CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/11

Paper 11 (Core)

Key messages

To succeed in this paper, candidates need to have complete coverage of the full Core syllabus. They need to be able to apply formulae and show all necessary working clearly.

General comments

All working must be shown to enable candidates to access method marks in case 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 others towards the end of the paper. For questions in context, candidates should check that their answers make sense, for example the extra money that Ahmed earns in **Question 4**.

The questions that were answered best were **Questions 1**, **2**, **3**, **5(a)**, **11(a)**, **11(b)** and **12**. Those that proved to be the most challenging were **Questions 6(b)**, **6(c)**, **7**, **8**, **9** and **10(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**, graphs of functions and **Question 10(c),** equation of a line; both of these are demanding topics.

Comments on specific questions

Question 1

Candidates did well with this opening question. Candidates should check whether they are asked for all numbers from a list that satisfy a description or just a single number. In this question there was only one answer each time. Some gave 69 as a prime number. A common wrong choice for **part (c)** was 10, the highest common factor or 20 and 30 rather than the lowest common multiple. Occasionally, candidates gave 2 but this value was not on the list. In this situation, candidates should focus on the word 'multiple' rather than thinking they are looking for a number less than the given values.

Answers: **(a)** 63 **(b)** 61 **(c)** 60

Question 2

(a) The most common incorrect answer to this part was 0.4 and when candidates converted this to a percentage in **part (b)**, this could become 4%, 14%, 0.4% or 400%.

(b) This part was more likely to be correct even if **part (a)** was wrong which seems to indicate that not all candidates treated the two parts as connected. Candidates who gave an incorrect answer in **part (a)** could still gain the mark in this part if they followed through their original incorrect answer.

Answer: **(a)** 0.25 **(b)** 25%

Question 3

(a) Candidates did very well here with nearly all giving the correct answer.

(b) Again, this was answered well, although some gave C, 3, 4 or 5 as their answer.

(c) Most found the number of candidates correctly but 15 (from adding together the numbers on the frequency axis) or 5 (number of candidates who got the modal grade) or 10 (following an arithmetic slip) were given a few times.

(d) In this final part, a few misread the question or the chart and found the difference between adjacent grades B and C.

Answers: **(a)** 2 **(b)** B **(c)** 11 **(d)** 4

Question 4

This question was done well by a large number of candidates. However, a variety of errors were seen. The first error was for some candidates to use 2% as 0.2 rather than 0.02. Some wrote the correct method as 2 500 × 0.02 but then gave this as equal to \$2 502 or \$2 498. Some found the \$50 extra that Ahmed earned but did not add it on. With percentage questions in particular, candidates should check that they have answered the question asked e.g. is it the extra amount that is asked for or the new total?

Answer: 2 550

Question 5

In this question, some candidates confused perimeter with area and reversed the answers and so were unable to gain any marks.

(a) From the workings of some candidates, it could be seen that sometimes the two sides at the top right of the shape were ignored. Some gave 6 (from the number of sides), 256 (16^2) or made slips when adding all the lengths together.

(b) For the area, some candidates quoted the formula for the area of a rectangle or triangle giving the answers 16 or 8 respectively. Candidates also tried to multiply all the 6 side lengths together.

Answers: **(a)** 16 **(b)** 12

Question 6

(a) The incorrect fractions, $\frac{1}{10}$, $\frac{4}{6}$, $\frac{1}{9}$ and $\frac{1}{4}$ as well as answers in an incorrect form such as 3:5 or 6:4 were seen.

(b) Many candidates were unsure of how to label the tree diagram even though they were then able to continue and work out correct probabilities. Some candidates did not follow through from their answers to **part (a)** when it came to completing the tree diagram. Candidates used integers or letters (P and M). However, most who filled in the first stage correctly went on to realise that the second stage would be in ninths as one chocolate had been taken from the ten already.

(c) For the final part, answers were often greater than 1 (an impossible value for a probability) or in a ratio when the candidate had used fractions before. Those who had a usable tree diagram often added the probabilities rather than multiplied them.

Answers: **(a)** $\frac{4}{10}$ **(b)** Correct fractions on branches **(c)** $\frac{12}{90}$

Question 7

Candidates should be aware that correct names for transformations must be used, both here and in **Question 9**. In general, transformation questions that are worth 3 marks tend to be rotations or enlargements as there are three pieces of information that candidates must give. Those questions worth 2 marks are mostly reflections or translations. In this case, as the image is the same size, this is a rotation. This shape has been rotated through 90° anticlockwise so that is the second piece of information. The most complex procedure is to find the centre of rotation. The simplest centres to consider are the vertices of the shape itself but as *Q* is not touching *P*, this is not the case. The origin is the next to consider and here, this is the answer. Candidates can use tracing paper to help them in the hunt for the centre. Candidates need to take note that, with transformation questions, it is usually a **single** transformation is required. This means that the candidates who wrote rotation and translation got no marks.

Answer: Rotation of 90° anticlockwise about origin (or (0, 0))

Question 8

Most candidates attempted this challenging question. This was more of a problem solving question in the context of angles in circles rather than an application of π and thus needs breaking down into smaller steps. The most straightforward method was to realise that the sector was a third of a whole circle so that the arc length was a third of the total circumference so the calculation was 300 ÷ 3 = 100. Some candidates tried to include the 2 radii in their calculations. Others used π which would have worked as it would have cancelled at the end. However, some candidates tried to use 3.142 in their calculations and then had rounding errors. Incorrect answers include 240 (300 – 120), 900 (300 × 3), 60, (180 – 120) and 90. Some gave the correct method, 300 × (120/360) but then made errors when calculating.

Answer: 100

Question 9

Candidates found this question hard, and quite a few candidates omitted it. The two functions given only translated the function, but most diagrams showed reflections or made some other change to the given function. However, many candidates gave translation as the answer to **part (c)** even if their vector was not correct. As with **Question 7**, the correct wording must be used so ‘move’, ‘slide’, ‘shifted’, ‘transfer’ and ‘has gone’ are all unacceptable descriptions.

Answers: **(a)** Correct graph **(b)** Correct graph **(c)** Translation $\begin{pmatrix} 0 \\ -2 \end{pmatrix}$

Question 10

(a) Candidates generally did well in this part. A common error was for candidates to confuse the co-ordinates so placing *Q* at (– 2, 6). A significant number of candidates placed *Q* at (4, 2)**.**

(b) Candidates answered this part of the question well.

(c) Candidates often have difficulties finding the equation of a line. There are two pieces of information that must be found, the gradient of the line and where the line crosses the *y*-axis. Here, the candidates did not need to calculate the gradient but rather to know that gradients of parallel lines are the same so this gradient is going to be $\frac{1}{4}$. As the line crosses the *y*-axis at *R* then the constant comes from the co-ordinates found in **part (b)**. For this equation of a line, no calculations were needed as the information was contained in the question and the candidates’ own answers.

Answers: **(a)** (4, 0) **(b)** (0, –1) **(c)** $y = \frac{1}{4}x - 1$

Question 11

(a) Candidates did very well in this part, although some candidates applied the minus sign to the 4*d* as well as to the number 1. Some collected all the terms involving *d* but did not combine the integers.

(b) Although this part was also answered well, occasionally candidates did not use multiplication to expand the brackets, but rather gave 12 or 5*n* as part of their answer. In a very few cases, candidates got to the correct answer but then 'combined' the terms to give 8*n*.

(c) In this part, some candidates only part-factorised the expression or combined the two terms to give answers such as –6*xy*.

Answers: **(a) (i)** $4 + 7d$ **(ii)** t^4 **(b)** $32 – 24n$ **(c)** $3x(3x – 5y)$

Question 12

Many candidates did well solving the equation. Some candidates appeared to confuse themselves by doing too many steps in one go. It is best to deal with the *q* terms as one step before moving on to collect the number terms on the other side of the equation. Candidates must remember if the answer is a decimal that terminates as is the case here, rounding is not appropriate.

Answer: 1.1

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/12

Paper 12 (Core)

Key messages

To succeed in this paper, candidates need to have complete coverage of the full Core syllabus. They need to be able to apply formulae and show all necessary working clearly.

General comments

All working must be shown to enable candidates to access method marks in case their final answer is wrong. This will also help the candidates to check their own work. This is vital in two-step problems, in particular with algebra and others towards the end of the paper. For questions in context, candidates should check that their answers make sense, for example the cost of hiring a machine in **Question 9(a)**.

The questions that presented least difficulty were **Questions 1**, **2**, **4(a)**, **4(b)**, **6(a)**, **9(b)** and **(c)**. Those that proved to be the most challenging were **Questions 4(c)**, **8**, **11**, and **12**. In general, candidates attempted the vast majority of questions rather than leaving them blank. Virtually all candidates attempted all parts of the first six questions. The questions that showed a number of blank responses were **Question 9(d)**, solving inequalities, **Question 11(a)(ii),** finding the interquartile range and **Question 12**, use of similar triangles; all topics that many candidates find demanding.

Comments on specific questions

Question 1

In general, candidates coped very well with this opening question. Common wrong answers to **part (a)** include 5300 (a truncation), 392 (digits in the hundreds) and 540 or 539.2 from misunderstanding the instruction to correct the number to the nearest 100. These types of errors were often repeated in **part (b)**.

Answers: **(a)** 5400 **(b)** 5390

Question 2

This question was not done as well as the previous one, but most candidates gained some marks. A slight twist to this question was that there was a choice of answers to three of the four parts and this apparent freedom may have momentarily confused candidates. Candidates were only expected to give a single answer but if they gave more than one answer, all had to be correct. A vast majority only gave answers from the list. Occasionally in **part (b)**, 20 was expressed as a product of its factors and, as the prime factor, 2, was not on the list, this answer did not gain the mark. For **part (d)**, 27 was a popular incorrect choice.

Answers: **(a)** 4 **(b)** 4 or 5 or 20 **(c)** 5 or 20 **(d)** 5 or 11 or 43

Question 3

Most candidates answered this question. Wrong answers included 6 sides, 6 angles or hexagon. The angle 60°, either by itself or coupled with a 6, did not score the mark. Candidates must take care to note the difference between lines of symmetry and the order of rotational symmetry. The answer 3, seemed to come from lines of symmetry drawn connecting point to point and those who gave 4 as their answer added in the vertical line.

Answer: 6

Question 4

(a) It was fairly common for candidates to ignore the correct order of operations and give 8 as their answer. The answer 10, seen in a few places was from adding the 4 on to the 6 instead of subtracting.

(b) A common incorrect answer to this part was 512, from multiplying 128 by 4 instead of carrying out the division.

(c) Many candidates had problems handling the negative index in this part, giving –8 (-2^3), –6 (2×-3), –9 (derived from 3^2), –1 (2 – 3) or 8.

Answers: **(a)** 2 **(b)** 32 **(c)** $\frac{1}{8}$

Question 5

In this type of question, candidates would be well-advised to show some working to help them decide on the relative size of the numbers. However, even those that did convert values to decimals still had problems deciding the correct order.

Answer: $\frac{1}{5}$ **<** 25% < 0.3 < $\frac{1}{3}$

Question 6

(a) In this part, some candidates drew a triangle that on first sight looked like the correct reflection but the triangle's apex was at (–3, 3) instead of (–4, 3) turning this into a translation. Some reflected the shape in the wrong line, most commonly the *x*-axis.

(b) The rotation was more challenging for candidates. Quite a large number produced a rotation of the correct orientation but used the wrong centre.

Answers: **(a)** Correct reflection drawn **(b)** Correct rotation drawn

Question 7

(a) The placing of point *C* varied widely with some candidates producing angle *CAB* = 56°. Sometimes the line to point *C* started at *A* or the centre of the line *AB* instead of at *B*. Those that drew the angle *ABC*, were, generally, accurate.

(b) In this part, many candidates gave an answer of 108° which is the obtuse angle between the north line and the line joining *P* and *Q*. This is the first stage of the solution, as this angle must then be taken away from 360°. Another method of solution is to add the given 72° to 180°.

Answers: **(a)** Correctly drawn angle **(b)** 252°

Question 8

Those who chose Timi were not always correct with their reason, but many gave a good attempt at explaining that more spins means a more accurate estimate of probability. Candidates incorrectly wrote 'Mark as his probability is higher', 'Mark as the probability is easy to work out as it is out of 100'. Other candidates choose Elaine and gave incorrect reasoning which was difficult to categorise.

Answer: Timi – number of times the spinner is spun is greater

Question 9

(a) Often **parts (i)** and **(ii)** were both right or both wrong with the common wrong pair of answers being \$150 and \$525, from not observing the correct order of operations.

(b) Candidates performed much better in this part, where occasionally the wrong answers of $7x - 3y$ or $3x + 3y$ were able to score for a correct term given.

(c) & (d) In these parts candidates needed to show their workings so that marks could be given if the final answer was not correct and to enable the candidates to check their own work. Candidates were less comfortable working with the inequality in **part (d)** than the equality in **part (c)**. It was a shame that those that managed well with **part (d)** then wrote their answer as $x = 2.5$.

