core)

Key Messages

To succeed in this paper, it is essential for candidates to have completed full syllabus coverage, to show clear working when necessary in the working space provided and to give their answers to a suitable degree of accuracy.

General Comments

Overall, this paper proved accessible to most of the candidates. They appeared to have sufficient time to complete the paper and the majority were able to tackle most of the questions.

Candidates should remember that the instructions in the rubric are important, particularly with regard to accuracy and to the value of π .

If answers are exact, then the exact answer must be given in full. If they are not exact, then the final answer should be given correct to 3 significant figures, or to one decimal place in the case of angles. Too frequently, answers are only given correct to one or two significant figures, whether rounded or truncated, and these will not earn the marks. Furthermore, if an answer is obtained and is then needed for a further calculation, candidates should use its most accurate value, preferably by using the calculator memory.

When π is needed, the calculator value or 3.142 should be used. The values 3.14 or $\frac{22}{7}$ will not give sufficiently accurate answers.

Comments on Specific Questions

Question 1

In some candidates this question revealed a lack of knowledge of the vocabulary used.

- (a) Most candidates identified 25 as the square number in the list.
- (b) Nearly all the candidates identified 21 as the multiple of 7.
- (c) Many candidates chose 22 as the factor of 66, although 26 was also occasionally selected.
- (d) Some candidates could not recognise 27 as the only cube in the list.
- (e) A surprising number of candidates could not identify 23 as the prime number, and some even offered an even number from the list of numbers.

Answers: (a) 25 (b) 21 (c) 22 (d) 27 (e) 23

Question 2

This question was answered well by the majority of the candidates.

- (a) (b) Most candidate substituted the given values correctly and obtained the required answers.
- (c) This rearrangement was carried out well by the more able candidates, while others made sign errors or other mistakes.

Answers: (a) 13.7 (b) 3.5 (c) $q = \frac{r - 2p}{3}$

Question 3

There was a mixed response to this question.

- (a) Nearly all the candidates found the next two terms of the sequence correctly.
- (b) Most candidates were able to find the square root of 60, although some either gave the answer to the nearest whole number or wrongly corrected the answer to 7.8. Those who had written down the full calculator answer were able to gain a part mark.
- (c) Although there were many correct answers, they were not always written in the simplest form. There were also candidates who appeared not to know how to express a decimal as a fraction, but offered answers such as $\frac{1}{28}$.
- (d) Once again there were two types of answer. Those candidates who understood what to do had no difficulty in answering correctly. A common, incorrect, approach was to divide 504 in turn by 7 and by 2, obtaining the frequent incorrect answer of 72 : 252.
- (e) Many candidates were able to put at least three of these four numbers in the correct order, with $\frac{1}{8}$ being the number most frequently in the wrong position. A few candidates ordered the numbers in decreasing order with the largest number first in spite of the clear instruction.

Answers: (a) 21, 17 (b) 7.7 (c) $\frac{7}{25}$ (d) 392 : 112 (e) 0.11, $\frac{1}{8}$, 1.3×10^{-1} , 14%

Question 4

This was a straightforward question which required knowledge of the properties of a rectangle (right angles and parallel sides) and of the sum of angles on a straight line, and most candidates successfully found all three required angles.

Answers: (a) 70 (b) 20 (c) 110

Question 5

The first two parts of this question were well answered by nearly all candidates, while the final part caused the most difficulty.

- (a) Nearly all the candidates counted up the missing table values correctly.
- (b) All the candidates completed the bar chart correctly from their table, with a large majority drawing very neat bars with ruled lines.
- (c) (i) The range was found successfully by a large number of candidates. A few candidates gave the answer as $37 - 43$ or $34 < x < 43$, forgetting that, in statistics, the range is a single number, found by subtracting the smallest from the largest value under consideration.

- (ii) Once again, there were many correct answers, a few spoiled by the inclusion of the number 8 on the answer line.
- (iii) This part was less well answered with many candidates choosing the centre of the table and writing 40 or 4.
- (iv) While the better candidates had no difficulty in calculating the correct answer, others tried a variety of wrong approaches such as adding the frequencies in their table and dividing this sum by 7.
- (d) In this part, there was also a distinct difference in the type of answer offered. Many had the correct answer although some candidates included in their probability the number of packets containing 40 raisins. Some candidates gave their answers as a decimal or a percentage, but should remember that in such cases 3 significant figures must be given. A few candidates gave answers in the form of a ratio; this is not correct for probability and earned no marks.

Answers: (a) 8, 7, 4, 2 (b) heights 8, 7, 4, 2 (c)(i) 6 (ii) 38 (iii) 39 (iv) 39.4 (d) $\frac{8}{30}$

Question 6

Most of this question was answered well.

- (a)(b) Nearly all the candidates correctly calculated Rana's weekly earnings and the amount she had left.
- (c) With some rare exceptions, candidates were able to calculate the 10 % Rana gave to charity and the amount she saved each week.
- (d) Many candidates made errors in this part, either multiplying their answer to part (c)(ii) by 52 instead of 46, or by starting again with her weekly earnings.

Answers: (a) 1750 (b) 450 (c)(i) 45 (ii) 405 (d) 18630

Question 7

This proved to be a challenging question for many candidates.

- (a) Nearly all candidates obtained the correct answer to this simple start to the question.
- (b) Although many candidates evaluated this answer correctly, there were a large number who were unsure of what to do, many trying to involve the number 4 in their calculation.
- (c) It was clear here that a majority of candidates did not understand the word "bias" in this context, with many of them answering as if they thought it meant "fair". Hence, some answers gave a correct reason but preceded it with the word "No". Many candidates made reference to the fact that the probability of throwing any number is $\frac{1}{6}$, although the pie chart for this particular die obviously contradicted this. Some candidates incorrectly talked about the size of the faces of a die.

Answers: (a) 120 (b) 20 (c) yes, correct reason

Question 8

- (a) Many candidates who gave the right answer here felt unnecessarily that they needed to embellish it with other descriptive terms. However, a number wrote words such as moderate but omitted the essential word positive. A few candidates felt that the scatter diagram showed negative correlation.
- (b) The mean point was plotted accurately by most candidates.
- (c) Many candidates drew a suitable line, most passing through the point they had just plotted, but there were some which just missed the mean point. A line of best fit should be ruled and candidates must be dissuaded from drawing freehand lines here. There is still a small number of

candidates who join up all the individual plots and an even smaller number who draw a curve down to the origin.

- (d) A large number of candidates gave answers within the required range, but there was significant evidence of many candidates misreading the vertical scale, whether from a correct or a wrong line of best fit.

Answers: (a) positive (d) 75 ± 2

Question 9

The two parts of this question differentiated significantly between the candidates. While nearly all did well in part (a), dealing with the time conversion in part (b) proved to be more challenging for many.

- (a) Nearly all candidates obtained the correct answer.
- (b) Although many candidates used the correct method here, what they did with their answer of 10.9777... varied considerably. Among the better candidates, the correct answer, or 10h 58 min or 11 h, were common. Weaker candidates, however, treated their answer as 10 hours and 98 min, with the result that an answer of 11 h 38 min appeared frequently. There were a few candidates who did not divide the distance by the speed.

Answers: (a) 76 (b) 10 h 59 min

Question 10

The probability part of this question was well answered but this was not the case for the other parts.

- (a) Most candidates obtained a mark for writing 3 in the intersection, but forgot that these 3 were now also in sets S and A and so wrote 8 and 7 in the outer parts of these sets.
- (b) Nearly all candidates earned a part mark for calculating this value for their Venn diagram but only the few who answered part (a) correctly were able to earn full marks.
- (c) There was a surprisingly large number of incorrect answers here, from isosceles or right-angled triangle to circle. Although the word square was a frequent correct answer, a few candidates felt that the word was not sufficient and needed embellishments such as “equilateral”.
- (d) There was a wide variety in the shading, with only about half the candidates shading the correct region.

Answers: (b) 8 (c) square, equilateral triangle or regular polygon

Question 11

- (a) Most candidates wrote down the equation correctly.
- (b) There were a number of good answers with the correct values obtained for d and for s . Some candidates made errors in eliminating one of the variables from the simultaneous equations. However, many candidates ignored the first equation that was given in the question and attempted to find d and s from just a single equation, usually by dividing 1850 by 9.

Answers: (a) $5d + 4s = 1850$ (b) $d = 250, s = 150$

Question 12

This question again differentiated between candidates with many obtaining both answers easily and others unable to do so.

- (a) For those candidates who realised they must use Pythagoras' theorem, this was an easy question. Others simply added the two given sides or found the area of the triangle.

- (b) Candidates were expected to use trigonometry in the right-angled triangle to obtain the result and those who did, whether using the given sides or the one they found in part (a), found the angle without any difficulty. A few could go no further than stating $\tan = \frac{6}{11}$ and some simply guessed at an answer, frequently 45°

Answers: (a) 12.5 (b) 28.6°

Question 13

There were many occasions in this question where candidates made simple errors.

- (a) Those candidates who knew and used the formula for the area of a trapezium found this part very straightforward. For the majority who split the cross-section into a rectangle and two triangles (the expected method), the difficulty lay in realising that the base of each triangle was 5 mm and not 10 mm. A small number treated the cross-section as a rectangle using either 30 mm or 40 mm.
- (b) The most common error here was in using 18 mm for the width of the two side rectangles. Although some candidates realised that this was not the case, few showed their working in using Pythagoras' theorem to obtain the correct length of 18.68... and many reached a wrong result by again using 10 mm instead of 5 mm for the base of the triangle.
- Some candidates did not include all the sides of the prism in their calculation.
- (c) Many candidates used the total surface area instead of the area of the cross-section to find the volume of the prism.
- (d) Although correct answers were seen, many candidates gave the wrong answer here, often dividing by 10 or 100, or occasionally multiplying by some power of 10.
- (e) Many candidates did not know what was required here and offered no answer. Those who understood that they must divide the volume of the prism, in cubic centimetres, by the area of the circular cross-section of the cylinder often used a corrected value of 12.6 for this area and lost the accuracy of their answer.

Answers: (a) 630 (b) 9850 (c) 50400 (d) 50.4 (e) 4.01

Question 14

This was a question which tested the most able of candidates.

- (a) Most candidates tried to use trigonometry using the sides of 8 cm and 12 cm instead of dropping a perpendicular to form a right-angled triangle. There was a certain amount of guessing at an answer, frequently of 120° .
- (b) A number of candidates gained marks here as they used the angle properties of a circle to reach an answer from their response to part (a).
- (c) As in part (b), marks were available here for those who correctly used their answer to part (a) to find the fraction of the circumference required. A surprising number, however, chose to use the formula for the area of a circle instead of the circumference.

Answers: (a) 97.2° (b) 48.6° (c) 13.6

Question 15

This question required the use of the graphics calculator and a number of candidates showed some proficiency in its use to produce their sketch, although the questions relating to the curve were less well answered.

- (a) There were some good sketches of approximately the expected shape. A number of candidates drew only the section of the curve for $x < 1$. The quality of the sketching varied considerably, with

the best being excellent but others very poor. A few attempted to plot a selection of points with limited success.

- (b) The majority of candidates were unable to find the position of the local minimum point, offering a variety of wrong answers.
- (c) Many candidates did not appear to understand what an asymptote is, with many answers giving an equation in y rather than in x .
- (d) This time there were answers involving x instead of y or $f(x)$, suggesting a degree of confusion about the meaning of the term “range” in this context. There was again a variety of wrong answers and, although some candidates did write the number 3, it was frequently on its own rather than in a correct statement.
- (e) Most candidates drew a line with approximately the correct gradient although its intersection with the y -axis was occasionally 0 or negative.
- (f) A number of candidates were able to find the points of intersection of the two functions, although both the co-ordinates of the points were sometimes given instead of only the x co-ordinates as required. Answers were only rarely given correct to 3 significant figures.

Answers: (b) (2, 7) (c) $x = 1$ (d) $f(x) \leq 3$ (f) 0.423, 1.58

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/41
Paper 41 (Extended)

Key Messages

This syllabus has an emphasis on showing full methods and so thorough communication in all questions is to be encouraged.

This paper requires the use of a graphics calculator and candidates should be fully experienced in the list of uses stated in the syllabus as well as being aware of other opportunities which may arise, such as solving an equation by sketching the function. In many cases it is essential to show how the calculator has been used and this is often by sketching a function that has been used.

Other key points are the need for full syllabus coverage and the use of appropriate accuracy as indicated in the rubric of the front cover of the examination paper.

General Comments

The paper proved accessible to most of the candidates although certain questions proved very difficult for all but the very best. There remain a few candidates, at the lower end of the scale, where an entry at core level would have been a much more rewarding experience.

There was evidence from some candidates of unfamiliarity with the use of a graphics calculator. Some, who did the sketch graphs by plotting, also did not seem to appreciate the use of solution functions either. The regression equation was sometimes found by drawing a line of best fit by eye and finding the equation of that rather than using the graphics calculator function.

Most candidates showed sufficient working but there were a significant number who produced answers without justification. The penalties for this are twofold. For certain questions, working is required to get full marks; on others, whilst full marks are available without working, they depend on an accurate correct answer and no method marks are available if the answer is not correct.

The general guidelines about 3 figure accuracy mean that candidates should work to at least 4 significant figures and return to the more accurate version when using that answer in a later part. Premature approximation sometimes led to an answer outside the required range. Some candidates appeared to ignore or forget the accuracy required.

Comments on Individual Questions

Question 1

Many candidates did not find this an easy start. A possible reason for this is that the transformations were carried out on a single point rather than the usual shape that they have become used to. There were some sign errors and some x and y reversals. Part **(c)** proved the most difficult with the vast majority not appreciating that a general result in terms of x and y was required, giving a numerical pair of co-ordinates instead. Better candidates coped quite well with part **(d)** but many gave other transformations, such as rotation or translation or a combination of transformations. The latter was disappointing as the word 'single' was emboldened and this mistake has been referred to in previous Examiners reports.

Answers: **(a)** $(1, -4)$ **(b)** $(-1, -4)$ **(c)** $(x, -y)$ **(d)** Reflection in the x -axis

Question 2

This question proved much more accessible to candidates and the majority scored well on all parts. The gradient in part (b) proved most difficult with positive and inverted answers being relatively common, but even here the correct answer was seen more often than not. The equation of the line was marked on a follow through basis and so an error with the gradient did not prevent full marks for that part. A number of candidates got the gradient wrong but still gave $-\frac{1}{3}x$ in their equation. Parts (d) and (e) were very well done. It was surprising to see how many candidates, when faced with a question asking for a distance between two points, automatically apply the learned formula derived from Pythagoras, when all that was required was to count squares. The 1 mark tariff for this part should have indicated that little work was required.

Answers: (a) $\begin{pmatrix} 6 \\ -2 \end{pmatrix}$ (b) $-\frac{1}{3}$ (c) $-\frac{1}{3}x + 5$ (d) (9, 10) (e) (15, 8) (f) 8

Question 3

In part (a), it was pleasing to note that a large majority of the candidates recognised that the order of the letters was important to ensure that the vertices in the similar triangles coincided. In part (b) many candidates simply used $\frac{x}{12} = \frac{3.5}{6.5}$ not realising that either $\frac{x}{12-x}$ or $\frac{3.5}{10}$ was required in the equation. In part (c) weaker candidates often simply used $\frac{6.5}{3.5}$, not realising that it was necessary to square the ratio.

Some inaccuracy was evident here where some candidates prematurely approximated $\frac{6.5}{3.5}$ to 1.8 or 1.9. That said, many candidates answered this whole question very well.

Answers: (a) BCA (b) 4.2 cm (c) 24.1 cm³

Question 4

In this question, although the majority of candidates gave the correct bearing in part (a)(i), their lack of familiarity with bearings often led to a loss of marks in later parts. Candidates seemed unaware of which quadrant a bearing was in as 51° was a common answer in part (ii). The majority got part (b) correct although the Sine rule was often used rather than straight forward right angle trigonometry. Most recognised that the Cosine Rule was required in part (c) although some made errors in the substitution. Many candidates coped well with the trigonometry in part (d) with some using Sine Rule and some Cosine Rule. Relatively few, however, were able to go on from a correct angle to the bearing.

Answers: (a)(i) 129° (ii) 309° (b) 41.6° (c) 4.92 km (d) 161.8°

Question 5

There was some impressive work on logarithms in part (a) from the better candidates. Almost all knew the power rules for logs with, for example, $3\log 4 = \log 4^3$, but fewer were able to deal with the adding and subtracting rules such as $\log 8 - \log 9 = \log \frac{8}{9}$, $\frac{\log 8}{\log 9}$ being fairly common. Some candidates resorted to logs on their calculator but most could not proceed from $\log x = 1.857\dots$ to the answer.

Part (b) was one of the better done questions with the vast majority knowing the correct techniques for solving simultaneous equations. The elimination method usually proved more successful than the substitution method as the transformed equation proved too difficult for some using substitution. Sign mistakes were the most common source of error.

Answers: (a) 72 (b) $x = -3, y = -4$

Question 6

Almost all candidates gained at least one mark for the sketch graph. Many however simply drew the full parabola, not recognising the significance of the modulus sign. A few, who did attempt the modulus graph, spoil their sketch with the wrong curvature for the outside sections.

There remain a few candidates who try to do these questions by plotting. Part **(b)** was usually correct, although part **(c)** was less well done, particularly as one solution depended on recognising the modulus function. In both parts **(b)** and **(c)**, a few candidates appeared to have used the trace function rather than the solve function and hence there were some inaccurate answers.

Parts **(d)(i)** and **(ii)** required more understanding and proved too difficult for many. Better candidates however did them well. It was expected that these better candidates would recognise that it was necessary to go outside the original sketch requirement to solve these equations and most did.

Answers: **(b)** $-1.5, 1.5$ **(c)** $1.98, 3.25$ **(d)(i)** $k = 9$ **(ii)** $0 < k < 9$

Question 7

Almost all candidates gained some success here, but there were a number of statistical misconceptions. For example, in part **(a)** some thought 20, the frequency, was the mode and even more made a similar mistake in part **(b)** with 16, from $20 - 4$, being a very common answer. Better candidates gave a correct interquartile range and many also were successful with the mean. In part **(e)** there was a method mark available for the mean but most candidates did not put working in and so, if their answer was wrong, this mark could not be awarded.

There was some excellent work shown on probability in part **(f)** by the better candidates, but many just found the probability of '7' not 'at least 7' and many considered the events independent.

Answers: **(a)** 2 **(b)** 10 **(c)** 3 **(d)** 5 **(e)** 4 **(f)** $\frac{380}{5550}$

Question 8

The vast majority of candidates gained some success here and full marks for the first three parts was fairly common. Some misplaced a few numbers in the Venn diagram and a few did not realise that it was necessary to include the elements of $(A \cup B \cup C)'$. Although many did understand the notation in part **(d)**, there were also many who did not and gave a list of elements rather than the number in the set. Some even added the elements.

Answers: **(a)** 29, 31 **(c)** 25, 26, 27, 30, 33, 34, 35 **(d)** 4

Question 9

Both parts of **(a)** were very well done with most candidates recognising the n th term as n^3 in part **(i)** and at least recognising that the second differences were required in part **(ii)**.

Part **(b)** proved more difficult as most candidates did not recognise that each term of the sequence was simply the ones in the previous sequence added and then 1 also added. Many did, however, manage to reach 271 as the next term and reached third differences of 6.

Answers: **(a)(i)** $216, n^3$ **(ii)** 54, $n^2 + 3n$ **(b)** 271, $n^3 + n^2 + 3n + 1$

Question 10

This question proved difficult for many candidates. In part **(a)** many tried to add on 15% and 20% not recognising that the technique of reverse percentages was required. Even those who did recognise this often tried to do it all in one calculation, using 65%. In part **(b)** there were several common errors. Firstly, some candidates worked with 25% of \$18 700 rather than the 2010 figure. Then, some worked with the percentage reductions of the 2012 figure rather than \$18 700. Those using trials often did not work accurately enough and those using logs sometimes found it too difficult. Final errors came in either giving the number of years rather than the calendar years or giving an answer to the nearest year, 2019, instead of realising that it would happen during 2018. That said, there was some impressive work from the best candidates.

Answers: **(a)** \$27 500 **(b)** 2018

Question 11

Although the first part was quite well done, many candidates found the rest of this question difficult. In part **(a)(ii)** many candidates divided by 100 or other powers of 10 rather than the required 100^2 .

Some spoilt their answer by only giving it to two significant figures. Although better candidates did part **(a)(i)** well by equating πr^2 to $\frac{1}{4}\pi 15^2$, there were many who did not realise what was required. Some gained partial credit by assuming the radius was 7.5 and verifying it. Candidates should realise that, when asked to show something, they should not start with what they are asked to show. All too often candidates simply divided 15 by 2 or 30 by 4 with no justification. Whilst there were some good attempts at part **(b)(i)**, many were spoilt by dividing the circumference by 16 instead of 12 or by wrong sector formulae. By far the most common approach to part **(b)(ii)** was to find the surface area of the whole cake instead of the piece of the cake. Those that did make a valid attempt usually started again from scratch, attempting to find the areas of the six surfaces and this often resulted in errors or omissions. Very few candidates recognised that the efficient approach was to simply multiply the perimeter in part **(b)(i)** by 8 and add on twice the area found in part **(a)(i)**.

Answers: **(a)(i)** 44.2 cm² **(ii)** 0.00442 m² **(b)(i)** 26.8 cm **(ii)** 303 cm²

Question 12

In part **(a)** many candidates worked with areas rather than perimeter and many others could not go from $12x + 4y = 60$ to a simplified expression for y . For the better candidates able to reach $y = 15 - 3x$, the algebra in going to the correct quadratic equation was often excellent. Part **(b)(ii)** was easily the best done part of the question with most candidates applying the quadratic equation formula correctly, a few using their graphics calculator and showing the sketch and a very few with successful completing the square method. This was one of the questions where it was expected that candidates would show working or a sketch, and unsupported correct answers did not gain full marks. In part **(iii)** it was expected that candidates would give the answer 2.86 and explained why 19.6 was not suitable. Many did not do this. Whilst better candidates were able to use their answer to find the total area many did not see the question through to its conclusion.