(e) In general, candidates found it difficult to solve the simultaneous equations. A common error was to subtract the second equation from the first but instead of the right hand side equalling 24, it became 14 from 19 – 5.

Answers: **(a)(i)** 100 **(ii)** 225 **(b)** $7x + 3y$ **(c)** 6 **(d)** $x \le 2.5$ **(e)** [x =] 12, [y =] –17

Question 10

The area of the square was often given as 12 cm^2 (from 3 × 4) and the area of each triangle given as 6 cm^2 (from 3 × 2) or 5 cm^2 (from 3 + 2) rather than 3 cm^2.

Answer: 21

Question 11

This question as a whole was not done well and had the most number of blank responses. Many gave the median as 25 from reading the cumulative frequency axis instead of the time for the 25^{th} customer. If candidates get confused with which axis to read, a look at the units written on the answer line should remind them of what to do. The interquartile range was not done well but many candidates did remember that a subtraction of two values was required. It was pleasing to see that even if candidates had not answered the first two parts, they often went on to read the graph at 10 minutes correctly.

Answers: **(a)(i)** 9 to 9.5 **(ii)** 5.25 to 6.25 **(b)** 28

Question 12

This question was a multi-step problem that needed to be broken down into smaller tasks. Many realised that they were dealing with similar triangles and found the ratio of a correct pair of sides. They then went on to find *AD* correctly. However, this was not the end of the problem as the question wanted *ED* so candidates were expected to then subtract *AE* from *AD* to leave the length of *ED*.

Answer: 2

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/13

Paper 13 (Core)

Key messages

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General comments

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The questions that were answered best were **Questions 1**, **2**, **3**, **5(a)**, **11(a)**, **11(b)** and **12**. Those that proved to be the most challenging were **Questions 6(b)**, **6(c)**, **7**, **8**, **9** and **10(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**, graphs of functions and **Question 10(c),** equation of a line; both of these are demanding topics.

Comments on specific questions

Question 1

Candidates did well with this opening question. Candidates should check whether they are asked for all numbers from a list that satisfy a description or just a single number. In this question there was only one answer each time. Some gave 69 as a prime number. A common wrong choice for **part (c)** was 10, the highest common factor or 20 and 30 rather than the lowest common multiple. Occasionally, candidates gave 2 but this value was not on the list. In this situation, candidates should focus on the word 'multiple' rather than thinking they are looking for a number less than the given values.

Answers: **(a)** 63 **(b)** 61 **(c)** 60

Question 2

(a) The most common incorrect answer to this part was 0.4 and when candidates converted this to a percentage in **part (b)**, this could become 4%, 14%, 0.4% or 400%.

(b) This part was more likely to be correct even if **part (a)** was wrong which seems to indicate that not all candidates treated the two parts as connected. Candidates who gave an incorrect answer in **part (a)** could still gain the mark in this part if they followed through their original incorrect answer.

Answer: **(a)** 0.25 **(b)** 25%

Question 3

(a) Candidates did very well here with nearly all giving the correct answer.

(b) Again, this was answered well, although some gave C, 3, 4 or 5 as their answer.

(c) Most found the number of candidates correctly but 15 (from adding together the numbers on the frequency axis) or 5 (number of candidates who got the modal grade) or 10 (following an arithmetic slip) were given a few times.

(d) In this final part, a few misread the question or the chart and found the difference between adjacent grades B and C.

Answers: **(a)** 2 **(b)** B **(c)** 11 **(d)** 4

Question 4

This question was done well by a large number of candidates. However, a variety of errors were seen. The first error was for some candidates to use 2% as 0.2 rather than 0.02. Some wrote the correct method as 2 500 × 0.02 but then gave this as equal to $2 502 or $2 498. Some found the $50 extra that Ahmed earned but did not add it on. With percentage questions in particular, candidates should check that they have answered the question asked e.g. is it the extra amount that is asked for or the new total?

Answer: 2 550

Question 5

In this question, some candidates confused perimeter with area and reversed the answers and so were unable to gain any marks.

(a) From the workings of some candidates, it could be seen that sometimes the two sides at the top right of the shape were ignored. Some gave 6 (from the number of sides), 256 (16^2) or made slips when adding all the lengths together.

(b) For the area, some candidates quoted the formula for the area of a rectangle or triangle giving the answers 16 or 8 respectively. Candidates also tried to multiply all the 6 side lengths together.

Answers: **(a)** 16 **(b)** 12

Question 6

(a) The incorrect fractions, $\frac{1}{10}$, $\frac{4}{6}$, $\frac{1}{9}$ and $\frac{1}{4}$ as well as answers in an incorrect form such as 3:5 or 6:4 were seen.

(b) Many candidates were unsure of how to label the tree diagram even though they were then able to continue and work out correct probabilities. Some candidates did not follow through from their answers to **part (a)** when it came to completing the tree diagram. Candidates used integers or letters (P and M). However, most who filled in the first stage correctly went on to realise that the second stage would be in ninths as one chocolate had been taken from the ten already.

(c) For the final part, answers were often greater than 1 (an impossible value for a probability) or in a ratio when the candidate had used fractions before. Those who had a usable tree diagram often added the probabilities rather than multiplied them.

Answers: **(a)** $\frac{4}{10}$ **(b)** Correct fractions on branches **(c)** $\frac{12}{90}$

Question 7

Candidates should be aware that correct names for transformations must be used, both here and in **Question 9**. In general, transformation questions that are worth 3 marks tend to be rotations or enlargements as there are three pieces of information that candidates must give. Those questions worth 2 marks are mostly reflections or translations. In this case, as the image is the same size, this is a rotation. This shape has been rotated through 90° anticlockwise so that is the second piece of information. The most complex procedure is to find the centre of rotation. The simplest centres to consider are the vertices of the shape itself but as *Q* is not touching *P*, this is not the case. The origin is the next to consider and here, this is the answer. Candidates can use tracing paper to help them in the hunt for the centre. Candidates need to take note that, with transformation questions, it is usually a **single** transformation is required. This means that the candidates who wrote rotation and translation got no marks.

Answer: Rotation of 90° anticlockwise about origin (or (0, 0))

Question 8

Most candidates attempted this challenging question. This was more of a problem solving question in the context of angles in circles rather than an application of π and thus needs breaking down into smaller steps. The most straightforward method was to realise that the sector was a third of a whole circle so that the arc length was a third of the total circumference so the calculation was 300 ÷ 3 = 100. Some candidates tried to include the 2 radii in their calculations. Others used π which would have worked as it would have cancelled at the end. However, some candidates tried to use 3.142 in their calculations and then had rounding errors. Incorrect answers include 240 (300 – 120), 900 (300 × 3), 60, (180 – 120) and 90. Some gave the correct method, 300 × (120/360) but then made errors when calculating.

Answer: 100

Question 9

Candidates found this question hard, and quite a few candidates omitted it. The two functions given only translated the function, but most diagrams showed reflections or made some other change to the given function. However, many candidates gave translation as the answer to **part (c)** even if their vector was not correct. As with **Question 7**, the correct wording must be used so ‘move’, ‘slide’, ‘shifted’, ‘transfer’ and ‘has gone’ are all unacceptable descriptions.

Answers: **(a)** Correct graph **(b)** Correct graph **(c)** Translation $\begin{pmatrix} 0 \\ -2 \end{pmatrix}$

Question 10

(a) Candidates generally did well in this part. A common error was for candidates to confuse the co-ordinates so placing *Q* at (– 2, 6). A significant number of candidates placed *Q* at (4, 2).

(b) Candidates answered this part of the question well.

(c) Candidates often have difficulties finding the equation of a line. There are two pieces of information that must be found, the gradient of the line and where the line crosses the *y*-axis. Here, the candidates did not need to calculate the gradient but rather to know that gradients of parallel lines are the same so this gradient is going to be $\frac{1}{4}$. As the line crosses the *y*-axis at *R* then the constant comes from the co-ordinates found in **part (b)**. For this equation of a line, no calculations were needed as the information was contained in the question and the candidates’ own answers.

Answers: **(a)** (4, 0) **(b)** (0, –1) **(c)** $y = \frac{1}{4}x - 1$

Question 11

(a) Candidates did very well in this part, although some candidates applied the minus sign to the 4*d* as well as to the number 1. Some collected all the terms involving *d* but did not combine the integers.

(b) Although this part was also answered well, occasionally candidates did not use multiplication to expand the brackets, but rather gave 12 or 5*n* as part of their answer. In a very few cases, candidates got to the correct answer but then 'combined' the terms to give 8*n*.

(c) In this part, some candidates only part-factorised the expression or combined the two terms to give answers such as –6*xy*.

Answers: **(a) (i)** $4 + 7d$ **(ii)** t^4 **(b)** $32 - 24n$ **(c)** $3x(3x - 5y)$

Question 12

Many candidates did well solving the equation. Some candidates appeared to confuse themselves by doing too many steps in one go. It is best to deal with the *q* terms as one step before moving on to collect the number terms on the other side of the equation. Candidates must remember if the answer is a decimal that terminates as is the case here, rounding is not appropriate.

Answer: 1.1

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/21

Paper 21 (Extended)

Key messages

In order to do well in this examination, candidates need to have full knowledge of the syllabus and, in particular, should remember to simplify their answers and to take care with signs when expanding algebraic terms.

General comments

Candidates were well prepared for the paper and demonstrated very good algebraic skills and knowledge of the syllabus. Candidates used their time efficiently and usually attempted all of the questions. There were, however, instances of numerical slips, particularly with negative numbers and simple arithmetic operations, which could have been avoided. Candidates should always leave their answers in their simplest form, as specified on the front of the examination paper.

Comments on specific questions

Question 1

Many candidates obtained the correct answer by writing the numbers out in full with all their zeros, rather than the more eloquent use of 12.1×10^8 or 0.177×10^9. The exact answer, and not the commonly given rounded answer of 1.39×10^9, was required for full marks. A very common error was a final answer of 2.98×10^{17}.

Answer: 1.387×10^9

Question 2

(a) Nearly all candidates found the co-ordinates of the midpoint. Errors arose from arithmetic errors or from subtracting the *x* and *y* co-ordinates.

(b) There were many correct answers but there were a noticeable number of candidates who made careless arithmetic slips with the negative numbers. In addition, some candidates used run/rise.

(c) (i) Most candidates understood the need to find the negative reciprocal of their gradient from part **(b)** and for many candidates this question was straightforward. Some candidates did not earn the second mark as they were unable to simplify the reciprocal of a fraction. Candidates should remember that, when asked for an equation, the "y =" is a required part of the answer to gain full marks.

(ii) From a correct **2(c)(i)**, a correct answer was often seen. A common error was $x = \frac{8}{3}$. $x = \frac{-4}{1.5}$ was not accepted as it is not in its simplest form. Many candidates scored a follow through mark from their **2(c)(i).**

Answer: **(a)** (1, 3) **(b)** $-\frac{2}{3}$ **(c)(i)** $y = \frac{3}{2}x + 4$ **(ii)** $-\frac{8}{3}$

Question 3

The majority of candidates solved the simultaneous equations efficiently and accurately. The preferred method was to equate coefficients rather than to use substitution. Most of the errors arose from arithmetic slips when dealing with the negative numbers.

Answer: $x = 3$, $y = –2$

Question 4

(a) A significant number of candidates converted fractions to incorrect decimals. The most common mistakes were 0.34 or 0.38 for "silver" and 0.8 for "other". The majority of candidates who tried long division were unsuccessful. Writing answers as correct fractions gained full marks.

(b) Most candidates set out their intention to calculate 0.2 x 18000 and were awarded the method mark. Many candidates did not work this out correctly, the most frequent incorrect answer being 360. A noticeable number of candidates misread 18000 as 1800.

Answers: **(a)** 0.39, (0.2), 0.18, 0.15, 0.08 **(b)** 3600

Question 5

(a) Candidates found this question challenging. Many candidates gave x = 50° by wrongly using "opposite angles in a cyclic quadrilateral" with the centre O as a vertex or $x = \frac{130}{2} = 65^\circ$. Very few candidates indicated that the reflex angle AOD = 230°. Even fewer candidates used the alternative approach of adding a further vertex on the major arc AD of 65°.

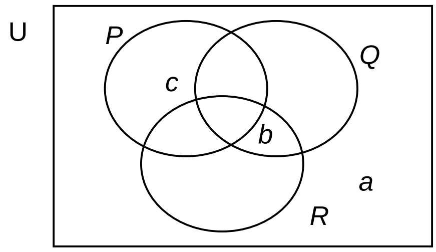
(b) This part was answered rather better, with many candidates scoring two follow through marks. Others gained one mark for their recognition that angle ACD was also x. Some candidates subtracted their x from 180° incorrectly.

Answers: **(a)** 115° **(b)** 65°

Question 6

This question was answered very well with many totally correct and clear answers. However, some candidates shaded the regions, which was not required, and this often led to ambiguous answers.

Answer:



Question 7

This question was answered very well by many candidates. However, some candidates appeared unfamiliar with the topic of logarithms and omitted this question.