Answers: **(a)** $y = 15 - 3x$ **(b)(ii)** $x = 2.86$ or 19.6 **(iii)** 2.86 m because 19.6 makes y negative or makes total fencing length greater than 60. **(iv)** 82.1 m²

Question 13

This question was quite well done. Most gained full or part marks for the graph although there was some misreading of the scale. The description of the correlation and calculations of the two means were normally correct. Although most candidates were able to use their graphics calculator to obtain the regression equation, this was sometimes spoiled by rounding one or both of the two numerical values to two significant figures. Other candidates appeared to be finding the regression equation by drawing a line of best fit on their graph and finding the equation of that. Extremely few candidates realised that a description of the rate of change was required in part **(c)(ii)**, most giving a further description of negative correlation. About half the candidates were able to use their equation to obtain an estimate for the time in part **(c)(iii)** although here too, some spoiled their answer by inaccuracy.

Answers: **(a)(ii)** Negative **(b)(i)** 30°C **(ii)** 3.05 min **(c)(i)** $y = 7.22 - 0.139x$ **(ii)** Rate of change in time with temperature **(iii)** 3.74 or 3.75 min

Question 14

Most candidates were able to gain 3 or 4 marks for their sketch and some candidates gave excellent answers showing the asymptotes and how the curve approached them. Whilst most of the middle and high ability candidates were able to give the two vertical asymptotes, relatively few recognised that the horizontal one was $y = 1$. Many candidates did not recognise the maximum as being at $(0, 0)$, in spite of the quality of their sketches. Some used their graphics calculators but did not recognise that extremely low values really meant that it was $(0, 0)$. Many candidates had difficulty identifying the minimum as it was not immediately obvious from the sketch where it was. Nevertheless those using their calculator efficiently were able to obtain the answer. As the very last question, part **(b)** was expected to be difficult and so it proved. Many of the best candidates were able to use their calculator to obtain the roots of the equation $f(x) = 3$, but only the very best candidates were able to use these to find the two disjoint parts of the graph as the solution to the inequality.

Answers: **(a)(ii)** $y = 1$, $x = -1$, $x = 3$ **(iii)** $(0, 0)$ **(iv)** $(-3, 0.75)$ **(b)** $-1.10 < x < -1$ or $3 < x < 4.10$

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/42
Paper 42 (Extended)

Key messages

This syllabus has an emphasis on showing full methods and so thorough communication in all questions is to be encouraged.

This paper requires the use of a graphics calculator and candidates should be fully experienced in the list of uses stated in the syllabus as well as being aware of other opportunities which may arise, such as solving an equation by sketching the function. In many cases it is essential to show how the calculator has been used and this is often by sketching a function that has been used.

Other key points are the need for full syllabus coverage and the use of appropriate accuracy as indicated in the rubric of the front cover of the examination paper.

General comments

Most candidates were well prepared for the examination and were able to attempt all or most of the questions. The presentation of work was usually clear and methods often fully shown. There is room for further improvement in accuracy and candidates should be aware that rounding off during a calculation is likely to give inaccurate answers.

The paper did prove to be quite demanding for some candidates and this will be mentioned in further detail when commenting on individual questions.

Topics on which questions were well answered include standard form, straightforward percentage changes, curve sketches and some properties, translation, volume of a compound shape, scatter diagram and line of regression, straight line equations, Venn diagrams, mode, range, median, mean and quartiles from a frequency table, quadratic equation and graph, angles in circles, Pythagoras, cosine rule, trigonometric formula for area of a triangle and solving a linear equation.

Difficult topics were population percentage changes for a large number of years, similar volumes, set notation, finding a range of a function, transformation of a graph of a function, explaining how a statistical range changes when the data changes from discrete to continuous, modal interval from continuous data, obtaining an equation from given information and average speed.

Almost all candidates were able to finish the examination in the 2 hours and 15 minutes.

Comments on specific questions

Question 1

- (a) Most candidates were able to write the given value in standard form.
- (b) The use of percentages for a calculation of a population in ten years' time was generally well answered. The answer as an ordinary number was accepted.

- (c) The reverse process of part (b) proved to be much more challenging, with many candidates multiplying by 1.05 instead of dividing by 0.95. Candidates need to be aware that the factor for a 5% decrease is 0.95 whether it be multiplying or dividing. Again, the answer as an ordinary number was accepted.
- (d) The calculation of a percentage reduction was more successful and candidates who used 1.05 in part (c) were usually able to earn the two method marks here.
- (e) The calculation to find the number of years for the population to reach a given value was also found to be challenging, although it was more successful than part (c). Many candidates chose to use trial and improvement rather than set up an equation using exponents or logarithms, which could be solved either graphically or algebraically.

Answers: (a) 8.5×10^6 (b) 5.1×10^6 (c) 2.37×10^7 (iv) 78.5 (b) 2017

Question 2

- (a) This trigonometric function was sketched clearly by the majority of candidates.
- (b) The three turning points were usually correctly found. A few candidates traced along the curve and hence did not arrive at the exact answers. A few others need to be aware that an answer, from a graphics calculator, such as 9.4×10^{-12} is actually 0.
- (c) The sketch of the modulus of a linear function was also well answered.
- (d) The two solutions to $f(x) = g(x)$ were often correctly found. However, candidates need to be aware that y co-ordinates should not be included in the answers. Accuracy from a graphics calculator is no different to any other situation, unless specified in a question, and two significant figure answers are not normally accepted.

Answers: (b) $(-9, -10)$, $(0, 10)$, $(9, -10)$ (d) $-3.94, 3$

Question 3

- (a) The translation was almost always correctly drawn.
- (b) The single transformation equivalent to the combination of two transformations was more challenging. Many gave rotation with the correct angle. Finding the centre of rotation was found to be more difficult, thus providing a discriminating question.

Answers: (b) Rotation, 90° clockwise, centre $(1, 7)$.

Question 4

- (a) The volume of the shape made up of a hemisphere, cylinder and cone was well answered. It is important for candidates to show their working as individual volumes correctly evaluated do earn marks. This was quite often the case when some candidates used $\frac{4}{3}\pi \times 1.3^3$ or $\frac{2}{3}\pi \times 1.3^2$ for the hemisphere but had the cylinder and cone correctly worked out.
- (b) Most candidates were able to find the mass of the object.
- (c) This question was very challenging and candidates need to be aware that the ratio of similar volumes is the cube of the ratio of any corresponding lengths. The most common error was to multiply the overall height by 2 and not the cube root of 2. A number of candidates attempted to go back to the volumes of the three shapes and used the original radius, not realising that this would change too. A few used the square root of 2. Another method seen was to double the volume found in part (a) and use $\left(\frac{55.2}{27.6}\right) = \left(\frac{h}{7.3}\right)^3$, usually leading to the correct answer.

Answers: (a) 27.6 cm^3 (b) 232 g (c) 9.20 cm

Question 5

- (a) Most candidates completed the scatter diagram correctly. A few made a careless plot such as (27, 22) for (22, 27) and a surprising number omitted this part of the question, thus losing two easy marks.
- (b) Almost all candidates recognised the positive correlation.
- (c)(i), (ii) The two mean marks were usually correctly stated. A number of candidates appeared to use long methods as opposed to the facility on the graphics calculator.
- (d) The equation of the regression line was often correctly stated, although a large number of candidates gave the coefficient of x to only two significant figures even though they gave the constant term to an appropriate accuracy.
- (e) The calculation using the equation in part (d) was usually carried out correctly.
- (f) Many candidates drew the line of regression to sufficient accuracy. There is clearly the need for candidates to be more aware of the fact that the line must go through the mean point and should realise that if a question asks for one or both means then such values should be plotted.
- (g) This question required a little interpretation of how to change an equation based on the new information and a large number of candidates successfully added the 12 to their answer to part (d). Quite a number omitted this part and a few subtracted 12.

Answers: (b) positive (c)(i) 42.1 (ii) 29.6 (d) $y = 0.665x + 1.64$ (e) 18.9 (g) $y = 0.665x + 13.6$

Question 6

- (a) The gradient of the given line was usually successfully answered. Candidates should be aware that the gradient does not include x .
- (b) The intersection with the y -axis was equally successfully answered.
- (c) The equation of the perpendicular through a given point was also well answered and the form $y = mx + c$ proved to be a popular form to ask for.

Answers: (a) -0.4 (b) $(0, -4)$ (c) $y = \frac{5x}{2} - 2$

Question 7

- (a) The completion of the Venn diagram was very well answered.
- (b) The set notation proved to be too challenging for many candidates and a common answer was the set stated without the $n(\)$ used.
- (c) The straightforward probability from the Venn diagram was well answered.
- (d) This combined events probability, by choosing two candidates out of 40, was more challenging but many candidates answered it clearly and showed the product of the probabilities in their working. A few candidates had both fractions with 40 as the denominator.
- (e) This part was similar to part (d) but had the extra difficulty of choosing 2 from only one set rather than the universal set. It was found to be a little more demanding but not to a large extent, indicating that candidates found the visual aspect from the Venn diagram very helpful. The error of treating the problem as with replacement was repeated by those who had done this in part (d).

Answers: (b) $n(B \cup C)$ (c) $\frac{13}{40}$ (d) $\frac{132}{1560}$ (e) $\frac{156}{600}$

Question 8

- (a) The function was well sketched, endorsing continued improvement in this area of the syllabus. Most candidates used the brackets in the denominator correctly as there were very few incorrect sketches. The skills needed are typing in with correct algebra and correct setting up of the limits on the axes. The vertical asymptotes were not required on the sketch but those who did draw them tended to have more accurate sketches with fewer overlaps or wide gaps.
- (b) The equations of the three asymptotes were well answered.
- (c) The ranges of values of x for the given inequality $f(x) < 4$ proved to be very challenging with many candidates not connecting this with the asymptotes. This is a demanding and discriminating part of the syllabus requiring much experience and practice.
- (d) This transformation of the graph of a function also proved to be demanding. The translation $\begin{pmatrix} 1 \\ 0 \end{pmatrix}$ required the x to be replaced by $x - 1$ in each of three places. Many candidates used $f(x) - 1$ and a large number only replaced one or two of the x s.

Answers: (b) $x = -1, x = 3, y = 0$ (c) $x < -1, -0.866 < x < 3, x > 3.39$ (d) $\frac{2(x-1)}{x(x-4)}$

Question 9

- (a) (i) The mode from the frequency table was correctly found by almost all candidates.
- (ii) The range was also well answered with some candidates giving the lower and upper values instead of the range itself. There is the need to be aware of the difference between a range in statistics and a range of a function.
- (iii) The median was generally well answered. A small number of candidates gave the answer of 3.5, probably the result of ignoring the frequencies.
- (iv) Many candidates gave the mean correctly to 3 significant figures or to a greater accuracy, which was accepted. A number of candidates gave answers to 2 or 1 significant figures and a few others again overlooked the frequencies and gave an answer of 3.5.
- (v) The upper quartile met with similar success to the mean and the most common error was again overlooking the frequencies.
- Very few candidates appeared to use the graphics calculator which would have provided most of the answers to part (a).
- (b) (i) This question was testing the candidates' ability to demonstrate that the range for the continuous variable would be larger and it was hoped to see 0.5 and 6.5 as part of the explanation. To simply state that this was a continuous variable was considered to be insufficient and so this part met with limited success.
- (ii) The modal interval also proved to be very challenging and it appeared to be a topic on which many candidates had limited experience, even though the difference between a mode for discrete data and a modal interval for continuous data is a good way to understand the two types of data.

Answers: (i) 2 (ii) 5 (iii) 3 (iv) 3.04 (v) 4 (b) (ii) $1.5 < x \leq 2.5$

Question 10

- (a) This was a demanding question involving the substitution of co-ordinates into a quadratic equation containing two unknown coefficients to obtain a pair of simultaneous linear equations. The stronger candidates were able to carry out this process whilst others only had equations which still contained x and y .
- (b) This part required success in part (a) and therefore proved to be very difficult with a large number of candidates not attempting it.
- (c) (i) Candidates were able to recover in this part and there was a good success rate in solving the quadratic equation. Only a small number of candidates solved the equation graphically as few sketches were seen and it is clear that the next two parts would have been easier with a sketch.
- (ii) The line of symmetry of the quadratic function was usually correctly stated but quite a number omitted this part and it is likely more success would have followed a good sketch.
- (iii) The same comment as for part (c)(ii) applies here although more candidates were able to do this part which asked for the minimum value of y .

Answers: (a) $2 = 1^2 + b + c$, $-6 = (-3)^2 - 3b + c$ (c) (i) $-4.65, 0.65$ (ii) $x = -2$ (iii) -7

Question 11

- (a) (i) This part requiring knowledge of angles in a semi-circle was well answered.
- (ii) This part could have been done by using angles on a straight line and in a triangle or by angles in the same segment and was generally well done.
- (iii) The best method for this part was to use the angle at the centre property and candidates were generally successful.
- (b) (i) A quadrilateral needed to be split into two congruent right-angled triangles and then the most efficient method was to use the tangent ratio, although a large number of candidates chose to use the sine rule. There was reasonable success in spite of so many candidates choosing longer methods. A trigonometric ratio of 56° was occasionally seen and yet this angle was not in a triangle.
- (ii) This part was best done by finding the third angle in the right-angled triangle and doubling it. The question was well answered with the only frequent error seen being the 56° doubled.
- (iii) The required perimeter was the sum of two arc lengths and was found to be more challenging. Full marks depended on full success in parts (i) and (ii) but method marks were available to candidates who used their answers to the two previous parts correctly. This part was omitted by a number of candidates.

Answers: (a)(i) 67° (ii) 29° (iii) 46° (b) (i) 4.25 cm (ii) 124° (iii) 17.0 cm

Question 12

- (a) Almost all candidates applied Pythagoras' theorem correctly. A few treated the unknown side as the hypotenuse.
- (b) The use of the cosine formula was also demonstrated successfully by a large number of candidates. A few calculated one of the other two angles in the triangle.
- (c) The area of the quadrilateral was to be found by using $\frac{1}{2}$ base \times height in one triangle and $\frac{1}{2}ab\sin C$ in the other triangle. This was also well answered with good clear and accurate working usually seen.

Answers: (a) 7.53 cm (b) 95.1° (c) 125 cm²

Question 13

- (a) The algebraic expression for the time of part of the journey was quite well answered. Many candidates gave an expression for the time of the complete journey, thus losing a reasonably easy mark.
- (b)(i) This more challenging and discriminating question required the writing down of an equation and then simplifying it to the stated linear equation. This met with limited success as a result of problems with algebraic fractions and changing times in minutes into hours. A number of candidates solved the equation in a “show that” situation.
- (ii) This was a more straightforward part requiring the given linear equation to be solved. The success rate was much higher.
- (c) The value for x from part (b)(ii) was required to find a total distance in kilometres and a total time in hours to calculate the overall average speed. Candidates found this to be more difficult with errors with units, finding the average of two speeds or finding the speed of only one part of the journey.

Answers: (a) $\frac{x-4}{60}$ (b) (ii) 24 min (c) 45 km/h

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/43
Paper 43 (Extended)

Key message

This syllabus has an emphasis on showing full methods and so thorough communication in all questions is to be encouraged.

This paper requires the use of a graphics calculator and candidates should be fully experienced in the list of uses stated in the syllabus as well as being aware of other opportunities which may arise, such as solving an equation. In many cases it is essential to show how the calculator has been used and this is often by sketching a function that has been used.

Other key points are the need for full syllabus coverage and the use of appropriate accuracy as indicated in the rubric of the front cover of the examination paper.

General comments

Most candidates were well prepared for the examination and were able to attempt all or most of the questions. The presentation of work was usually clear and methods often fully shown. There is room for further improvement in accuracy and candidates should be aware that rounding off during a calculation is likely to give inaccurate answers.

The paper did prove to be quite demanding for some candidates and this will be mentioned in further detail when commenting on individual questions.

Topics on which questions were well answered include straightforward percentage, average speed, money, inequality from number line, vectors, co-ordinates, mean and quartiles from frequency table, curve sketching and turning point, angles in a polygon, cosine and sine rules, mean and histogram for continuous data, straightforward probability and Pythagoras and trigonometry in a 3-dimensional shape.

Difficult topics included a percentage change when the answer was greater than 100%, solving an inequality from a graph of a function, finding a linear regression equation and explaining why it was not reliable, using a sketch to find a range of a function and to find a condition for the function to have one solution, area of similar triangle, solving unfamiliar equations using a graphics calculator, shortest distance from a point to a line using trigonometry, reverse bearing, simplifying an algebraic fraction by factorising and cancelling, probability of combined events and angle of elevation.

Most candidates were able to finish the examination in the 2 hours and 15 minutes.

Comments on specific questions

Question 1

- (a) This percentage growth question was answered reasonably well with candidates showing the need to multiply by 1.045^{10} . A number of candidates used 10×4.5 and increased the value by 45%, indicating the challenge of distinguishing between linear and exponential growth.
- (b) The number of years to reach a certain value was also quite well answered. Many used a trial and improvement method and a smaller number used logarithms. Very few sketches of the exponential function were seen.

- (c) This percentage change question was expected to be more straightforward than parts (a) and (b). Candidates need to understand that the original value is always the denominator in the calculation regardless of whether it is larger or smaller than the final value or the change in value. The other requirement often overlooked was to find the change, not the final value, as a percentage.

Answers: (a) \$357 200 (b) 34 (c) 335 %

Question 2

- (a) (i) This part required the calculation of the time of a journey and then a calculation to find the arrival time. It was generally well answered. A few candidates divided speed by distance and a few showed the need to be more familiar with dealing with minutes in an hour.
- (ii) The overall average speed of the journey was quite well answered. A number of candidates did not appear to know that this calculation required total distance and total time and not the average of the two speeds.
- (iii) The cost of fuel for the journey was usually correctly calculated with the only real difficulty being the use of the 9.5 litres per 100 km together with the distance of 80 km.
- (b) Almost all candidates answered this money calculation correctly.
- (c) The average cost per person of the whole trip was found to be a little more challenging with candidates often overlooking part of the cost, usually the fuel for the return journey. The success rate of candidates was nevertheless quite high.

Answers: (i) 09 10 (ii) 64 km/h (iii) €12.16 (b) €65.35 (c) €22.78

Question 3

- (a) Almost all candidates stated the correct inequality from the given number line.
- (b) The inequality from the graph of a function proved to be much more demanding and this part turned out to be a good discriminator. Many candidates demonstrated the need for more experience in interpreting the zeros into inequalities. A large number also omitted this part.
- (c) The quadratic equation proved to be much more accessible. Many candidates used the formula and quite a number used the sketching method, probably influenced by part (b) being graphical. The requirement of answers to 2 decimal places was occasionally overlooked.

Answers: (a) $2 < x \leq 7$ (b) $-2 < x < 0$, $1 < x < 4$ (c) -3.41 , -0.59

Question 4

- (a)(i), (ii) These two vector geometry questions were found to be very straightforward.
- (b)(i) Almost all candidates used the information given to find the correct co-ordinates of a point.
- (ii) The equation of a straight line through two given points proved to be challenging and many candidates demonstrated the need for more practice in this area. The gradient of the line was often correct but the use of co-ordinates to find the constant term was often not seen. The extra difficulty with this question was that the $ax + by = d$ form seemed to be unfamiliar to many candidates, who left their answer in the more common $y = mx + c$ form.

Answers: (i) $-p + q$ (ii) $q + 2p$ (b) (i) (9, 5) (ii) $x - 3$ $y = -6$

Question 5

- (a) The median and quartiles from a table of single items of data were quite well answered.
- (b) The means of the same data was very well answered.

- (c) The equation of the regression line was found to be more challenging with quite a low success rate, and a large number of candidates did not attempt this part. It appeared that many candidates needed more experience with this topic. The other problem seen in this particular case was to give the coefficient of g to fewer than 3 significant figures.
- (d)(i) The use of the equation in part (c) was more successful although many could not attempt this as they did not have an answer for the equation.
- (ii) This part was for candidates to recognise that the correlation was weak and so the equation could not be reliable. Many candidates did not connect their explanation to the lack of correlation.

Answers: (a) 58.5, 44, 72 (b) 58.1, 60.3 (c) $s = -0.0214g + 61.5$ (d) (i) 60

Question 6

- (a) Many good sketches were seen, giving candidates every opportunity to answer the remaining parts.
- (b) The zeros proved to be quite challenging with a number of candidates not aware of the connection of zeros to the intersections with the x -axis. Another misunderstanding seen was the inclusion of the y co-ordinates.
- (c) Almost all candidates who had a correct sketch were able to state the turning point. A few used the tracing facility and did not give the exact answer.
- (d) The range of a function continues to be an area in need of attention as endorsed by the attempts at this question. Many candidates went outside the domain given in the question.
- (e) Interpreting when an equation with the function has a given number of solutions was found to be even more demanding and there was very limited success with this part.

Answers: (b) 0, 5 (c) (4, 256) (d) $-146 \leq f(x) \leq 256$ (e) any negative integer or integer > 256

Question 7

- (a) This question involving angles in an octagon was quite well answered. The challenge for quite a number of candidates was to find the angle sum of this shape, with 720 and 1440 seen quite frequently.
- (b) Most candidates appeared to recognise the angle at the centre of a circle property but often went astray because of the need to write an equation in x . Some candidates made the angle at the circumference double the angle at the centre and a few made the two angles equal. There were also some errors in solving a straightforward equation.
- (c) This areas of similar triangles question offered a challenge to many candidates, largely due to the need to select the side to pair with the 3 cm in the smaller triangle. This required the recognition of alternate angles and then the 5 cm paired with the 3 cm. Many candidates chose the 6 cm instead of the 5 cm, perhaps thinking the easier ratio would be the correct one. A number of candidates used $\frac{1}{2}ab\sin C$ and this was a more complicated method leading to very limited success.

Answers: (a) 145° (b) 18° (c) 14.2 cm^2

Question 8

- (a)(i) The volume of this prism with cross-section the sector of a circle was quite well answered. A number of candidates need more familiarity with arcs and sectors so as to know when to use area and when to use arc length. As this question was a context one, answers in terms of π could only earn method marks.