(a) These parts were answered correctly by the majority of candidates answering the question. The most common errors were 10^3 for part **(i)** and 2 or –3 for part **(ii)**.

(b) Most candidates who attempted this part were able to show good knowledge of the rules of logarithms and, in particular, correct use of $2\log 5 = \log 5^2$.

Answers: **(a)(i)** 3 **(ii)** –2 **(b)** p = 12.5

Question 8

Many candidates were able to demonstrate an excellent understanding of areas and sectors as well as an accurate manipulation of numbers. The best candidates recognised the correct approach to keep π as a symbol and cancel it from both sides of their equations. Final answers needed to be written in their simplest form with the removal of the surds. Those candidates who replaced π by a numerical approximation, more often than not, quickly ran into difficulty with the arithmetic and could not obtain the exact answer required. Other candidates lost the last mark for not being able to simplify their square root to 7.5. Whilst many solutions were excellently presented, other candidates' solutions were not clear or easy to follow. Candidates should be aware that Examiners must be able to follow working if partial credit is to be awarded.

Answer: 7.5

Question 9

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

(a) The common errors were to write $2\sqrt{5}$ for $5\sqrt{2}$ or to spoil their answer by combining $5\sqrt{2}+2\sqrt{2}$ incorrectly.

(b) Those candidates who expressed the question as two adjacent brackets were more likely to correctly expand the brackets and identify the four terms. Candidates were not always then able to correctly simplify the expression. Those who did not write the two brackets out commonly gave an incorrect answer of 28 (from 3 + 25).

Answers: **(a)** $7\sqrt{2}$ **(b)** $28+10\sqrt{3}$

Question 10

There were many fully correct and mathematically well-presented solutions seen. Candidates who multiplied the bracket out first had most success. Most candidates then attempted to move the terms in *x* to one side but this sometimes included a sign error. The third step was the hardest for candidates to complete. They often factorised but were unsure how to divide by their "*a* – *b*".

Answer: $\dfrac{2by+3y}{a-b}$

Question 11

This question proved to be the most difficult on the paper. Whilst many candidates completed the question correctly there were a noticeable number who did not know how to proceed. Some candidates were able to work out the answers but did not simplify their answers or wrote them in an incorrect form.

Answers: $\mathbf{p} = \mathbf{a} + \mathbf{b}$, $\mathbf{q} = -\frac{1}{2}\mathbf{a} - \mathbf{b}$, $\mathbf{r} = 2\mathbf{b} - \mathbf{a}$

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/22
Paper 22 (Extended)

Key messages

In order to improve performance on this paper, candidates must:
- remember to simplify their answers, as specified in the rubric on the front cover of the question paper
- take care with signs when expanding algebraic terms
- remember that questions on exact values of trig ratios can be set on the non-calculator paper.

General comments

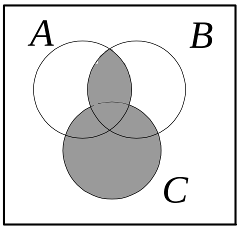
Candidates were well prepared for the paper and demonstrated very good algebraic skills and knowledge of the syllabus. However, many candidates lost marks through careless numerical slips, particularly with negative numbers and simple arithmetic operations. Candidates should always leave their answers in their simplest form, as specified on the front of the examination paper.

Question 1

(a) Many candidates answered the first part correctly, but the majority of candidates were unable to obtain a correct answer in the second part, with an incorrect answer of 16 regularly occurring.

(b) Candidates showed a good understanding of Venn diagrams with many scoring full marks.

Answers: **(a)(i)** 15 **(ii)** 26 **(b)**



Question 2

(a) Nearly all candidates answered this part correctly.

(b) This part tested the candidate's knowledge of the angle at centre theorem. Although there were many correct answers, an answer of 32.5° was seen in a number of scripts.

(c) This part discriminated between candidates. A significant number of candidates subtracted their answer in part **(b)** from 180.

Answers: **(a)** 65 **(b)** 130 **(c)** 115

Question 3

(a) There were many fully correct answers to this part, although a number of candidates enlarged *P* by a scale factor of 3 but used an incorrect centre of enlargement.

(b) Candidates need to use the correct mathematical terminology if they are to score full marks. The transformation is a stretch. Candidates who gave the correct transformation nearly all gave the scale factor of 3, but then did not identify that the *y*-axis was invariant. Although the question clearly stated that a single transformation was required, a number of candidates gave a combination of 2 transformations as their answer, which received no credit.

Answers: **(a)** Image at (–3, 1), (3, 1), (–3, –8) **(b)** Stretch, factor 3, *y*-axis invariant

Question 4

(a) Although there were many correct answers, a significant number of candidates divided the powers giving them an answer of $8x^8$.

(b) This question proved to be too demanding for all but the best of candidates. Candidates needed to handle both the negative and fractional index. This is an area of the specification which invariably proves challenging to candidates and so more practice would be beneficial.

Answers: **(a)** $8x^{14}$ **(b)** $-\frac{1}{3}$

Question 5

(a) The majority of candidates realised that they had to multiply throughout by $\sqrt{3}$, but a common stumbling block was the simplification of $\sqrt{3}\times\sqrt{3}$.

(b) This part discriminated well between candidates. Although there were many correct answers, a number of candidates multiplied throughout by $\sqrt{3}$ or by $\sqrt{3}-1$. Candidates who correctly eliminated the surd in the denominator usually completed the question correctly.

Answers: **(a)** $\frac{2\sqrt{3}}{3}$ **(b)** $\frac{\sqrt{3}+1}{2}$

Question 6

(a) Many candidates found this question challenging. Candidates had to realise that they needed to find the cube of 5 first before multiplying by 1200. Answers based on 216 were seen more frequently than the correct answer. Some candidates who started the question correctly were unable to give their answer in a correct standard form.

(b) This part was answered better than part **(a)**. Candidates were able to demonstrate their algebraic skills and many fully correct answers were seen. Some candidates tried to cube root as their first step in the question, but they were still able to earn 1 mark if they completed the question correctly following on from their initial mistake.

Answers: **(a)** 1.5×10^5 **(b)** $\sqrt[3]{\frac{y}{a}}$

Question 7

(a) Although there were correct answers to this part, it clearly demonstrated that many candidates are unsure about applying two rules of logs and the order in which they should be applied. Some candidates who arrived at the correct answer then spoilt their working by expanding the numerator and then incorrectly dividing by the denominator.

(b) Candidates found it difficult to translate the log equation into index form. A number of candidates who started the question correctly ended up with an answer of 64.

Answers: **(a)** $\log\left(\dfrac{(x+1)^2}{x-1}\right)$ **(b)** 81

Question 8

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

(b) It was pleasing to see many fully correct answers to this part of the question. There were a number of different approaches that led to the correct answer. Some candidates realised that the n^{th} term was dependent on n^2 but were unable to fully complete the question.

Answers: **(a)** 42 **(b)** $n(n+1)$

Question 9

This question discriminated well between the candidates, but fully correct answers were rarely seen.

(a) Candidates found it difficult to apply the function twice and a final answer of –5 was common. Questions on functions can be asked in many different ways and candidates must be familiar with all different possibilities.

(b) Although there were many correct answers, an answer of $\dfrac{1}{3+2x}$ was equally as common.

Answers: **(a)** –7 **(b)** $\dfrac{x-3}{2}$

Question 10

Candidates who set up an equation with a constant *k,* in general, went on to complete the question correctly. However a significant number of candidates incorrectly divided 24 by 4 to find their constant.

Answer: $y=\dfrac{96}{x^2}$

Question 11

(a) Candidates were required to take out a factor of π before using the difference of 2 squares. Many candidates tried to factorise without taking out this common factor and then, incorrectly, had π in both brackets.

(b) Although many candidates set up a correct equation they were let down as they did not cancel π. Some candidates made unnecessary numerical slips that spoilt an otherwise fully correct solution.

Answers: **(a)** $\pi(R+r)(R-r)$ **(b)** 2.5

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/23

Paper 23 (Extended)

Key messages

In order to do well in this examination, candidates need to have full knowledge of the syllabus and, in particular, should remember to simplify their answers and to take care with signs when expanding algebraic terms.

General comments

Although many candidates were well prepared for the paper and demonstrated very good algebraic skills and knowledge of the syllabus, there was a significant number of candidates who would have found the core papers a more rewarding experience. Candidates lost marks through careless numerical slips, particularly with negative numbers and simple arithmetic operations. Candidates should always leave their answers in their simplest form, as specified on the front of the examination paper.

Comments on specific questions

Question 1

This question proved to be challenging for many candidates. They had to realise that they needed to divide 1.6 by 4 and to deal with the powers. Some candidates who started the question correctly were unable to give their answer in a correct standard form, leaving their answer as 0.4×10^{-2}.

Answer: 4×10^{-3}

Question 2

(a) Many candidates did not expand the brackets correctly, but they were still able to be awarded later marks if they correctly collected like terms and then solved their subsequent equation.

(b) This part tested the candidate's knowledge of both general angles and the knowledge of $\frac{\sin^{-1}\sqrt{3}}{2} = 60°$. It proved to be too demanding for the majority of candidates. Many candidates who correctly found the value in the first quadrant were unable to find all of the other solutions.

Answers: **(a)** 0.9 **(b)** 60, 120, 240, 300

Question 3

(a) Virtually all candidates scored this mark.

(b) Candidates need to be able to apply the rules of indices. Some candidates were able to deal with the negative index but then could not deal with the fractional index. The common mistake was to square 27 and then these candidates were unable to cube root 729.

Answers: **(a)** 1 **(b)** $\frac{1}{9}$

Question 4

(a) Although there were many correct answers, a significant number of candidates simplified the question with answers of $2\sqrt{10} - 2\sqrt{7}$.

(b) This part discriminated well between candidates. Although there were many correct answers, a number of candidates multiplied throughout by $\sqrt{3}$ or by $5 - \sqrt{3}$. Candidates who correctly eliminated the surd in the denominator usually completed the question correctly.

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

Question 5

Candidates found this question difficult.

(a) The majority of candidates realised that the required graph was of a modulus function, but a large number of candidates simply copied the original graph in the ranges $-3 \le x \le 1$ and $2 \le x \le 3$ and omitted the graph outside these ranges.

(b) Candidates realised that this graph was a translation of the original graph. However there were many graphs translated in the wrong direction of the *x*-axis or translated in the *y*-axis.

Question 6

Again, candidates found this question difficult. Many candidates did not realise that the final answer cannot have *x* on both sides of the equation. Candidates needed to eliminate the fraction, expand, collect like terms, factorise and then divide. The order of these operations was paramount to arrive at the correct answer.

Answer: $\frac{3b}{a-b}$

Question 7

Nearly all candidates found the value of *x* correctly. Finding the value of *y* tested the candidate's knowledge of the properties of an isosceles triangle. Although there were many correct answers, an answer of 70 was seen in a number of scripts. Finding the value of *z* discriminated between candidates. A significant number of candidates thought that triangle *ABE* was isosceles.

Answers: $x = 35$, $y = 55$, $z = 60$

Question 8

(a) This part was well answered by the majority of candidates, although a number started the question correctly but were then unable to simplify $\sqrt{100}$.

(b) (i) There were many fully correct answers to this part of the question.

(ii) It was pleasing to see the attempts made by the majority of candidates. They realised that the gradient of *AB* was needed and hence found the gradient of the perpendicular. There were, however, a significant number of candidates who knew the method but were let down by careless arithmetic mistakes.

Answers: **(a)** 10 **(b)(i)** (4, 5) **(ii)** $y - 5 = \frac{3}{4}(x - 4)$

Question 9

This question discriminated well between the candidates. A number of candidates struggled to cope with the units in this question, 45 minutes was often taken as 0.45 hr. Another common mistake was to find the speed for each part of the journey and then to find the average of the two answers.

Answer: 8

Question 10

(a) Candidates answered this part of the question well. Using the fact that the sum of probabilities is always 1 led the candidates to correctly completing the table.

(b) Candidates were expected to use their table to answer this part of the question. However, many candidates started the question again with little success and answers greater than 1 were regularly seen.

Answers: **(a)**

0.55	0.1	(0.65)
(0.15)	0.2	0.35
0.7	(0.30)	(1.00)

(b) 0.25

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/31
Paper 31 (Core)

Key Message

To succeed in this paper, candidates need to have completed full syllabus coverage, make their working clear in the working space provided and use 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.

Questions 1, **2** and **8** were particularly well answered, while the areas where most candidates appeared to struggle included functions, transformations, bearings, and the use of geometrical terms.

The presentation of answers was generally good, with most candidates writing clearly in the appropriate spaces. Candidates should be aware that the use of a ruler is important when drawing lines which should be straight, but not when sketching curves or drawing graphs.

As instructed in the rubric, candidates must remember that answers which are not exact should always be given to 3 significant figures. Moreover, if any answer is needed for a further calculation, candidates should use the most accurate figure available, preferably by using the calculator memory.