- (ii) The total surface area of the same prism met with similar success to part (a). Many candidates omitted part of the shape but were still able to earn some marks by showing the separate areas clearly.
- (b) The total mass of the same prism was more successfully answered and most candidates were able to change the grams into kilograms.

Answers: (i) 141 cm^3 (ii) 178 cm^2 (b) 1.44 kg

Question 9

- (a) This unfamiliar equation required the use of the graphics calculator but only with a graphical method as instructed in the question. There were some good sketches and correct answers. Answers without sketches were not given full marks as solving facilities on graphics calculators are not expected to be used as they do not allow the candidate to show any method.
- (b) Exactly the same comments as in part (a) apply to this part.

Answers: (a) 0.758 (b) $-1, 3.17$

Question 10

- (a) This “show that” question involving the cosine rule was quite well answered. The success would have been greater if the question had simply been a “calculate” type. This wording of “Calculate...” and then “show that it rounds to ...” should send the message that it is a normal calculate question but an accuracy to allow it to round to the given value must be used. This also rules out any reverse method to justify the answer as it overlooks the rounding issue. Most candidates demonstrated good use of the cosine rule. A few showed the need to practice the re-arranging to calculate an angle.
- (b) The sine rule was applied successfully by many candidates.
- (c) (i) The shortest distance from a point to a line proved to be a very discriminating question. Many candidates appeared to be unsure as to which line this was when a simple sine calculation would have been available if the line had been correct. A large number also omitted this part.
- (ii) The area of the quadrilateral met with much more success with the majority of candidates using $\frac{1}{2}ab\sin C$ in both triangles, even if they had an answer to part (c)(i), which allowed the use of $\frac{1}{2}\text{base}\times\text{height}$ in one triangle. Hero’s formula was used by a small number of candidates.
- (d) (i) This straightforward bearing was quite well answered as all that was required was the sum of 80° and the answer to part (a). A large number of candidates omitted this part.
- (ii) The reverse bearing proved to be much more challenging with a limited number of correct answers seen. Again, a large number of candidates omitted this part.

Answers: (a) $63.064\dots^\circ$ (b) 24.1 km (c) (i) 16.0 or 16.1 km (ii) 208 or 209 km^2 (d) (i) 147° (ii) 327°

Question 11

- (a) This addition of two algebraic fractions was quite well answered with most candidates being familiar with the process of finding and using a common denominator.
- (b) This algebraic fraction required numerator and denominator to be factorised and then factors could be cancelled. This met with limited success and the simple message to many candidates is that only factors can be cancelled. Many candidates cancelled the x^3 term at the beginning of each expression and many others made other similar errors.

Answers: (a) $\frac{7x-5}{(2x-1)(x-2)}$ (b) $\frac{x+1}{x+3}$

Question 12

- (a) The mean from a frequency table containing continuous data was quite well answered, often without using the statistics function in the graphics calculator.
- (b) The histogram with unequal column widths was also quite well answered and this quite challenging topic seems to show continued improvement.

Answers: (a) 34.4 s

Question 13

- (a) (i) This basic probability of a score on a die was very well answered.
- (ii) This basic probability of a score on a die was very well answered.
- (b) (i) The probability of a straightforward combined event from two dice being rolled was well answered.
- (ii) This more complicated combined event was found to be much more difficult. Most candidates attempted to multiply pairs of fractions when the most efficient way was to subtract one product from 1. A sample space would have helped many candidates who found this question too difficult.
- (iii) This was another quite complicated event and candidates found it very challenging, again with very few subtracting one product from 1. A few candidates did draw a sample space grid (6 by 6) and found the question suddenly very easy. This was a situation where the use of probability theory can be quite abstract and a much simpler intuitive approach is possible.

Answers: (i) $\frac{5}{6}$ (ii) $\frac{2}{6}$ (b) (i) $\frac{12}{36}$ (ii) $\frac{30}{36}$ (iii) $\frac{11}{36}$

Question 14

- (a) The angle between the two planes was frequently successfully found, normally using the tangent ratio.
- (b) The length using Pythagoras twice was very well done.
- (c) The angle of elevation proved to be much more challenging, with many candidates appearing to be unsure of which angle to calculate. There was also quite a large number of candidates who omitted this part. Some correct answers were seen from the use of the sine rule when right-angle triangle trigonometry was available.

Answers: (a) 23.2° (b) 14.2 cm (c) 12.2°

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/51
Paper 51 (Core)

Key Messages

To perform well in an investigation paper, candidates need to be prepared to look for generalisations that are not necessarily algebraic. They need to be able to explain and show how the solution works and, most importantly, they need to look for and follow the theme of the investigation, using this to enable them to answer questions quickly and efficiently.

General Comments

This paper required candidates to follow the theme of the investigation and to look for and use the connection(s) between questions, such as linking **Question 3(b)** to **Questions 4(a), 5(a), 6 and 9**.

Comments on Specific Questions

Question 1

Candidates showed complete understanding of writing numbers, specifically the factors of 16, as powers of 2. They were able to follow the pattern that was set out on the question paper.

Answer: $2^2, 2^3$

Question 2

(a) Candidates understood what factors are and were able to write down the missing factors of 27.

Answer: 3, 9

(b) Again this question was well answered. Candidates correctly wrote the powers in ascending order and included the power of 1. This helped them to see the pattern, which was necessary for the next question.

Answer: $3^0, 3^{(1)}, 3^2, 3^3$

Question 3

Algebra is very commonly used in investigations and practice working with algebraic sequences will always be useful to prepare candidates for these papers.

(a) Following the pattern in the previous questions made the completion of this first part straightforward.

Answer: $p^{(1)}, p^2, p^3, p^4$

- (b) There were no guided steps to this question, which demanded that the candidates realised that they needed to look back at the previous questions for a link between the number of factors and the largest power. This was too big a step for some of them. Many wrote their answer as a power of p which could be interpreted as a lack of understanding of writing down a number. Some time spent on writing numbers in terms of letters would prove useful for most candidates.

Answer: $n + 1$

Question 4

- (a) This question related back to **Question 3** and thus to **Questions 1** and **2** as well. Some candidates treated it as a separate question and wrote out the factors of 128 so that they could count how many there are, instead of using the $n + 1$ rule. For the rest, it was exceptionally easy to answer and helped them to answer part (b).

Answer: 8

- (b) Several different ways of working this out were shown. The simplest was to calculate the powers of 2 from 2^0 to 2^7 . Even though candidates did not see the link with the previous questions it was commendable that they tried other means to get the answers. It would have been even better if some had gone back and changed their answer to part (a) once they had completed part (b).

Answer: 1, 2, 4, 8, 16, 32, 64, 128

Question 5

- (a) Candidates could answer this correctly even if they had not been following the investigation.

Answer: 5^3

- (b) This was a straightforward matter of adding 1 to the power of 3. Some candidates used other methods when they did not see the connection. It will help them if they realise that the investigation questions will link together to enable them to work out something much more easily and quickly.

Answer: 4

Question 6

- (a) This next step proved to be quite difficult for many candidates. Even some of those who had correct answers for **Question 3(b)** and appeared to recognise the connections between **Questions 4(a)** and **4(b)** and **5(a)** and **5(b)** did not realise that they were looking for $2^{(14-1)}$.

Answer: 8192

- (b) In a similar manner to part (a), candidates did not realise the continuation of the theme of the investigation. Others, who correctly answered part (a) did not make the connection to look for 3^{13} or 4^{13} etc.

Answer: 1 594 323 or 1 220 703 125 or other prime 13 evaluated

Question 7

- (a) This question was well answered and, by following the pattern in the table, all 3 cells were completed accurately by most candidates.

Answer:

Powers of 5		
	5^0	5^1
2^0	$2^0 \times 5^0 = 1 \times 1 = 1$	$2^0 \times 5^1 = 1 \times 5 = 5$
2^1	$2^1 \times 5^0 = 2 \times 1 = 2$	$2^1 \times 5^1 = 2 \times 5 = 10$
2^2	$2^2 \times 5^0 = 4 \times 1 = 4$	$2^2 \times 5^1 = 4 \times 5 = 20$

- (b) Many of the candidates saw this connection but some were not able to explain it. So although they lost the marks for this part of **Question 7**, they were able to pick up marks for part (c).

Answer: Multiply

- (c) (i) More candidates were able to show their understanding by means of numerical answers here than by explaining in part (b). This does indicate that more practice on explaining in words would be a useful activity to prepare the candidates for investigation work.

Answer: rows = 5
 columns = 3

- (c) (ii) Like **Question 4(a)**, some candidates did work these out using a longer method. Most of the correct answers came from the understanding of the theme of the investigation and consequently multiplying 5 and 3.

Answer: 15

Question 8

- (a) This part of **Question 8** was answered well. Some good use of trial and improvement with the calculator was seen here.

Answer: 3

- (b) Again this part of the question relied on the fact that the candidate was following the investigation and they would realise how to use the information about the powers to answer this quickly.

Answer: 16

- (c) Candidates who had not understood the theme of this investigation and did not see the connection between 1000 and 1 000 000 and the powers of 2 found this question hard work. It was time consuming and trial and improvement needed to be carried out very methodically to find the correct answer.

Answer: 49

Question 9

- (a) Candidates are still much less confident with 'explain' and 'show that' questions. More work on this type of question, would be very helpful to all candidates. Some candidates did manage to see the links with the powers but then forgot about their learning in **Questions 7(c) and 8** and answered that the total of the factors was 4 because of $2 + 2$ instead of 2×2 . Whereas they might not have made this mistake if another number, rather than 2, had been used, this question, being the last on the paper, was to test the understanding of this investigation.

Answer: 5^1 , 17^1 and 2×2

- (b) Using the result of this investigation to find 2 prime factors of the numbers between 80 and 90 was very quick. Many candidates did well to find other ways of finding these numbers. This exemplifies the spirit of an investigation, when candidates will continue to work to find an answer using whatever skills they have.

Answer: 82, (85), 86, 87

Communication

Communication shown in this investigation was good, particularly in showing how the answer to **Question 8(c)** was obtained.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/52
Paper 52 (Core)

Key Messages

To perform well in an investigation paper, candidates need to be prepared to look for generalisations and follow patterns that are not necessarily algebraic. They need to be able to explain and show how the solution works and, most importantly, they need to look for and follow the theme of the investigation, using this to enable them to answer questions quickly and efficiently.

General Comments

Checking answers was a key issue on this paper. To do well it was necessary to do both checks on numerical answers such as **Question 1(b)**, and checks to see if an assumed generalisation would work for several terms in the sequence and not just the first ones, such as **Question 3(b)**.

More than one strategy was employed to calculate answers to the sequences in this investigation. Once the two methods had been established, candidates could have used both methods to calculate and check their answers.

Comments on Specific Questions

Question 1

- (a) (i) Many candidates were able to follow the example given and use it to complete the missing fraction of the calculation of the fourth term of the sequence. Just as many were not comfortable with writing $\frac{1}{3}$ as $\frac{2}{3}$, as shown in the example and they did not use this to help them to complete the answer box in this part.