Candidates must be reminded that simply quoting a formula does not constitute showing a method; the correct values must be shown substituted into the formula. When π is needed, candidates must remember to use the calculator value. 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 nearly all the candidates.

(a) Nearly all candidates obtained the correct answer, with only a minority choosing to ignore the cents.

(b) Most candidates successfully calculated 10% of their previous answer.

(c) Again, most candidates correctly added their two previous answers together, although some chose to subtract.

(d) This part caused difficulty for some candidates, who added one third of the service charge to the cost of Leon’s meal instead of dividing the total cost by 3.

(e) Nearly all correctly calculated the change Leon would receive from their answer to part **(d)**.

Answers: **(a)** 42.60 **(b)** 4.26 **(c)** 46.86 **(d)** 15.62 **(e)** 4.38

Question 2

(a) Most candidates correctly calculated the size of the three angles, although some weaker candidates assumed the triangle to be isosceles and others worked on the principle that the sum of the angles on a straight line is 90°.

(b) (i) Many candidates correctly drew four lines of symmetry, although often without the use of a ruler. This did not cost them the mark but could look very untidy.

(ii) There were many incorrect answers to this part, with a number of candidates not recognising that a single digit was required here. Answers such as "clockwise" or "90°" were common, as was the answer 2.

Answers: **(a)** a = 138°, b = 77°, c = 103° **(b)(i)** 4 lines drawn **(ii)** 4

Question 3

A small number of candidates began this question by substituting the values incorrectly.

(a) Although many correct answers were seen in the working space, some candidates wrote down in the answer space a truncated answer or an answer corrected to the wrong number of decimal places.

(b) Many candidates gave their answer here correct to 2 decimal places instead of to 2 significant figures.

(c) Standard form appeared to cause problems for a number of candidates, with 12 or 13 rather than 1.3 appearing, and the power of 10 ranging from a negative number up to 9.

Answers: **(a)** 129.969 **(b)** 130 **(c)** 1.3(0) x 10^2

Question 4

The concept of a stem and leaf diagram was obviously well understood by a number of candidates, but there were many who had no clear idea of what was required. However, many candidates who could not deal successfully with part **(a)** were able to give completely correct answers to part **(b)**.

(a) Few candidates took advantage of the empty space on the page to write down the unordered values first. This meant that some of the responses were unordered or contained many deleted and inserted numbers. The key was omitted or wrong in many cases.

(b) (i) Many of the candidates calculated the range correctly from their diagram.

(ii) Many candidates wrote down the median correctly.

(iii) & (iv) These two parts were omitted by many candidates. Of those who offered an answer, many were incorrect with a variety of wrong numbers. A few candidates reversed the two correct answers.

Answers:

(a)

stem	leaf
1	3 7 8 8 8 9 9
2	0 0 1 3 5 5 6
3	1 2 3 4 6 6
4	0 1 3

Key 1|3 = 13 **(b)(i)** 30 **(ii)** 25 **(iii)** 19 **(iv)** 34

Question 5

Many of the candidates answered most parts of this question well.

(a)(i) Plotting of the four remaining points was done well, with most candidates coping satisfactorily with the different scales. However there were candidates who omitted this part of the question.

(b) Many candidates gave the word negative although in many cases it was embellished with a variety of additional, unnecessary words.

(c) (i) The mean number of hours was found successfully by a large number of candidates but was occasionally given only to 2 significant figures.

(ii) Similarly, although the mean number of seconds was often correct there were some candidates who wrote down only 60.

In both these parts some candidates showed no working and they are to be commended if this means that they used their graphics calculators to obtain the results.

(iii) In spite of correctly plotting the points in part **(a)**, a large number of candidates plotted the mean incorrectly, often at (3.32, 64) or (3.2, 64) instead of (3.32, 60.4).

(d) The plotting of the mean point was intended to help the candidates with the drawing of the line of best fit. However, a large number drew a line which avoided the mean point altogether, although in nearly all cases the line did have a correct negative gradient. Most candidates used a ruler although there were some freehand lines. A few candidates joined up the individual points on the grid, revealing a lack of understanding here.

(e) Most candidates successfully read off the correct answer from their graph.

Answers: **(b)** Negative **(c)(i)** 3.32 **(ii)** 60.4 **(e)** 32 to 50

Question 6

The answers to this question revealed an imperfect knowledge of the terms obtuse and perpendicular among a substantial number of the candidates, as well as a reluctance to use three letters to define an angle precisely.

(a) (i) Many candidates named a correct acute angle, frequently using only one letter instead of three. This was acceptable in most cases but not if they named the angle *D.*

(ii) Many incorrectly named the right angles at C or E, or one of the acute angles.

(iii) A large majority named the lines *BC* and *DE* apparently confusing the words perpendicular and parallel. Other incorrect answers named lines such as *AC* and *AB* which are neither perpendicular nor parallel. A few candidates used only one letter which is not sufficient to define a line.

(b) (i) For many candidates this was an easy question to answer, but a surprising number felt the need to attempt calculations here and offered a variety of different answers.

(ii) As in part **(b)(i)** many, but not all, candidates found this part straightforward.

Answers: **(a)(i)** *ADE* or *ABC* or *BAC* **(ii)** *BDE* **(iii)** *BC* and *AC* or *DE* and *AE* **(b)(i)** 90^{o} **(ii)** 45^{o}

Question 7

This proved to be a challenging question for some candidates.

(a) (i) Most successful candidates here used the expected method to obtain the result. A number of alternative approaches, when clearly expressed, also gained the marks. However, many candidates felt that dividing 3500 by 87.5 and reaching 40 was a sufficient method, which it is not.

(ii) This was a more accessible part with many candidates obtaining the correct answer.

(b) (i) For many candidates, this part was straightforward and they successfully found the required cost. A few found only the cost for one day, or used 360 as the number of days in a year. Some divided the 87.5 by 0.5 instead of multiplying.

(ii) Most candidates correctly divided their previous answer by 15 and many of these realised that they must round up their answer to the nearest whole number.

Answers: **(a)(i)** $\frac{1600}{1600+1400+500}\times 87.5$ **(ii)** 35 **(b)** 15968.75 **(c)** 1065

Question 8

This was one of the questions that was answered well by a large majority of the candidates.

(a) (i) All the candidates wrote down the correct numbers here.

(ii) Most answers were correct, if sometimes written as n x 3 rather than 3n, although there were a few who wrote n + 3.

(iii) As in part **(a)(i)**, this part was answered very well.

(b) (i) Once again this was answered well, except for a small number of candidates who counted the number of sticks rather than the number of triangles.

(ii) This was another well answered part.

(iii) There were some wrong answers in this part, notably 2n +1, and also expressions involving 4n, but these were in the minority.

Answers: **(a)(i)** 6, 9 **(ii)** $3n$ **(iii)** 30 **(b)(i)** 7, 9 **(ii)** 19 **(iii)** $2n - 1$

Question 9

The two parts of this question brought out a very different response from the candidates. While most of them did well in part **(a)**, part **(b)** proved to be more challenging for many.

(a) There were many correct reflections, although some were drawn without the help of a ruler. A few candidates reflected the shape in the x-axis instead of the y-axis.

(b) This enlargement proved more difficult for many candidates. Often a figure of the correct size and shape appeared, but in an incorrect position. However there were many very distorted shapes. Those who drew lines from the origin through the vertices of the given shape took a sensible approach but they often omitted to extend these lines sufficiently.

Answers: **(a)** Vertices at (–1, 2) (–2, 4) (–4, 1) (–2, 2) **(b)** Vertices at (2, 4) (4, 8) (8, 2) (4, 4)

Question 10

This question proved to be challenging for a number of candidates, with the combination of set notation and probability leading to errors.

(a) Most candidates identified the correct elements.

(b) Many candidates wrote the letters in the correct areas of the Venn diagram but a large number also repeated these letters inside the universal set and outside the sets S and T, making part **(c)** much more difficult for themselves.

(c) In all of this part, many candidates listed the elements rather than write down the probability required. Where probabilities were written, many candidates, instead of giving their answers in the simpler form of a fraction, chose to use percentages, leading to errors of truncation or giving only 2 significant figures. A small number of candidates gave answers in ratio form, which is incorrect.

(i) A number of candidates neglected to include the letters that were inside the intersection and wrote down $\frac{3}{9}$.

(ii) Many gave the probability of the letter being in the intersection of the sets instead of the union.

(iii) Many gave the probability of the letter being in the set *T* instead of its complement (*T*').

(d) Many candidates correctly used 5 as the denominator but $\frac{2}{9}$ was a common error.

Answers: **(a)** g, i **(c)(i)** $\frac{5}{9}$ **(ii)** 1 **(iii)** $\frac{3}{9}$ **(d)** $\frac{2}{5}$

Question 11

Many candidates made a sensible attempt at the first two parts although the conversion of minutes to hours, if attempted, often involved the use of 100 instead of 60.

(a) Most candidates correctly attempted to divide the distance by the time in order to find the speed.

(b) Most candidates realised that they would obtain the time taken by dividing the distance by the speed.

(c) Only the better candidates used a correct method here, dividing the total distance of 40km by the sum of the three times converted to hours. Instead, the majority calculated the speed for the rollerblading part of the race, added the three speeds together and either gave this as their answer or divided by 3 to find the mean of these three individual speeds.

Answers: **(a)** 15 **(b)** 48 **(c)** 20

Question 12

This question highlighted the difficulties many candidates have with bearings. It was also one of the questions where lack of working could cost a candidate marks.

(a) (i) Most candidates were able to draw a line from *F* to *G* in approximately the right direction, but this was not the case with the line from *G* to *H*.

(ii) Although many candidates marked the angle of 50° at *F*, the angles required at *G* were often incorrect or not marked. As a minimum, 130° was needed between *FG* and the North line (which was not always drawn) and 140° between the North line and *GH*.

(b) (i) This was a simple exercise using Pythagoras' theorem. Many candidates who applied the formula correctly, spoiled their answer by truncating it to 360. Candidates lost all the marks for this part when their answer was 360 and no working was shown.

(ii) The simplest approach here was to use the tangent of the required angle, and many did, although once again, after a correct method, marks were lost for inaccurate answers such as 56°. In addition, those who chose to use sine or cosine with their answer to part **(b)(i)**, and who used an inaccurate answer from part **(b)(i)**, such as 360, also lost the accuracy mark.

Answers: **(b)(i)** 361 **(ii)** 56.3°

Question 13

In this question, candidates who showed their method and maintained accuracy were able to gain full marks.

(a) (i) A number of candidates gave accurate answers, but those who wrote the answer 0.5 could not earn the accuracy mark. The rubric requires 3 significant figures in answers which are not exact.

(ii) To answer this part, candidates were required to show a division of 50 by their previous answer. With an accurate answer this would have given a decimal result and, unlike **Question 7**, this answer needed rounding down to the nearest whole number. Candidates who had the answer 0.5 in part **(a)(i)** and who wrote 100 here without showing the division lost the marks in this part.

(b) (i) Many candidates used the correct formula here and the majority who did not get the right answer had omitted to convert the 2 metres to centimetres.

(ii) As in part **(i)**, many candidates used the correct formula for the volume of the cylinder and obtained the right answer or were wrong by a factor of 100.

Answers: **(a)(i)** 0.503 **(ii)** 99 **(b)(i)** 10100 **(ii)** 40200

Question 14

This question required the use of the graphics calculator and a number of the candidates showed some proficiency in its use.

(a) About half of the candidates entered the function accurately and set up correctly the ranges for x and y on their calculators, producing a sketch of approximately the expected shape. There were some who used an incorrect range for y or who entered the function without the brackets, resulting in a sketch with two separate sections and no intercept on the y-axis. Some attempted to plot a selection of points, and this often resulted in a sharp peak on the y-axis instead of a maximum on a smooth curve.

(b) Some candidates gave the correct answer but (2, 0) was more frequently seen, indicating some confusion with co-ordinate notation.

(c) Many candidates did not offer an answer here but $x = 0$ was seen, again indicating the difficulty some candidates have with co-ordinate notation.

(d) The few good responses to this part gave the inequalities correctly, while some candidates recognised that the values 0 and 2 were required but were unable to write them in a suitable form. This part was left unanswered by many candidates although mention of –4, 4 and x in some answers suggested a degree of confusion between range and domain.

Answers: **(b)** (0, 2) **(c)** $y = 0$ **(d)** $0 < y \leq 2$

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/32

Paper 32 (Core)

Key Message

In order to perform well on this paper, full syllabus coverage is necessary. Candidates should be aware that it is important to show all necessary working when questions carry more than one mark and that the use of a graphics calculator is necessary throughout the course and its applications go well beyond curve sketching.

General comments

The standard of work on this paper was generally good. The presentation of work was usually of a high standard but there are still candidates who only write down answers when method marks could be available in the event of the answer being incorrect. In any case, with this syllabus, there is an emphasis on communication and there could be situations where correct answers without working do not earn full marks. The level of accuracy with answers was usually within the requirements.

There is evidence that all candidates were able to finish in the allotted time.

Curve sketching continues to improve with candidates now usually setting up suitable ranges on the axes. There remains a reluctance to use the graphics calculator in other situations and many candidates do not appear to realise the potential of this most useful device.

Questions that were answered well were on the topics of number, ratio, simple probability, scatter diagrams, mean values, simple angle geometry, pie charts, expanding brackets and simple factorising.

Candidates found the transformations of graphs, gradient and equations of a straight line, trigonometry, mensuration and indices more difficult.

Comments on specific questions

Question 1

(a) This simple subtraction was correctly answered by almost all candidates.

(b) This simple addition was correctly answered by almost all candidates.

(c) (i) The probability for 90 out of 270 was usually correctly answered. A few candidates gave $\frac{1}{90}$ as the answer.

(ii) This probability required a subtraction for an event not happening. Most candidates answered this correctly with a few making the same error as stated in part **(i)**.

(iii) This was an impossible event and most candidates gave the correct answer of 0.

(d) This ratio question was answered correctly by most candidates.

Answers: **(a)** 30 **(b)** 270 **(c)(i)** $\frac{90}{270}$ **(ii)** $\frac{150}{270}$ **(iii)** 0 **(d)** 90

Question 2

(a) The four remaining points of the scatter diagram were usually correctly plotted.

(b) The correlation was usually correctly stated to be positive and this was the only description that was accepted. Answers such as linear, increasing or fuller descriptions of how one changed with the other did not earn any marks. Candidates should know key words for correlation and in this case the key word was positive.

(c) (i) The mean value was usually correctly calculated.

(ii) The mean value was usually correctly calculated.

(iii) Most candidates plotted the mean point correctly from their answers to parts **(i)** and **(ii)**. Some omitted this part, suggesting that it was a topic on which they were unsure.

(d) As candidates had been asked to plot the mean point, it was reasonable to expect that the line of best fit would go through this point. Many candidates did not do this and needed to be more aware of this part of the syllabus.

(e) The range for this reading from the line of best fit allowed most candidates to gain this mark.

Answers: **(b)** positive **(c)(i)** 14.6 **(ii)** 39.4 **(e)** 18 to 23

Question 3

(a) This part required candidates to write down two equations in two variables from the information in the question. The variables were given in the question which led to a good degree of success. A few candidates could only write down some numbers, being unable to formulate equations.

(b) Those with correct equations in part **(a)** usually went on to solve them correctly, with the elimination method proving to be the most successful. Occasional errors in solving $18c = 9$ and $15j = 12$ were seen with $c = 2$ and $j = 1.25$.

Answers: **(a)** $12c + 5j = 10$, $6c + 10j = 11$ **(b)** $c = 0.50$, $j = 0.80$

Question 4

(a) Most candidates found the next two terms of the sequence correctly.

(b) The *n*th term proved to be more challenging, as expected, but there were many correct answers. Both simplified and unsimplified answers were awarded full marks. The common error was $n + 2$, because each term was 2 greater than the previous term.

(c) Many candidates were able to apply their answer to part **(ii)** to find the value of n. Some candidates went back to the early terms of the sequence and counted through to reach the given value, usually successfully.

Answers: **(a)** 7, 9 **(b)** $2n - 1$ **(c)** 42

Question 5

(a) This question asked for the two zeros of a function shown on a diagram. Most candidates answered it correctly. A few included the y co-ordinates of 0 and this was condoned.

(b) The graph in the diagram had to be transformed in two ways, firstly 3 units vertically downwards and secondly 2 units horizontally to the left. This was a much more searching question with limited success.

There was confusion between f(x + k) and f(x) + k and also the direction for f(x + k).

There was every indication of a greater need of experience with this topic and it is a topic which can be covered well during the course using a graphics calculator.

Answers: **(a)** – 3, 1

Question 6

This question tested various angle properties and was generally well answered.

(a) The property tested in this part was vertically opposite angles and most candidates found the correct answer.

(b) This part tested angles in a right angle or angles on a straight line and again most candidates were successful.

(c) This part tested angles on a straight line and was well answered. A number of candidates thought it was a right angle, probably because it looked as though it may be 90˚. This showed the need to only use the information that is given and not to make presumptions.

(d) This angle was a right angle using parallel lines and most candidates answered this correctly.

(e) This angle was also a right angle using parallel lines and again most candidates answered this correctly.

(f) This angle could be found by using parallel lines or angles in a quadrilateral and this was also usually answered correctly.

Answers: **(a)** 40 **(b)** 50 **(c)** 89 **(d)** 90 **(e)** 90 **(f)** 140

Question 7

(a) Almost all candidates plotted the two required points correctly.

(b) The column vector connecting the two points was a little more demanding with x and y components being occasionally mixed up and a few problems with signs. There were many correct answers.

(c) The midpoint was usually correctly stated, often after seeing a formula being used, which seemed unnecessary when an accurate diagram was available.

(d) Most candidates correctly applied Pythagoras or the formula for the distance between two points. Some candidates measured the length of the line, probably because the diagram was accurate, without realising it was only accurate to a scale, and the question did use the command word calculate.

(e) The gradient of the line was more challenging with stronger candidates succeeding while others had problems with which lengths were numerator and denominator and also with signs.

(f) This was the most testing part of this question, requiring the equation of the line, and was often omitted. As in part **(e)**, the stronger candidates gave fully correct answers, connecting this part with the gradient found in part **(e)**. The constant term could have been found by drawing the line accurately to reach the y-axis but most candidates preferred to use algebra, substituting co-ordinates into $y = -2x + c$.

Answers: **(b)** $\begin{pmatrix} 6 \\ -12 \end{pmatrix}$ **(c)** (4, 3) **(d)** 13.4 **(e)** – 2 **(f)** $y = -2x + 11$

Question 8

(a) This question required candidates to use angles round a point as it was to find an unknown angle in a pie chart. Most candidates answered this correctly.

(b) The number represented by one of the sectors was usually calculated correctly.

(c) The straightforward probability from the pie chart was also usually calculated correctly, either by using the angles or the numbers of candidates.

Answers: **(a)** 102 **(b)** 14 **(c)** $\frac{54}{360}$

Question 9

(a) Most candidates were able to put the elements of the sets into the correct regions. A few put some elements in more than one region. This was the most accessible part of the whole question as little notation needed to be understood.

(b)(i) Most candidates did correctly give the list of members of the union of the two sets. A few took the union symbol as the intersection symbol.

(ii) The complement of the set *B* was more challenging with candidates appearing to understand that the elements must not be in *B* but some of these candidates did not include the elements outside the union of the two sets.

(iii) The single member of the intersection was usually correct.

(iv) This was much more challenging than the other parts with many candidates not including the element in the intersection.

Part **(b)** indicated a few problems with set notation and a few with identifying a region, with the union of one set and the complement of the other set being particularly difficult.

(c) Another piece of notation was tested here, the number of elements in a set. Many gave the correct answer while quite a number listed the elements, again suggesting the need for more experience with set notation.

Answers: **(b)(i)** {c, e, f, g, h} **(ii)** {a, b, c, d, e} **(iii)** {g} **(iv)** {a, b, c, d, e, g} **(c)** 5

Question 10

(a) Many candidates found the length of a hypotenuse correctly. One of the two other sides was to be found by subtracting two lengths and a number of candidates overlooked this and calculated the length of a side not on the diagram.

(b) Candidates were told to use trigonometry in this part and many were very successful, especially those who used tangent, as this method did not require the answer to part **(a)**. A few candidates appeared to be lacking in experience with trigonometry.

(c) This speed question involved dividing a length by a time, which most candidates could do. There was a complication which required units to be changed. The distance given was in centimetres and the time in seconds when the answer needed to be in metres per minute. This changing of units did pose a problem to a number of candidates.

Answers: **(a)** 541 **(b)** 33.7 **(c)** 108

Question 11

(a) Good sketches of this cubic function were seen. A few candidates had three vertical lines, an indication of not taking *y* from – 40 to 40.

(b) Most candidates gave the turning points correctly and to an appropriate accuracy. The *x* co-ordinate of the maximum point was often given to only 2 significant figures.

(c) Almost all candidates drew a correct straight line.

(d) The *x* co-ordinates of the points of intersection were usually correct, with a few not to the required level of accuracy.

Answers: **(b)** (– 0.667, 14.8) (4, – 36) **(d)** – 2.04, 0.693, 6.35

Question 12

(a) (i) The surface area of the closed cylinder was often correctly calculated with answers suitably accurate. Some candidates found the surface area of a cylinder open at one end or both ends. Candidates should use π on the calculator and there is no guarantee that any other value of π will give answers in an accuracy range.

(ii) The volume of the same cylinder met with more success as no parts needed to be collected. Most candidates gained full marks in this part.

(b) (i) The volume of the sphere was also successfully answered. A few candidates used the formula for the surface area of a sphere.

(ii) The percentage of the cylinder not occupied by the sphere was a little more demanding but there were many good answers. Some candidates found the percentage occupied by the sphere and a few did not use the volume of the cylinder as the denominator.

Answers: **(a)(i)** 4240 **(ii)** 21200 **(b)(i)** 14100 **(ii)** 33.3 to 33.5

Question 13

(a) The expansion of two pairs of brackets was generally well answered. A few candidates made sign errors and a few omitted the two middle terms.

(b) The factorising was also successfully carried out by many candidates. A few candidates only took one of the common factors out of the expression and a few others tried to collect the two (unlike) terms or multiply them.

(c) (i) This question required candidates to cancel an algebraic fraction, with the factors that would cancel being 2 and *y*. Overall the question was well answered.

(ii) This part involved changing the division by an algebraic fraction to the multiplication by the reciprocal. This was found to be more challenging for many candidates with some not multiplying by the reciprocal and some not cancelling any common factors.

(iii) This part was the subtraction of two algebraic fractions, although the denominators were numerical. The question was quite well answered, although some candidates did not realise that they needed to find the common denominator, with some subtracting the denominators.

(iv) This question certainly tested a rule of indices. The question was $\left(2y^2\right)^3$ and there were many correct answers of $8y^6$. Other answers seen frequently were $8y^5$, $2y^6$ and $2y^5$.

Answers: **(a)** $2x^2 - x - 6$ **(b)** $5x(2x - 3)$ **(c)(i)** $4xy$ **(ii)** $6s$ **(iii)** $\dfrac{p}{12}$ **(iv)** $8y^6$

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/33

Paper 33 (Core)

Key Message

To succeed in this paper, candidates need to have completed full syllabus coverage, make their working clear in the working space provided and use 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. The presentation of answers was generally good, with most candidates writing clearly in the appropriate spaces. Candidates should be aware that the use of a ruler is important when drawing lines which should be straight, but not when sketching curves or drawing graphs. As instructed in the rubric, candidates must remember that answers which are not exact should always be given to 3 significant figures. Moreover, if any answer is needed for a further calculation, candidates should use the most accurate figure available, preferably by using the calculator memory. Candidates must be reminded that simply quoting a formula does not constitute showing a method; the correct values must be shown substituted into the formula. When π is needed, candidates must remember to use the calculator value; the values 3.14 or $\frac{22}{7}$ will not give sufficiently accurate answers. **Questions 1**, **2** and **8** were particularly well answered, while the areas where most candidates appeared to struggle included functions, transformations, bearings, and the use of geometrical terms.

Comments on specific questions

Question 1

This question was well answered by nearly all the candidates.

(a) Nearly all candidates obtained the correct answer, with only a minority choosing to ignore the cents.

(b) Most candidates successfully calculated 10% of their previous answer.

(c) Again, most candidates correctly added their two previous answers together, although some chose to subtract.

(d) This part caused difficulty for some candidates, who added one third of the service charge to the cost of Leon's meal instead of dividing the total cost by 3.

(e) Nearly all correctly calculated the change Leon would receive from their answer to part **(d)**.

Answers: **(a)** 42.60 **(b)** 4.26 **(c)** 46.86 **(d)** 15.62 **(e)** 4.38

Question 2

(a) Most candidates correctly calculated the size of the three angles, although some weaker candidates assumed the triangle to be isosceles and others worked on the principle that the sum of the angles on a straight line is 90°.

(b) (i) Many candidates correctly drew four lines of symmetry, although often without the use of a ruler. This did not cost them the mark but could look very untidy.

(ii) There were many incorrect answers to this part, with a number of candidates not recognising that a single digit was required here. Answers such as "clockwise" or "90°" were common, as was the answer 2.

Answers: **(a)** a = 138°, b = 77°, c = 103° **(b)(i)** 4 lines drawn **(ii)** 4

Question 3

A small number of candidates began this question by substituting the values incorrectly.

(a) Although many correct answers were seen in the working space, some candidates wrote down in the answer space a truncated answer or an answer corrected to the wrong number of decimal places.

(b) Many candidates gave their answer here correct to 2 decimal places instead of to 2 significant figures.

(c) Standard form appeared to cause problems for a number of candidates, with 12 or 13 rather than 1.3 appearing, and the power of 10 ranging from a negative number up to 9.