Answer: $\frac{1}{1 + \frac{2}{3}}$

- (ii) There was further evidence in the answers to this part that it would be helpful to the candidates to practice reading, more thoroughly, examples given and using them in their own work to give answers.

Answer: $\frac{1}{1 + \frac{3}{5}}$

- (iii) Candidates showed that they had been well prepared in looking for patterns and in working with sequences, even those in fractions. This question was well answered and very rarely omitted.

Answer: $\frac{8}{13} \frac{21}{34}$

- (iv) There were some very good explanations of the different patterns that the candidates saw in this sequence of fractions. It was not necessary to use the exact words as given here as long as the meaning was clear; so, for example, use of the phrase ‘the fraction before’ was commonly accepted to mean ‘the previous fraction’.

Answer:

(Numerator =) denominator of 7th or previous fraction
OR added the two previous numerators
OR denominator of (previous fraction + 1)

(Denominator =) numerator + denominator of 7th or previous fraction
OR added the two previous denominators
OR numerator of (previous fraction + 1)

- (b)(i) This question was also well answered showing, again, that candidates have been well prepared to work with number sequences. Some arithmetical mistakes might have been avoided with checking on the calculator, for example, by working backwards from their answers.

Answer: 34, 55, 89, 144, 233

- (ii) Misreading of the question is likely to be the reason many candidates wrote down incorrect numbers for their answer to this part. It cannot be stressed enough how important it is that candidates read questions thoroughly and interpret them carefully.

Answer: $\frac{144}{233}$

Question 2

- (a) Candidates did well on this question, calculating both the fractions. There was little evidence of written working out, but there was often evidence of checking, and correction, of answers: Some examples, therefore, of excellent practice.

Answer: $\frac{2}{3} \frac{6}{5}$

- (b) Arithmetical slips appeared to be the main reason for getting this answer wrong. Candidates made a good effort to calculate this correctly and worked with the given fractions without converting to decimals. This shows good evidence of candidates being confidently able to work with fractions.

Answer: $\frac{22}{21}$

- (c) This pattern was not so easily spotted by the candidates. Too many found a pattern that worked between the first 2 terms but they did not appear to check it with further terms in the sequence. It should, perhaps, be noted that descriptive answers require a similar check to numerical ones.

Answer: (Numerator =) $2 \times$ previous denominator

- (d) This question was answered better than part (c), probably because the pattern for the denominators had not changed from previous questions. Candidates still need practice in looking for themes running through an investigation: Some candidates did not realise that this pattern was the same as for the sequence of denominators in **Question 1**.

Answer: (Denominator =) numerator + denominator of previous fraction

Question 3

- (a) This question showed an alternative, simplified way of calculating the next fractions in these sequences of fractions. Some candidates followed the new pattern carefully, whilst others tried a combination of the 2 methods which was unsuccessful.

Answer: $\frac{21}{19}$ $\frac{57}{40}$

- (b) Explanations and descriptions in words are often asked for in investigations. It might be beneficial to the candidates to practice these skills. Many candidates were unable to find a common pattern within this sequence of fractions and some wrote down a method that worked for finding the second term from the first term, but this connection did not work for further terms.

Answer: (Numerator =) $3 \times 19 = 57$ or $3 \times$ previous (4th term) denominator

(Denominator =) $21 + 19 = 40$ or previous (4th term) numerator + previous (4th term) denominator

Question 4

Many candidates performed well in this question. Others calculated the first and second fractions correctly and then found the second two fractions more difficult. The method for these calculations was left entirely to the choice of the candidate. Many went back to the first principles of **Question 1** whilst fewer used the simplified, more straightforward method of **Question 3**.

Answer: $\frac{4}{[1]}$, $\frac{4}{5}$, $\frac{20}{9}$, $\frac{36}{29}$

Communication

Communication shown in this investigation was quite good, particularly in the calculation of the fractions in **Question 4**. It was rarely seen in **Question 2(a)** though more often in **Question 3(a)**. Candidates should be encouraged to show every step of their working-out, both when calculating an answer as well as checking an answer.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/53

Paper 53 (Core)

Key Messages

To perform well in an investigation paper, candidates need to be prepared to look for generalisations and follow patterns that are not necessarily algebraic. They need to be able to explain and show how the solution works and, most importantly, they need to look for and follow the theme of the investigation, using this to enable them to answer questions quickly and efficiently.

General Comments

Checking answers was a key issue on this paper. To do well it was necessary to do both checks on numerical answers such as **Question 1(b)**, and checks to see if an assumed generalisation would work for several terms in the sequence and not just the first ones, such as **Question 3(b)**.

More than one strategy was employed to calculate answers to the sequences in this investigation. Once the two methods had been established, candidates could have used both methods to calculate and check their answers.

Comments on Specific Questions

Question 1

- (a) (i) Many candidates were able to follow the example given and use it to complete the missing fraction of the calculation of the fourth term of the sequence. Just as many were not comfortable with writing $\frac{1}{3}$ as $\frac{2}{3}$, as shown in the example and they did not use this to help them to complete the answer box in this part.

Answer: $\frac{1}{1 + \frac{2}{3}}$

- (ii) There was further evidence in the answers to this part that it would be helpful to the candidates to practice reading, more thoroughly, examples given and using them in their own work to give answers.

Answer: $\frac{1}{1 + \frac{3}{5}}$

- (iii) Candidates showed that they had been well prepared in looking for patterns and in working with sequences, even those in fractions. This question was well answered and very rarely omitted.

Answer: $\frac{8}{13} \frac{21}{34}$

- (iv) There were some very good explanations of the different patterns that the candidates saw in this sequence of fractions. It was not necessary to use the exact words as given here as long as the meaning was clear; so, for example, use of the phrase ‘the fraction before’ was commonly accepted to mean ‘the previous fraction’.

Answer:

(Numerator =) denominator of 7th or previous fraction
OR added the two previous numerators
OR denominator of (previous fraction + 1)

(Denominator =) numerator + denominator of 7th or previous fraction
OR added the two previous denominators
OR numerator of (previous fraction + 1)

- (b)(i) This question was also well answered showing, again, that candidates have been well prepared to work with number sequences. Some arithmetical mistakes might have been avoided with checking on the calculator, for example, by working backwards from their answers.

Answer: 34, 55, 89, 144, 233

- (ii) Misreading of the question is likely to be the reason many candidates wrote down incorrect numbers for their answer to this part. It cannot be stressed enough how important it is that candidates read questions thoroughly and interpret them carefully.

Answer: $\frac{144}{233}$

Question 2

- (a) Candidates did well on this question, calculating both the fractions. There was little evidence of written working out, but there was often evidence of checking, and correction, of answers: Some examples, therefore, of excellent practice.

Answer: $\frac{2}{3}$ $\frac{6}{5}$

- (b) Arithmetical slips appeared to be the main reason for getting this answer wrong. Candidates made a good effort to calculate this correctly and worked with the given fractions without converting to decimals. This shows good evidence of candidates being confidently able to work with fractions.

Answer: $\frac{22}{21}$

- (c) This pattern was not so easily spotted by the candidates. Too many found a pattern that worked between the first 2 terms but they did not appear to check it with further terms in the sequence. It should, perhaps, be noted that descriptive answers require a similar check to numerical ones.

Answer: (Numerator =) $2 \times$ previous denominator

- (d) This question was answered better than part (c), probably because the pattern for the denominators had not changed from previous questions. Candidates still need practice in looking for themes running through an investigation: Some candidates did not realise that this pattern was the same as for the sequence of denominators in **Question 1**.

Answer: (Denominator =) numerator + denominator of previous fraction

Question 3

- (a) This question showed an alternative, simplified way of calculating the next fractions in these sequences of fractions. Some candidates followed the new pattern carefully, whilst others tried a combination of the 2 methods which was unsuccessful.

Answer: $\frac{21}{19}$ $\frac{57}{40}$

- (b) Explanations and descriptions in words are often asked for in investigations. It might be beneficial to the candidates to practice these skills. Many candidates were unable to find a common pattern within this sequence of fractions and some wrote down a method that worked for finding the second term from the first term, but this connection did not work for further terms.

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Question 4

Many candidates performed well in this question. Others calculated the first and second fractions correctly and then found the second two fractions more difficult. The method for these calculations was left entirely to the choice of the candidate. Many went back to the first principles of **Question 1** whilst fewer used the simplified, more straightforward method of **Question 3**.

Answer: $\frac{4}{[1]}$, $\frac{4}{5}$, $\frac{20}{9}$, $\frac{36}{29}$

Communication

Communication shown in this investigation was quite good, particularly in the calculation of the fractions in **Question 4**. It was rarely seen in **Question 2(a)** though more often in **Question 3(a)**. Candidates should be encouraged to show every step of their working-out, both when calculating an answer as well as checking an answer.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/61
Paper 61 (Extended)

Key Messages

In order to do well in this examination, candidates needed to give clear and well thought out answers to questions, with sufficient method being shown so that marks could be awarded. They should also remember that marks are awarded for their communication of mathematical ideas.

General Comments

This examination produced a wide spread of marks, with many scoring highly. Many candidates were well prepared for the examination and gave good, clearly presented answers. In order to improve, other candidates need to understand that their working must be detailed enough to show their method clearly. This is even more important if they make an error. This was highlighted in part **A** in **Questions 2(b), 4(b), 5** and **7** in this examination. Generally, showing clear method is also very important if a question starts with the words “Show that...” or “Explain why ...”. This indicates that the answer has been given to the candidates and that the marks will be awarded for showing how that answer has been found. The need for this was highlighted in **Question 2(b)** of part **B** in this examination. There are a few candidates who need to remember that good mathematical communication is being assessed in this paper and that answers alone are usually insufficient. The level of communication in part **A** was better, on the whole, than in part **B**, which candidates usually found more challenging.

Comments on Specific Questions

Part A: Investigation

Question 1

(a) This question provided a straightforward introduction into the task. Candidates rarely made errors.

Answers: (i) 2, 4, 8 (ii) $2^1, 2^2, 2^3$

(b) Again, this question was well answered, although a small number of candidates did not read the question carefully enough and did not give their factors as powers of 3.

Answer: $3^0, 3^1, 3^2, 3^3$

Question 2

(a) Candidates were asked to express results in algebraic form. Most did this well, although a small number misread part (ii) and gave the answer 6.

Answers: (i) p^1, p^2, p^3, p^4, p^5 (ii) $n + 1$

(b) Many seemed to forget they were being asked for the number of factors rather than just the relevant power of 5 and 7 was a common wrong answer.

Answer: 8

Question 3

The purpose of this question was to help candidates discover the rule for calculating the number of factors for a number when written as a product of its prime factors. Very many did this well. A common error among the few who gave incorrect answers to part (b) was, rather than multiply – as the structure of the table in part (a) should have suggested – to think that the number of factors was calculated by summing the rows and columns and then adding 1.

Answer: (a)

Powers of 5		
	5^0	5^1
2^0	$2^0 \times 5^0 = 1 \times 1 = 1$	$2^0 \times 5^1 = 1 \times 5 = 5$
2^1	$2^1 \times 5^0 = 2 \times 1 = 2$	$2^1 \times 5^1 = 2 \times 5 = 10$
2^2	$2^2 \times 5^0 = 4 \times 1 = 4$	$2^2 \times 5^1 = 4 \times 5 = 20$

(b) multiply (c) 24

Question 4

This question consolidated the knowledge candidates had developed, and prepared them for the final three questions of part A.

- (a) (i) A surprising number thought that 1 million was 10^5 , but most candidates found this straightforward.
 (ii) This was usually well answered by those who had managed **Question 3** successfully. A few candidates gave the answer $6 \times 6 = 36$, not using the 6 they had found in part (i) correctly.

Answers: (i) 6 (ii) 49

- (b) Many candidates omitted to square root and/or subtract 1. Consequently, there were many incorrect answers of either 30 or 899 seen for this part.

Answer: 29

Question 5

Some candidates wrote down $(m + 1)(n + 1) = 12$ and did not know how to progress. Those listing pairs of factors of 12 as well were often more successful. The most common error among the reasonably good number of candidates who realised the appropriate method, was to include the powers of 0 and 11 (thus including factors that were not prime). Many candidates used the factors of 12 for m and n without subtracting 1 and produced some extremely large values as a result. A small number of candidates left their answers as products of prime factors in index form, rather than finding the values – careful reading of the question should have avoided this error.

Presentation was often poor in this question and work was often difficult to follow. Better presentation may well have led to more logical and orderly thinking by some candidates.

Answer: 1323, 1701, 3087, 50421

Question 6

- (a) A good number of candidates expressed 336 in prime factors correctly, giving evidence of a factor tree or division. Some struggled to interpret the wording of the question and had algebraic bases or powers in their answer. Some seemed to think that 21 was a prime number.

Answer: $2^4 \times 3^1 \times 7^1$

- (b) Candidates tended to answer this part well if they had answered **Question 4(a)(ii)** correctly. Others often made similar errors to those seen in **Question 4(a)(ii)** in this part. Some candidates did recover from incorrect work in (a) and earned follow through marks.

Answer: 20

Question 7

This was the most challenging question in part A. Few candidates earned marks – of those who did, again, many were including zero as a power which resulted in much more work than was required. Only the best candidates appreciated that the key powers were 1, 1 and 2. Again, presentation was often poor in this question.

Answer: 60, 90, 150

Part B: Modelling

Question 1

- (a) (i) Given that candidates should have been using graphical calculators, it was disappointing that a few candidates did not produce graphs of sufficient accuracy to gain credit. As it was the first question in this part, the overall shape of the curve was marked generously but the amplitude and x -intercepts needed to be correct to score both marks. Some candidates needed to take more care – especially with the x -intercepts. Some attempts were drawn using a ruler to join plots and this should be discouraged when the question requires a sketch of a curve. Similarly, some candidates did not use a pencil to sketch their curve and if they then made an error, found it difficult to correct.
- (ii) Mostly well answered, although there were a few answers of 60 or 3 from those who did not read and/or understand the information given at the start of this task about the period of $y = \sin x$.

Answer: (ii) 120

- (b) Well answered by those who answered **part (a)(ii)** successfully.

Answer: 36

- (c) Again, well answered by those who had shown that they understood the concept of “period” in the previous parts of this question. However, some candidates incorrectly thought they should be rearranging $y = \sin(bx)$ to make b the subject or thought the period was $\frac{360}{bx}$.

Answer: $\frac{360}{b}$

Question 2

- (a) This was generally well answered by those who had dealt with **Question 1** successfully. Common wrong answers were 6 and 24 as well as the occasional 180° . Some candidates offered an answer of $12t$ and were not credited for this as candidates should realise that a period is a numerical quantity.

Answer: 12

- (b) It was not uncommon for the 1.2 to be justified as the amplitude – or a description of such – but candidates often did not consider the 30 or gave spurious or vague reasons for its use such as $\frac{30}{1.2} = 25$ and it is 25 April or 30 is used to match the scale for sine.

- (c) Some good answers but common wrong answers were $3.2\sin(30t)$ or simply 3.2 or 2.

Answer: $1.2\sin(30t) + 2$

- (d)(i) Fully correct answers were not common. Many found a correct pair of decimal values but could not convert these into times of day – or essentially, into hours and minutes. Many were insufficiently accurate with their times to score full marks. Common approximate answers were 8 and 10 and wrong answers were 9 and 21, from consideration of the minimum points.
- (ii) Many candidates omitted to take notice of the instruction to use their answer from part (i) here. The question required this and so those with a discrepancy in the number of minutes, following on from their part (i), were penalised. Candidates can avoid losing marks in this way by reading the question more carefully.

Answers: (i) 07:53 and 10:07 (ii) 19:53 and 22:07

Question 3

- (a) There was general misinterpretation of the question here, with only the very best actually commenting on how the **difference in height** between the curves varies with time. Even these observations lacked the idea of the approximation being a good fit in a particular time interval. A high proportion of candidates attempted to describe how **different** the heights were and generally made comments about one being above the other until about 11 and then the positions being reversed. This received only partial credit. Other candidates simply described the shapes of the two graphs. Very few commented on how close they became before they diverged. Some candidates thought that detailing the different heights of the two points was sufficient – not realising that a comment should be a form of words, not what was basically a table of values.
- (b) Candidates found this challenging, but it was pleasing to see a reasonable number of correct answers for this part. However, many candidates did not seem to appreciate that a translation was the appropriate transformation to apply and attempted to stretch the curve for D . It is likely that these candidates had not observed that they were considering t between 3 and 9 only. Some candidates need to take more care in writing down given equations, as many were possibly miscopied rather than modified.

Answer: $0.022t^3 - 0.403t^2 + 1.9t + 0.4$

Question 4

Again, it was the problem of converting between minutes and hours that affected many solutions. Some good candidates, who clearly knew what method needed to be applied, were penalised because they thought that 25 minutes was 0.25 hours. Given that modelling often involves converting units, candidates may improve if they practise this skill. Candidates who understood what was required in **Question 2(c)** generally did so in this part also.

Answer: $1.2\sin(29t)^\circ + 2$

Question 5

Candidates found this question very challenging and it was extremely rare to see anything relevant. Use of $\begin{pmatrix} \pm 24 \\ 0 \end{pmatrix}$ was common among those who understood how to transform their equation to produce a horizontal translation. Often the answer given was identical to **Question 4**, showing a lack of appreciation of the effect of the extra 25 minutes. It was not uncommon among those who were incorrect to see attempts to modify the equation from **Question 4** to produce a reflection in one or other of the co-ordinate axes. Other candidates gave a general form along the lines of $1.2\sin(29(t - x))^\circ + 2$ without stating the specific value of x to answer the question in this case.

Answer: $1.2\sin(29(t - \frac{5}{6}))^\circ + 2$

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/62
Paper 62 (Extended)

Key Messages

In order to do well in this examination, candidates needed to give clear and well thought out answers to questions, with sufficient method being shown so that marks could be awarded. They should also remember that marks are awarded for their communication of mathematical ideas.

General Comments

Most candidates showed sufficient working to gain credit for communication. In this particular paper 10% of the marks were awarded for clear communication: showing appropriate steps in working and giving full descriptions of the calculations done. It was also encouraging to see some candidates making intelligent use of the graphics calculator to achieve solutions to equations. Several marks were lost through a lack of precision, whether in replacing fractions by decimals or in using standard terminology. Specifically, candidates are advised to keep decimal accuracy in their calculator and not truncate early. It was also expected that candidates should correctly use the terms *numerator* and *denominator* when given in the question. In the modelling task the use of the graphics calculator produced many good graphs but candidates should understand that any graphical representation of a model must be supported by some indication of a scale.

The level of algebraic skill shown in each task was of a high standard overall and there were many very good responses to both tasks. Since some answers were provided in the form of *Show that* questions, candidates had more opportunity to recover after a weak start to either task. In the modelling task nearly all candidates knew how to use the formulae relating speed, distance and time, and the responses to the modelling task showed an improvement over previous years. In general, candidates appeared more familiar with the context. There are still a few candidates who do not use a graphics calculator, a requirement for this paper.

Comments on Specific Questions

Part A: Investigation

Question 1

- (a) The majority of candidates had little difficulty with this question which introduced candidates to the method for evaluating repeated fractions. Credit was given for recognising that $\frac{1}{\frac{3}{2}}$ was equal to $\frac{2}{3}$.

Answer: $\frac{1}{1 + \frac{2}{3}}$

- (b) Candidates were expected to show the reduction of the repeated fraction in clear steps. Here there was an opportunity to show good communication. Some candidates had difficulty with the organisation of the horizontal divisor lines. Examiners looked for work that included the expression

$\frac{1}{1 + \frac{3}{5}}$. Several candidates omitted steps in their working writing, without explanation, that $\frac{1}{1 + \frac{1}{\frac{5}{3}}} = \frac{1}{\frac{8}{5}}$ which is insufficient for a *Show that* question. Those candidates who could show

enough steps of working to support their final answer were credited with showing good communication skills.

- (c) Candidates who had not managed to gain marks previously usually recovered here, and there were hardly any candidates who did not score full marks.

Answer: $\frac{8}{13}$ and $\frac{21}{34}$

- (d) In this question a description of how to find the numerator and the denominator was required, the simplest acceptable answer being that the numerator was the sum of the previous two numerators while the denominator was the sum of the previous two denominators. Some candidates were not clear enough in their response; either they did not distinguish between the words *term*, *number*, *numerator*, *denominator* or they did not make clear to which term of the sequence their answer referred. The phrase *Fibonacci Sequence* was sometimes used but with no description of how it was formed.

Question 2

- (a) Nearly all candidates were successful with this question and showed that they could use the pattern to find the terms of the sequence.

Answer: $\frac{10}{11}$ and $\frac{22}{21}$

- (b) This question asked candidates to describe in correct terms (*numerator*, *denominator*) how the pattern could be continued. The best answer for the numerator was to say that it was twice the previous denominator. Some candidates discovered other more complex rules which were valid. Many rules were possible provided that they described how the whole sequence could be continued.

Question 3

- (a) (i) The Examiners looked for the statement $x(1 + x) = 1$ as an essential step in solving this equation. Most candidates were able to do so and it was noticeable that candidates were very successful in the algebraic work of this part and the next.

- (ii) The application of the formula given at the top of the page caused little difficulty for most candidates. Some candidates showed good use of the graphics calculator accompanied by an appropriate sketch. Credit was given for communication for such sketches or for showing their substitution into the formula clearly. Some candidates gave both solutions rather than just the positive one required. While this was not penalised this time candidates should take care when reading what is required.

Answer: 0.618

- (iii) The large majority gave the correct answers here written correctly to three decimal places. A few incorrectly truncated and gave 0.617.

Answer: 0.615 and 0.618

- (b) (i) As in part (a)(iii) many correct answers were seen. In this paper there is no general instruction regarding the use of significant figures, so when a table has to be completed candidates should be guided by the elements in the table that have been given. This will ensure they have enough information for subsequent work. Some candidates spoiled their responses by not using the three decimal places that was given throughout both tables.