Answers: **(a)** 129.969 **(b)** 130 **(c)** $1.3(0) \times 10^2$

Question 4

The concept of a stem and leaf diagram was obviously well understood by a number of candidates, but there were many who had no clear idea of what was required. However, many candidates who could not deal successfully with part **(a)** were able to give completely correct answers to part **(b)**.

(a) Few candidates took advantage of the empty space on the page to write down the unordered values first. This meant that some of the responses were unordered or contained many deleted and inserted numbers. The key was omitted or wrong in many cases.

(b) (i) Many of the candidates calculated the range correctly from their diagram.

(ii) Many candidates wrote down the median correctly.

(iii) & (iv) These two parts were omitted by many candidates. Of those who offered an answer, many were incorrect with a variety of wrong numbers. A few candidates reversed the two correct answers.

Answers:

(a)

stem	leaf
1	3 7 8 8 8 9 9
2	0 0 1 3 5 5 6
3	1 2 3 4 6 6
4	0 1 3

Key 1|3 = 13 **(b)(i)** 30 **(ii)** 25 **(iii)** 19 **(iv)** 34

Question 5

Many of the candidates answered most parts of this question well.

(a)(i) Plotting of the four remaining points was done well, with most candidates coping satisfactorily with the different scales. However there were candidates who omitted this part of the question.

(b) Many candidates gave the word negative although in many cases it was embellished with a variety of additional, unnecessary words.

(c) (i) The mean number of hours was found successfully by a large number of candidates but was occasionally given only to 2 significant figures.

(ii) Similarly, although the mean number of seconds was often correct there were some candidates who wrote down only 60.

In both these parts some candidates showed no working and they are to be commended if this means that they used their graphics calculators to obtain the results.

(iii) In spite of correctly plotting the points in part **(a)**, a large number of candidates plotted the mean incorrectly, often at (3.32, 64) or (3.2, 64) instead of (3.32, 60.4).

(d) The plotting of the mean point was intended to help the candidates with the drawing of the line of best fit. However, a large number drew a line which avoided the mean point altogether, although in nearly all cases the line did have a correct negative gradient. Most candidates used a ruler although there were some freehand lines. A few candidates joined up the individual points on the grid, revealing a lack of understanding here.

(e) Most candidates successfully read off the correct answer from their graph.

Answers: **(b)** Negative **(c)(i)** 3.32 **(ii)** 60.4 **(e)** 32 to 50

Question 6

The answers to this question revealed an imperfect knowledge of the terms obtuse and perpendicular among a substantial number of the candidates, as well as a reluctance to use three letters to define an angle precisely.

(a) (i) Many candidates named a correct acute angle, frequently using only one letter instead of three. This was acceptable in most cases but not if they named the angle *D.*

(ii) Many incorrectly named the right angles at C or E, or one of the acute angles.

(iii) A large majority named the lines *BC* and *DE* apparently confusing the words perpendicular and parallel. Other incorrect answers named lines such as *AC* and *AB* which are neither perpendicular nor parallel. A few candidates used only one letter which is not sufficient to define a line.

(b) (i) For many candidates this was an easy question to answer, but a surprising number felt the need to attempt calculations here and offered a variety of different answers.

(ii) As in part **(b)(i)** many, but not all, candidates found this part straightforward.

Answers: **(a)(i)** *ADE* or *ABC* or *BAC* **(ii)** *BDE* **(iii)** *BC* and *AC* or *DE* and *AE* **(b)(i)** 90^{o} **(ii)** 45^{o}

Question 7

This proved to be a challenging question for some candidates.

(a) (i) Most successful candidates here used the expected method to obtain the result. A number of alternative approaches, when clearly expressed, also gained the marks. However, many candidates felt that dividing 3500 by 87.5 and reaching 40 was a sufficient method, which it is not.

(ii) This was a more accessible part with many candidates obtaining the correct answer.

(b) (i) For many candidates, this part was straightforward and they successfully found the required cost. A few found only the cost for one day, or used 360 as the number of days in a year. Some divided the 87.5 by 0.5 instead of multiplying.

(ii) Most candidates correctly divided their previous answer by 15 and many of these realised that they must round up their answer to the nearest whole number.

Answers: **(a)(i)** $\frac{1600}{1600+1400+500} \times 87.5$ **(ii)** 35 **(b)** 15968.75 **(c)** 1065

Question 8

This was one of the questions that was answered well by a large majority of the candidates.

(a) (i) All the candidates wrote down the correct numbers here.

(ii) Most answers were correct, if sometimes written as n x 3 rather than 3n, although there were a few who wrote n + 3.

(iii) As in part **(a)(i)**, this part was answered very well.

(b) (i) Once again this was answered well, except for a small number of candidates who counted the number of sticks rather than the number of triangles.

(ii) This was another well answered part.

(iii) There were some wrong answers in this part, notably 2n +1, and also expressions involving 4n, but these were in the minority.

Answers: **(a)(i)** 6, 9 **(ii)** $3n$ **(iii)** 30 **(b)(i)** 7, 9 **(ii)** 19 **(iii)** $2n - 1$

Question 9

The two parts of this question brought out a very different response from the candidates. While most of them did well in part **(a)**, part **(b)** proved to be more challenging for many.

(a) There were many correct reflections, although some were drawn without the help of a ruler. A few candidates reflected the shape in the x-axis instead of the y-axis.

(b) This enlargement proved more difficult for many candidates. Often a figure of the correct size and shape appeared, but in an incorrect position. However there were many very distorted shapes. Those who drew lines from the origin through the vertices of the given shape took a sensible approach but they often omitted to extend these lines sufficiently.

Answers: **(a)** Vertices at (–1, 2) (–2, 4) (–4, 1) (–2, 2) **(b)** Vertices at (2, 4) (4, 8) (8, 2) (4, 4)

Question 10

This question proved to be challenging for a number of candidates, with the combination of set notation and probability leading to errors.

(a) Most candidates identified the correct elements.

(b) Many candidates wrote the letters in the correct areas of the Venn diagram but a large number also repeated these letters inside the universal set and outside the sets S and T, making part **(c)** much more difficult for themselves.

(c) In all of this part, many candidates listed the elements rather than write down the probability required. Where probabilities were written, many candidates, instead of giving their answers in the simpler form of a fraction, chose to use percentages, leading to errors of truncation or giving only 2 significant figures. A small number of candidates gave answers in ratio form, which is incorrect.

(i) A number of candidates neglected to include the letters that were inside the intersection and wrote down $\frac{3}{9}$.

(ii) Many gave the probability of the letter being in the intersection of the sets instead of the union.

(iii) Many gave the probability of the letter being in the set *T* instead of its complement (T').

(d) Many candidates correctly used 5 as the denominator but $\frac{2}{9}$ was a common error.

Answers: **(a)** g, i **(c)(i)** $\frac{5}{9}$ **(ii)** 1 **(iii)** $\frac{3}{9}$ **(d)** $\frac{2}{5}$

Question 11

Many candidates made a sensible attempt at the first two parts although the conversion of minutes to hours, if attempted, often involved the use of 100 instead of 60.

(a) Most candidates correctly attempted to divide the distance by the time in order to find the speed.

(b) Most candidates realised that they would obtain the time taken by dividing the distance by the speed.

(c) Only the better candidates used a correct method here, dividing the total distance of 40km by the sum of the three times converted to hours. Instead, the majority calculated the speed for the rollerblading part of the race, added the three speeds together and either gave this as their answer or divided by 3 to find the mean of these three individual speeds.

Answers: **(a)** 15 **(b)** 48 **(c)** 20

Question 12

This question highlighted the difficulties many candidates have with bearings. It was also one of the questions where lack of working could cost a candidate marks.

(a) (i) Most candidates were able to draw a line from *F* to *G* in approximately the right direction, but this was not the case with the line from *G* to *H*.

(ii) Although many candidates marked the angle of 50° at *F*, the angles required at *G* were often incorrect or not marked. As a minimum, 130° was needed between *FG* and the North line (which was not always drawn) and 140° between the North line and *GH*.

(b) (i) This was a simple exercise using Pythagoras' theorem. Many candidates who applied the formula correctly, spoiled their answer by truncating it to 360. Candidates lost all the marks for this part when their answer was 360 and no working was shown.

(ii) The simplest approach here was to use the tangent of the required angle, and many did, although once again, after a correct method, marks were lost for inaccurate answers such as 56°. In addition, those who chose to use sine or cosine with their answer to part **(b)(i)**, and who used an inaccurate answer from part **(b)(i)**, such as 360, also lost the accuracy mark.

Answers: **(b)(i)** 361 **(ii)** 56.3°

Question 13

In this question, candidates who showed their method and maintained accuracy were able to gain full marks.

(a) (i) A number of candidates gave accurate answers, but those who wrote the answer 0.5 could not earn the accuracy mark. The rubric requires 3 significant figures in answers which are not exact.

(ii) To answer this part, candidates were required to show a division of 50 by their previous answer. With an accurate answer this would have given a decimal result and, unlike **Question 7**, this answer needed rounding down to the nearest whole number. Candidates who had the answer 0.5 in part **(a)(i)** and who wrote 100 here without showing the division lost the marks in this part.

(b) (i) Many candidates used the correct formula here and the majority who did not get the right answer had omitted to convert the 2 metres to centimetres.

(ii) As in part **(i)**, many candidates used the correct formula for the volume of the cylinder and obtained the right answer or were wrong by a factor of 100.

Answers: **(a)(i)** 0.503 **(ii)** 99 **(b)(i)** 10100 **(ii)** 40200

Question 14

This question required the use of the graphics calculator and a number of the candidates showed some proficiency in its use.

(a) About half of the candidates entered the function accurately and set up correctly the ranges for x and y on their calculators, producing a sketch of approximately the expected shape. There were some who used an incorrect range for y or who entered the function without the brackets, resulting in a sketch with two separate sections and no intercept on the y-axis. Some attempted to plot a selection of points, and this often resulted in a sharp peak on the y-axis instead of a maximum on a smooth curve.

(b) Some candidates gave the correct answer but (2, 0) was more frequently seen, indicating some confusion with co-ordinate notation.

(c) Many candidates did not offer an answer here but $x = 0$ was seen, again indicating the difficulty some candidates have with co-ordinate notation.

(d) The few good responses to this part gave the inequalities correctly, while some candidates recognised that the values 0 and 2 were required but were unable to write them in a suitable form. This part was left unanswered by many candidates although mention of –4, 4 and x in some answers suggested a degree of confusion between range and domain.

Answers: **(b)** (0, 2) **(c)** $y = 0$ **(d)** $0 < y \leq 2$

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/41

Paper 41 (Extended)

Key Messages

Candidates should be aware that they need to write down sufficient working in order to gain method marks, and to give their answers to the required degree of accuracy.

Candidates should be familiar with the expected uses of a graphics calculator.

General Comments

The paper proved accessible to the majority of candidates. The overall standard from most of the candidates was quite high, however, there were a few candidates for whom entry at core level would have been a much more rewarding experience. The paper differentiated well with the whole range of available marks being seen.

There were a few candidates who appeared unused to questions which expected the use of a graphics calculator. Some did the sketch graphs by plotting and these often showed no familiarity with the use of the solution functions either.

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.

In some cases the questions stated the required accuracy and this was often ignored or perhaps forgotten. In most other cases the required accuracy was given although some candidates did not work accurately enough to achieve the required number of figures in the answer. 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.

There was little evidence of time being a problem as almost all candidates appeared to finish.

Comments on Specific Questions

Question 1

(a) (i) Many candidates did not recognise the reverse percentage nature of the problem. The usual response was to add on 12% to $15 840. Those who did recognise that $15 840 was equal to 88% of the 2010 figure, were usually successful.

(ii) This part was correct much more frequently, with most candidates able to carry out the three successive reductions. The usual errors were to use 1.12 instead of 0.88 or to reduce by 36%.

(iii) Although there were many excellent solutions to this part many were spoilt when, having reached 9.02, candidates did not realise that this meant the figure went below $5000 in 2010 not 2011. A few gave the number of years rather than the calendar year. Weaker candidates again often used 1.12.

(b) This part was generally well done. Here, however, accuracy proved a problem where many candidates did not give the answer to the required degree of accuracy of at least 3 significant figures. There appears to be a misconception that percentages can only be whole numbers. Of course, if the accuracy is not there, and there is no working then the score is 0 despite three method marks being available.

Answers: **(a)(i)** \$18 000 **(ii)** \$10 800 **(iii)** 2020 **(b)** 18.2

Question 2

(a) Most recognised that the transformation was a reflection and the majority of those gave the mirror line as $y = -x$. Some omitted or were incorrect with the mirror line and a number gave a combination of transformations despite 'single' being emboldened in the question.

(b) (i) Most candidates were able to rotate 180°, although many used the wrong centre.

(ii) Most candidates could enlarge with scale factor 2 but, again, many used the wrong centre.