Answer: 0.909 and 1.048

- (ii) As in part (a) the good majority of candidates showed competent algebraic skills and solved this equation successfully. Credit for communication was given if the correct quadratic equation was

derived. The few who offered both solutions were again not penalised this time. Some were confused by the $x > 0$ restriction and interpreted > 0 as applying to their quadratic expression.

Answer: $x = 1$

(iii) This was the most challenging question in the investigation. Examiners looked for any statement that implied that the decimals were approaching 1. Some candidates successfully used the word *limit* (which was given on the previous page). Others did not make the link with the previous part, which the question asked them to do, but instead wrote about the way the decimals increased and decreased. This gained no credit. A few wrote that the decimals rounded to 1, which was insufficient.

(c) (i) This question introduced another variable into the familiar quadratic equation, causing difficulty for several candidates. Some interpreted the question as solving for N in terms of x and a few left the \pm sign in the expression. However there were many correct answers seen, showing again that candidates in general had good algebraic skills.

Answer: $x = \frac{-1 + \sqrt{1 + 4N}}{2}$

(ii) This question presented the key result of the investigation, that the repeated fraction

$$\frac{N}{1 + \frac{N}{1 + \frac{N}{1 + \frac{N}{1 + \dots}}}}$$

will indeed equal a positive integer for certain values of N . Those values are easiest found by using the equation in part (i) and writing it as $N = x^2 + x$. Substituting values for x then gives the required answer.

Most successful candidates used their answer to part (i) and found values of N that gave a perfect square for $1 + 4N$. Credit for communication was given to those who could explain their method but this part was rarely communicated clearly. A common error was to give the x values (1, 2, 3, ..) instead of the corresponding N values.

Answer: Any three from 2, 6, 12, 20, 30,

Part B: Modelling

Question 1

(a) Almost all candidates knew what to do but some responses lacked accuracy in that 0.33 was used for $\frac{1}{3}$.

(b) The large majority of candidates were successful in getting the correct number of minutes. Credit for communication was given for showing the calculation that gave the correct result.

Answer: 18

(c) Most candidates were able to make a sequence to find the correct answer.

Answer: Day 5

Question 2

This question was also well done by most candidates, with those who used 0.33h for 20minutes unable to obtain a precise enough answer.

Answer: 2.7km

Question 3

- (a) There were a large number of correct responses to this question, demonstrating confidence in handling an algebraic expression. Some candidates were not sure how to handle 1 hour and x minutes together in one expression so a denominator of 60 was sometimes missing or wrongly placed. Several acceptable alternative forms of the correct answer were seen. Some candidates, probably through reading the simplification given in part (b), appeared to be working backwards from part (b), often with little success.

Answer: $D = 6.4\left(\frac{x}{60}\right) + 8.1\left(1 - \frac{x}{60}\right)$

- (b) Most candidates who had a correct formula in part (a) were able to derive the given model, tackling the algebra competently. Those with an incorrect formula in part (a) could not receive credit here.
- (c) With a graphics calculator, candidates were able to make a sensible sketch of the model and the large majority of candidates gained full credit here.
- (d) The most common error in this question was to substitute 60 rather than 30 into the formula for the model. There were few incorrect answers. Credit was given for communicating the numerical expression used to calculate the correct answer.

Answer: 7.25km

- (e) This question required several steps and credit for communication was given to those who clearly showed how to work out the distance remaining for running. Most candidates showed good understanding of the speed, distance, time relationship and answered correctly. For others the processes were too numerous for them to arrive at a sensible conclusion.

Answer: 12.5km/h

- (f) (i) The introduction of a second parameter in this question reduced the number of correct answers. As before, several candidates had difficulty in handling the mix of hours and minutes.

Answer: $D = 6.4\left(\frac{x}{60}\right) + 8.1\left(\frac{y}{60}\right) + 12.5\left(1 - \frac{x+y}{60}\right)$

- (ii) Many showed good algebraic skills in rewriting their expression and arriving at the given expression. Errors were seen in the use of brackets or fractions when subtracting the sum of two quantities.
- (g) (i) Even candidates who were unsuccessful in part (f) usually gained the mark here for replacing x and y by n in the expression given in part (f)(ii).

Answer: $\frac{1}{60}(750 - 10.5n)$

- (ii) In this question candidates were expected to use a scale of their choice on the vertical axis. Without such a scale no credit could be given. A sketch should indicate approximately the main features of a graph, one of which is a vertical intercept. A suggestion that the line crossed the vertical axis around 12.5 was required. The more successful candidates went further and labelled the right end of the line segment as (30, 7.25). Those candidates who did not give any further information were expected to show a line with a negative gradient which was reasonable for the scale they had indicated. In a modelling task it may often be the case that scales are not specifically stated and so a necessary skill for candidates is finding and using sensible scales for graphs. Some candidates were very casual in marking such a scale, often giving a number which bore little relationship to the position of the intercept on the vertical axis.
- (iii) This question required candidates to interpret the significance of n in the model in part (i). The correct response was to say that, when $n = 0$, Viola only runs. For some candidates the words *when $n = 0$* implied that 0 minutes had elapsed since the start of training and so they wrongly

concluded that Viola was at the start of her training and was not moving. A few candidates said that Viola did 12.5 km, which was accepted as a valid interpretation.

- (iv) As in part (iii) there were several candidates who misinterpreted the question. The correct answer was to make a statement equivalent to writing that Viola was not running. Interpretation of a model with regard to the context still causes candidates difficulty.
- (v) For this last question on the paper very few correct responses were seen. It was, however, the case that even candidates who were not especially strong in the earlier parts could follow through the previous questions and correctly replace 1 by H . The most common error was to place the H outside the brackets.

Answers: $\frac{1}{60}(486H - 1.7x)$ and $\frac{1}{60}(750H - 6.1x - 4.4y)$

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/63
Paper 63 (Extended)

Key Messages

Candidates could score for unsimplified algebraic rules. However it is normally easier to see patterns and generalise if rules are simplified.

Inequalities need to be properly understood, particularly when placed in a context. All the inequalities in this paper required understanding of the context and this area seemed especially weak.

General Comments

In general candidates scored better on the Investigation (**Part A**) than the Modelling (**Part B**) with some weaker candidates giving up fairly early on this section. In general, there was good evidence of communication in both sections and no evidence of candidates running out of time.

Comments on Specific Questions

Part A: Investigation

Question 1

- (a) For most candidates this was an accessible start to the paper with the majority able to give correct combinations and use a cross when appropriate. Some weaker candidates gave combinations using numbers other than those asked for or invalid calculations such as $2 \times 2 \times 2$.

Answer: $[1 \times]2 + [1 \times]3$ 4×2 or $[1 \times]2 + 2 \times 3$

X $[1 \times] 5$

2×2 $[1 \times] 2 + [1 \times]7$

- (b) Plenty of correct generalisations were seen here but many weaker candidates gave 5 as their answer not realising that a generalisation was required.

Answer: $y - 2$

Question 2

- (a) Again many correct combinations were seen.

Answer: $[1 \times]3 + [1 \times]5$ 2×5

3×3 $2 \times 3 + [1 \times]7$

X $[1 \times]3 + [1 \times]8$

- (b) Many candidates could see that only multiples of 3 could be formed whereas weaker candidates often just repeated the question pointing out that 3 and 6 have a common factor.

Answer: you only get multiples of 3

Question 3

Many correct answers were seen to both parts here, often in unsimplified form such as $5(y - 1) - y$. Weaker candidates lost some marks if they did not use brackets accurately with answers such as $5y - 5 + y$.

Answers: (a) $4y - 5$ (b) $6y - 7$

Question 4

- (a) The table here provided a useful prompt for some candidates to check the form of their generalisations and it was not unusual to see algebra corrected here.

Answer: $12y - 13$

- (b) It was pleasing to see so many correct two-variable generalisations here although again some candidates were let down by their use of brackets.

Answer: $(x - 1)y - x$

Question 5

- (a) The majority of candidates could apply their formula here. Some misunderstood the demand and gave an answer of $24y - 25$ and the weakest left it blank.

Answer: 551

- (b) Many correct answers were seen, often with good communication of method.

Answer: $5 \times 24 + 8 \times 25$

Question 6

- (a) The question asked candidates to use *their answer* to part 4(b) therefore Examiners were simply looking for *their answer* with 1 added. Other forms did not demonstrate that this connection had been spotted.

Answer: *their 4(b)* + 1

- (b) Most candidates realised that this question was asking for an algebraic justification. However weaker candidates simply tried to verify the formulas by substituting values. This gained no credit.

- (c) Even some of the weakest candidates could make some headway in this part often scoring 2 marks for identifying 2 or 3 pairs of integers.

Answer: 2, 25: 3, 13: 4, 9: 5, 7

Part B: Modelling

Question 1

Many candidates struggled with this modelling task and only the strongest managed 2 marks on this inequality. Some scored 1 for identifying the lower limit as 0 but 25 was the most common upper limit.

Answer: $0 < x < 12.5$

Question 2

This was probably the most successful question on this section for many candidates. Some candidates gave their answer as $(25 - 2x)^2$ presumably thinking of the central square rather than the whole net or possibly doing an incorrect difference of two squares on their correct answer.

Answer: $625 - 4x^2$

Question 3

There were many correct answers seen to this part. Weaker candidates gave an expression related to an area rather than a length. Some found a correct expression but thought that simplifying it meant dividing the expression by 2 or 4.

Answer: $100 - 4x$

Question 4

- (a) Many candidates could derive the given expression for the volume using length \times width \times height. Some struggled with the algebra, often missing the x term in $(25 - 2x)^2$. The weakest attempted an explanation of what each of the terms represented, rarely scoring any credit.
- (b) Good candidates could give valid reasons for the potential inaccuracy of the model such as a reason based on thickness of seal or the folds but a few disregarded the question stating that the measurements might not be accurate.

Answer: e.g. loss of metal through cutting

- (c) Most candidates could use their graphics calculator to produce a sketch. However only the better candidates considered the appropriate domain ($0 < x < 12.5$) or indicated the scale on the axes.
- (d) Most candidates could use their calculator to find the maximum value.

Answer: 1160

Question 5

Only the strongest candidates managed to score from this point on, with the majority not understanding whether questions were asking about x values or V values.

- (a) Very few correct answers or part answers were seen to this inequality, with only the strongest realising the need to solve $V = 1000$. Answers involving 1157 were common.

Answer: $2.5 < x < 6.1$

- (b) Very few realised the need to use their model from **Question 2** here and fewer still had a sensible inequality in part (a) to use.
- (c) Hardly any realised they had to solve their model from **Question 2** equal to 500.

Answer: $5.59 < x < 6.1$

Question 6

- (a) A few of the stronger candidates realised they had to use their models from **Question 2** and **Question 3** but some did not appreciate the different unit prices. It was important here that candidates showed their method clearly if Examiners were to award marks.

Answer: $2(625 - 4x^2) + (100 - 4x) + 500$

- (b) Again, clear working was important and good candidates showed 1.2C or some equivalent such as $\frac{C}{5} + C$.

Answer: 1.2(*their (a)*)

- (c) Only very few candidates made it this far, realising the need to use *their* answers from **Question 5(a)** and **Question 6(b)**.

Answer: *their (b)* with $x = \textit{their 6.1}$ from **5(a)**