(iii) Better candidates recognised that the transformation was an enlargement, but few gave the correct centre and only the very best gave the correct scale factor. The vast majority of candidates gave a combination of transformations again despite 'single' being emboldened in the question. Candidates should realise that, where they are asked for a single transformation, they will get no marks for a combination of transformations.

Answers: **(a)** Reflection in $y = -x$ **(b)(i)** Correct triangle **(ii)** Correct triangle
(b) Enlargement, scale factor –2, centre (2, 0).

Question 3

(a) Most candidates drew a good sketch graph. However, some made a table and plotted points. A few of these gave an incomplete sketch. The intention on this syllabus is for candidates to use their graphics calculator to sketch the graph and then to transfer the sketch on to the paper.

(b) Most were able to get the solution of 1, but the other solutions were often marred by inaccuracy with –0.73 being extremely common. Some candidates appear to use the trace functions rather than the solve functions on their calculator and they should be reminded that this very rarely gives sufficient accuracy as 3 significant figure accuracy is still required.

(c) (i) Most candidates using graphics calculators were clearly able to establish the turning points but here too insufficient knowledge of their calculators sometimes led to incorrect answers. Candidates should be aware that an answer from their calculator such as 1.999999... should really be 2.

(ii) In this part, the vast majority of candidates gave a range for x from part **(b)** rather than a range for k from the y values in **(c)(i)**. Those who did realise the correct situation sometimes lost a mark by giving $-2 \le k \le 2$.

(d) Better candidates gave a good sketch of $y = 6 - 3x$ but some did not indicate that this showed only one solution.

Answers: **(b)** –0.732, 1, 2.73 **(c)(i)** (0, 2), (2, – 2) **(ii)** $-2 < k < 2$

Question 4

(a) It was necessary for candidates to reach an accuracy of 70.986.... in order to establish that the answer was correct to 2 decimal places as asked for in the question. Most gave a correct method but just wrote down the answer 70.99. Some used the rather unwieldy Sine Rule rather than simple right angle trigonometry.

(b) Candidates were asked to use Cosine Rule and most did, even if it was occasionally on triangle *RPC* rather than triangle *RQC* as expected. This required them to answer part **(d)** first but was still accepted. This part was done very well by all but the weaker candidates.

(c) This part was marked on a follow through basis and was very well done.

(d) This was also well done with many using Pythagoras and fewer using trigonometry.

(e) Most candidates used the formula $\frac{1}{2}bc\sin A$ for the finding the area of the triangle. Those calculating base and height were less successful. Unfortunately a substantial number of candidates found the area of triangle *ABC* instead of triangle *BPC*.

Answers: **(b)** 81.5 m **(c)** 457 m **(d)** 64.3 m or 64.4 m **(e)** 1790 m^2

Question 5

(a) The lines were well drawn by most of the candidates with the commonest mistake being to draw $y = 4$ instead of $x = 4$. Where the lines were correct, so too usually was the region.

(b) This part was less well done and only the best candidates got both parts correct. In part **(i)** many gave a single or several points in the region rather than the number of points.

Answers: **(b)(i)** 7 **(ii)** 9

Question 6

Most candidates gained at least partial success with this question but it proved difficult to find all the correct values in all the parts to obtain full marks.

(a) Most candidates used the volume of the cuboid minus the half cylinder rather than finding the area of the cross-section then using the prism formula. The common mistakes were to subtract the full cylinder or to use the sphere formula rather than the cylinder formula.

(b) This part was marked on a follow through basis and was very well done.

(c) Almost all candidates gained marks in this part by correctly finding some of the relevant areas but few were able to find the areas of all eight surfaces correctly and obtain the final answer. Many used 2 x 2.5 x 10 for the top and bottom forgetting that the bottom was incomplete. Almost all were successful with the left and right sides. Here too some used 50 from the whole circle for the front or back instead of half the circle, and some forgot the area of the arch.

Answers: **(a)** 89.7 cm^3 **(b)** 71.7 or 71.8 g **(c)** 155 cm^2

Question 7

(a) This part was well done with both parts usually correct.

(b) (i) & **(ii)** Candidates almost invariably got this correct and most drew good cumulative frequency graphs. The most common mistake was to join (3, 6) to (0, 0) instead of (20, 0).

(iii) Most candidates pointed out that speeds were higher on Road B but very few actually compared values of median speed or compared interquartile ranges or even ranges. Candidates should be aware that, when asked to compare distributions, the standard comparisons that should be made are one measurement of average and one measurement of spread.

(iv) It was expected that candidates would use the statistics functions on their graphics calculator to calculate the mean but some did show the working. Many of these used the beginning or end of the interval or even the width of the interval rather than the midpoint of the interval. Here, as elsewhere, candidates lost marks through inaccuracy, often giving 59 with nothing to support it.

(v) This part was answered well by many candidates.

Answers: **(a)(i)** 38 km/h **(ii)** 32 km/h **(b)(i)** 33, 53, 85, 115 **(iii)** Comparison of median speeds and /or interquartile range or range. **(iv)** 59.1 km/h

Question 8

Understandably this question, which needed recognition of the dependence of events and use of conditional probability, proved difficult for many. Weaker candidates often just wrote down a single probability or, at best, treated the events as independent or added probabilities instead of multiplying. That said, there were some excellent solutions from the better candidates. Most of these drew tree diagrams.

(a) From those using correct methods, this part was usually correct.

(b) The common error in this part was not recognising the need to reverse the order, thus getting half the correct answer.

(c) Only the very best candidates recognised that the most efficient approach was to use 1 – P(both boys). Those trying to use the longer method often gave the probability of one boy and one girl but omitted the probability of both girls.

Answers: **(a)** $\frac{21}{496}$ **(b)** $\frac{56}{153}$ **(c)** $\frac{49}{60}$

Question 9

(a) Better candidates did this part very well. Those starting with $R = \frac{k}{d^2}$ usually obtained $k = 0.2$ and then went on to correct answers in parts **(ii)** and **(iii)**. Less strong candidates used other proportionalities, for example proportional to d or d^2 or inversely proportional to d or $\sqrt{d}$. The very weakest often left the question blank. In part **(ii)** some candidates lost a mark again by giving an accuracy to fewer than 3 significant figures.

(b) It was expected that candidates would recognise that, since this was a different type of wire, there was no reason why the constant of proportionality should be the same. Rather they were expected to realise that if the diameter was doubled the resistance would be divided by 4. Almost all candidates used the same constant of proportionality. This was not penalised providing they got the correct answer. Unfortunately many did not.

Answers: **(a)(i)** $R = \frac{0.2}{d^2}$ **(ii)** 0.05 ohms **(ii)** 0.224 mm **(b)** 0.5 ohms

Question 10

(a) There were many excellent sketches although some candidates drew curves curving away from the asymptotes or overlapping at the asymptote. Here, as in **Question 3**, some used plotting rather than using their calculator for the sketches. It was more difficult here, however, to get the full shape by this method.

(b) Those who were confident in the use of their graphics calculator could get this part correct but others could not.

(c) Better candidates were able to write down equations for both asymptotes but, for the horizontal one, $y = 2$ and $y = 3$ were quite common. Others were mixed up and gave $y = –3$ and/or $x = 1$.

(d) Again, better candidates had the right idea for the range but few gained full marks. Many only gave the top or bottom of the range or gave < when it should have been ≤ or vice versa. Some candidates gave $–0.333 \le x$ which strictly is incorrect but which was condoned on this occasion.

(e) Many were able to solve the equation on their graphics calculators. Some rearranged the graph to a quadratic and solved the equation. Many, however, lost a mark through neither showing the graph of the straight line or quadratic nor showing the substitution in the formula. Inaccuracy again proved a problem with answers given to fewer than three significant figures.

(f) Many were able to correctly translate the initial graph 3 units to the right but some only drew one branch. Others did not make it clear that the new asymptote was the *y*-axis and some translated it down three units.

Answers: **(b)** (1, 0) **(c)** $x = -3$ and $y = 1$ **(c)** $-\frac{1}{3} \le f(x) < 1$ **(e)** –4.41 and –1.59

Question 11

(a) Very few gained full marks here. Most made vague statements about similarity. What was required was to state the equality of at least two pairs of identified angles and state why the angles were equal i.e. vertically opposite angles and alternate angles. Only the best did this, though some others did identify the two pairs of angles.

(b) Most candidates were able to gain the correct answer in this part.

(c) (i) Only the best recognised that the fraction was $\frac{3}{5}$ since the heights were the same and therefore the areas were in the ratio of the bases.

(ii) Candidates were more successful in this part where the ratio of areas of similar figures was recognised by the better candidates.

(iii) Only the very best were successful in building up the areas.

Answers: **(b)** 10 **(c)(i)** $\frac{3}{5}$ **(ii)** $\frac{9}{25}$ **(iii)** $\frac{9}{64}$

Question 12

(a) Most candidates gave the correct expression in this part.

(b) Better candidates produced a correct equation although some had the correct terms with incorrect signs. Many made errors in simplification but there was some impressive algebra by the very best candidates.

(c) It was expected that, in order to obtain full marks, candidates would show the quadratic formula substituted or sketch an appropriate parabola. Many just gave solutions. Of those showing the formula several made sign errors. A substantial number who obtained the correct solutions did not obey the instructions to give their answers correct to the nearest whole number.

(d) Those recognising the need to use their positive solution to part **(c)** and divide it into 5500 gained a fair amount of success. These usually dealt with the time difference well but some failed to convert to hours and minutes correctly.

Answers: **(a)** $\frac{5500}{x}$ **(c)** 783, –843 **(d)** 1241 or 1242

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/42

Paper 42 (Extended)

Key message

The examination can test all parts of the syllabus and so full coverage is necessary to succeed.

The use of a graphics calculator is an important part of the syllabus and certain functions are expected to be used. The possible uses of the graphics calculator extend beyond curve sketching and candidates benefit from using this type of calculator throughout the IGCSE programme. Reference will be made in the comments on individual questions where candidates could have used the calculator but appeared to believe that this would not be allowed. Functions on the graphics calculator which are not included in the 0607 syllabus should be used with caution as candidates will run the risk of losing method marks.

Suitable accuracy is another important aspect of this examination and candidates should be encouraged to apply good practice throughout the examination, taking notice of any special instructions in individual questions.

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. Most candidates were able to finish the examination in the allotted time.

The paper did prove to be quite demanding for many candidates and this will be mentioned in further detail when commenting on individual questions. The sketching of graphs continues to improve.

Topics on which questions were well answered include ratio, percentages, mean and histograms, trigonometry, average speed, money, curve sketching and applications, and probability.

Difficult topics appeared to be using information with algebraic fractions to form an equation, surface area of a prism, 3-D trigonometry, solving an equation and inequality of a non-standard form and vector geometry.

Comments on specific questions

Question 1

(a) (i) This straightforward percentage question was well answered by almost all candidates.

(ii) This ratio question was also well answered. The most efficient method was to find the 25% of $720 and compare this with $196. Some candidates used their 3 figure answer to part **(i)** which did not give an accurate answer to this question.

(iii) The reverse percentage question was generally well answered and the topic has improved since the first examination of this syllabus. Candidates do need to be able to identify the given amount as a certain percentage as there are still those who use the given amount as 100%.

(iv) The percentage increase was usually correctly answered. A number of candidates only found the increase and others rounded the exact answer of $748.80 to $749. If a money answer is exact then candidates should leave it in its exact form.

(b) This question was testing the use of a continuous percentage increase. It was hoped that candidates would use either logarithms or a sketch of an exponential function. Logarithms were seen quite frequently but sketches were rarely seen. The most common method was to repeat the multiplication by 1.05 until the value of 1000 was exceeded and correct answers usually followed. The algebraic or graphics calculator methods are to be encouraged because a question could make the popular method too long and time consuming.

Answers: **(a)(i)** 27.2 **(ii)** 49:45 **(iii)** 500 **(iv)** 748.80 **(b)** 9 or 8.83

Question 2

(a) This question required the equating of the areas of two rectangles in terms of x and then solving the equation. The equation was quite straightforward as there were only x^2 and x terms. Most candidates succeeded in gaining full marks for the question. A few lost the context and included 0 as an answer.

(b) This was another equation forming question, involving a trigonometrical ratio and two sides in terms of y. There were many good solutions, showing all the working as the question instructed. Some candidates omitted some of the working and in such cases a correct answer did not gain full marks. A common error was to find the actual angle and use it with the two given sides.

(c) (i) This was the more challenging equation question in which two fractions with linear denominators were needed. The fractions were often seen but the given equation was not often derived fully. It is a more demanding part of the syllabus and candidates would benefit from much practice, especially in removing the fractions from the equations.

(ii) This part required the quadratic equation to be solved and then return to the context of the question by dividing the 10 km by the positive root from the equation. More candidates, as to be expected, were able to solve the equation than were able to establish it in part **(i)**. The equation was usually solved correctly and the required time evaluated correctly. A number of candidates did reach 3.33 hours and gave answers of 3 h 33 min or 3 h 19.8 min instead of the exact answer of 3 h 20 min.

Answers: **(a)** 7 **(b)** $\frac{1}{5}$ **(c)(ii)** 3 h 20 min

Question 3

(a) The equation of the line already drawn on the grid was usually correctly found. A number of candidates omitted the y from their answer.

(b) (i) The given straight line was usually accurately drawn on the grid provided.

(ii) The shading of a defined region proved to be too challenging for many candidates and indicated an area of the syllabus needing more attention.

(c) This part was to find the equation of the line through two given points. This is quite a challenging topic but was answered well by many candidates. The most common method seen was to find the gradient (there were many arithmetical slips because of negative signs) and then substitute one pair of co-ordinates into $y = mx + c$ and this seemed to be very efficient. A few candidates used the formula for an equation through two points with equal success. For some reason occasionally the perpendicular gradient was found. Candidates are advised to read questions carefully and not pre-empt another question. In this particular part candidates could have drawn the line and although it would not reach the y-axis on the grid, it would have indicated whether or not the equation was correct.

Answers: **(a)** $y = -x - 1$ **(c)** $y = 3x - 7$

Question 4

(a) This was a straightforward calculation of an estimate of a mean and the frequency table only had three intervals. The question was generally successfully answered although often without using the function available on the graphics calculator.

(b) The histogram was completed by the majority of candidates, clearly assisted by the presence of the first column. The frequency densities were usually correct in a topic which has seen considerable improvement recently.

Answers: **(a)** 125.7 or 126

Question 5

(a) Candidates applied the cosine rule successfully using the two given sides and the included angle. The question asked for a length to be calculated and then rounded to a given value. Most candidates realised that this required a more accurate answer to be stated and gained full marks.

(b) This part required the cosine rule again but for an angle with three sides given. This was also successfully answered by most candidates, especially those who used the explicit formula for the cosine of the angle. Candidates who used the other form of the cosine rule occasionally made errors in the rearranging of the equation.

(c) Bearings are a lower graded topic than the cosine rule and yet this part met with much less success than parts **(b)** and **(c)**. It is never a topic that candidates cope well with and in this particular question the North line was inside the angle calculated in part **(b)**, which appeared to make the calculation more demanding.

Answers: **(a)** 534.6… **(b)** 26.6 **(c)** 353

Question 6

(a) The volume of the triangular prism was usually correctly calculated.

(b) (i) The surface area of the same prism proved to be more challenging, especially with the need to calculate the length of a hypotenuse for one of the triangles in order to find the area of the sloping face. There were some good solutions with clear presentation of the method. Most candidates included the two triangles at the ends, often an area for errors. One of the rectangles was often not included when collecting the separate areas.

(ii) Most candidates were able to multiply their answer to part **(i)** by the cost per square centimetre.

(c) Three dimensional trigonometry proved to be quite challenging even though the line and plane were specifically stated with the use of letters. This part was omitted by a number of candidates and also quite a number found an incorrect angle. A mark was available for a relevant Pythagoras calculation and many candidates did gain the mark for this.

Answers: **(a)** 720 **(b)(i)** 700 **(ii)** 3.50 **(c)** 14.4

Question 7

(a) This date and time question caused many difficulties and many candidates showed a lack of experience in this type of calculation. There were some fully correct answers from the candidates who realised that all the values had to go forward in some way. The most direct way was to add the journey time to the 13 hours New Zealand is ahead of England and then work this forward from 14 00 on Feb 7th. Many candidates did use this method but still had problems with the 24 hour situation.

(b) The average speed was usually correctly calculated.

(c) (i) Most candidates were able to convert the value in pounds into New Zealand currency.

(ii) Most candidates correctly divided the cost of a ticket by the number of miles and rounded their answer to 2 decimal places. A few candidates divided the distance by the cost of a ticket.

Answers: **(a)** 06 30, February 9th **(b)** 669 **(c)(i)** 7524 **(ii)** 0.41

Question 8

This question proved to be the most demanding of the whole paper and indicated the need for much more experience with unfamiliar functions and to realise that these are almost certainly graphics calculator situations.

There were some candidates who gave good sketches and were therefore able to answer part **(a)** quite well, but success in part **(b)** often depended on the curve drawn.

There were many attempts without sketches and these usually led to incorrect answers.

(a) Sketches of the original equations or rearrangements usually led to full marks in solving the equations. Some candidates stated correct answers without any working, presumably by using an equation solving facility on the graphics calculator. Such cases were not awarded method marks and it must be remembered that there is a list of calculator requirements written in the syllabus document. In this case the expected method was to use and show a sketch.

(b) The inequality connected to the equation in part **(a)** was even more of a challenge. Candidates who sketched the two sides of the equation as separate graphs or sketched the equation rearranged by adding or subtracting, had the best chance of dealing with the inequality as these graphs helped visually. Those who multiplied by x to give a quartic equation gave themselves the added difficulty of the sign of x when being multiplied. These sketches were fine for part **(a)** but not so useful here.

Answers: **(a)** – 1.49, 0.798 **(b)** $x \le -1.49$, $0 < x \le 0.798$

Question 9

(a) There were many correct answers for the length of the chord, with the most popular method being the cosine rule and surprisingly few using right-angled trigonometry.

(b) A good understanding was also shown for the length of the arc, again with a high frequency of success.

(c) The area of the segment was a little more challenging but most candidates gained at least one mark for either the area of the sector or the area of the triangle. Many candidates showed a full correct method although a few lost the final mark by not using sufficient accuracy with the sector and the triangle, 39.1 – 30.1 giving an answer of 9, thus clearly losing the accuracy mark.

Answers: **(a)** 9.18 **(b)** 9.77 or 9.78 **(c)** 9.02 or 9.03

Question 10

(a) (i) The sketch of the cosine graph was usually correct.

(ii) The sketch of the sine graph was also usually correct.

It is worth pointing out that success in this type of question will depend on the sketches being correct.

(b) The line of symmetry was frequently correct. There were some omissions and a few horizontal lines given.

(c) The co-ordinates of the minimum point were usually correctly stated.

(d) Most candidates showed an understanding of period and amplitude with some using the sketch and some stating their knowledge. The amplitude was answered correctly a little more frequently than period and a few candidates mixed the two values up.

(e) (i) The range over the limited domain caused a few problems when it was expected that candidates would be able to use their sketch to answer this part.

(ii) The range for the domain of all real x was also found to be challenging and this topic proved to one in need of attention.

(f) Solving $f(x) = g(x)$ proved to be more successful with candidates clearly using the intersection facility on their calculators.

(g) The shading of the region satisfying two inequalities was a discriminating question and the stronger candidates were able to show their understanding of the situation.

This question demonstrated the importance of using a graphics calculator throughout the course, and the well experienced candidates were able to take full advantage of this as many answers could be seen from a good sketch.

Some answers in terms of x were seen and condoned but decimal answers in radians were not accepted.

Answers: **(b)** $x = 180$ **(c)** (180, –1) **(d)** 720, 2 **(e)(i)** $0 \le g(x) \le 2$ **(ii)** $-2 \le g(x) \le 2$
(f) 42.9, 317

Question 11

(a) (i) The straightforward probability question was almost always correctly answered.

(ii) The straightforward probability question was almost always correctly answered.

(iii) The straightforward probability question was almost always correctly answered.

(b) (i) The tree diagram was also usually correct with most candidates realising that the probabilities with the second spin were the same as the first spin.

(ii) Most candidates multiplied correctly to obtain the probability of the combined events. Errors seen were $\frac{1}{6}+\frac{1}{6}$ and even $\frac{1}{6}\times\frac{1}{6}=\frac{1}{12}$.

(iii) This slightly more challenging combined events was generally well answered by the full range of possible methods, the most efficient being to subtract the one product from 1. There were again some basic arithmetical slips. Quite a number of candidates omitted the probability of the event happening twice.

(c) This part required candidates to use the given probability to find the number of spins of the disc. This was designed to be a more testing question than earlier parts and it certainly discriminated well. There were some good answers and some correct answers without much working. The idea of $\left(\frac{5}{6}\right)^k \times \left(\frac{1}{6}\right) = \frac{625}{7776}$ was rarely seen.

Answers: **(a)(i)** $\frac{4}{6}$ **(ii)** $\frac{2}{6}$ **(iii)** 1 **(b)(ii)** $\frac{1}{36}$ **(iii)** $\frac{11}{36}$ **(c)** 5

Question 12

This question involved two sets of data and it was expected that candidates would use their graphics calculator to answer most parts.

(a) The mean, median, upper quartile and range can all be found by the graphics calculator but many candidates chose not to use this facility. The data needed to be input into the calculator for part **(b)** and this emphasises the benefit of reading through a question before starting. The mean and median were usually correct, although the median depended on ordering the data if the calculator was not used. Ordering would also be needed for the upper quartile and the range and the success with the upper quartile was less than expected. The range was found to be more accessible, whichever method had been used. Many candidates did not seem to be confident about dealing with the median and the upper quartile from an even set of values; in this question this being the average of the middle two of 12 and then the average of the middle two of 6.

(b) (i) The equation of the line of regression was well answered. A few candidates did not give at least 3 significant figures for the coefficients and a few others omitted this question. There were a few incorrect answers, suggesting some incorrect data had been input into the calculator.

(ii) The correlation was usually correctly stated to be negative and this was the only description that was accepted. Answers such as linear, decreasing or fuller descriptions of how one changed with the other did not earn any marks. Candidates should know key words for correlation and in this case the key word was negative.

(iii) Most candidates used their equation in part **(i)** correctly.

Answers: **(a)** 18.75, 18.5, 23.5, 13 **(b)(i)** $-4.31t + 120$ **(ii)** negative **(iii)** 25

Question 13

(a) This vector geometry question was found to be challenging. The correct answer depended on a correct expression for $\overrightarrow{PQ}$ or $\overrightarrow{QP}$ and only the stronger candidates in vector geometry were able to find this. A mark was awarded for a correct route from O to X and this was found to be more accessible.

(b) The same comment applies even more in this part and most candidates demonstrated that they found vector geometry demanding and probably needed more practice with the topic. There were some good solutions and some answers with one of the coefficients correct.

(c) This part, involving a column vector and its magnitude, met with more success. Candidates used either the formula for magnitude or Pythagoras and generally set up a correct equation for the unknown component, which then usually led to the correct answers. A few treated the unknown component as the hypotenuse.

Answers: **(a)** $\frac{2}{3}\mathbf{p} + \frac{1}{3}\mathbf{q}$ **(b)** $-\frac{2}{3}\mathbf{p} + \frac{5}{3}\mathbf{q}$ **(c)** ± 4

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/43

Paper 43 (Extended)

Key message

The examination can test all parts of the syllabus and so full coverage is necessary to succeed.

The use of a graphics calculator is an important part of the syllabus and certain functions are expected to be used. The possible uses of the graphics calculator extend beyond curve sketching and candidates benefit from using this type of calculator throughout the IGCSE programme. Reference will be made in the comments on individual questions where candidates could have used the calculator but appeared to believe that this would not be allowed. Functions on the graphics calculator which are not included in the 0607 syllabus should be used with caution as candidates will run the risk of losing method marks.

Suitable accuracy is another important aspect of this examination and candidates should be encouraged to apply good practice throughout the examination, taking notice of any special instructions in individual questions.

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. Most candidates were able to finish the examination in the time allowed.

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

Topics on which questions were well answered include simultaneous equations, transformations, curve sketching and applications, trigonometry, probability, mean and scatter diagrams.

Difficult topics appeared to be variation, logarithms, set notation, mensuration, inequalities, using information with algebraic fractions to form an equation, inverse of a function, lines of regression and a sequence which had an *n*th term of quadratic form.

The sketching of graphs continues to improve.

Comments on specific questions

Question 1

(a) This variation question proved to be a difficult starting question for many candidates. Candidates need to be sure of the procedure of introducing a constant and, more importantly, set up the correct expression. In this case the expression should have been the reciprocal of the square root of *x* or an equivalent expression. If the correct expression is not set up it is unlikely that later marks can be awarded.

(b) Those who had a correct expression for *y* in terms of *x* usually answered this calculation correctly.

(c) The same comment as for part **(b)** applies to this re-arrangement of the formula part. A number of candidates treated this as an inverse function question and this indicated a need to distinguish between the two topics.

Answers: **(a)** 8 **(b)** 0.25 **(c)** $\frac{1024}{y^2}$

Question 2

(a) This equation involving $\log x$ proved too challenging to most candidates. Many were able to simplify $2\log 6 - \log 9$ to $\log 4$ but did not simplify $\log 4 + \log x$ to $\log 4x$. Converting $\log 4x = 3$ into $4x = 10^3$ also proved to be a challenge for those who had reached $\log 4x$. There appeared to be the need for a better understanding of all the laws of logarithms, more than $\log a \pm \log b$. The basic conversion between index form and logarithmic form is an essential law in this topic.

(b) This part on simultaneous equations was the first question to be well answered by most candidates. The majority used the elimination method which was usually more successful than the use of substitution.

Answers: **(a)** 250 **(b)** $x = -2$, $y = -4$

Question 3

All parts of this question required candidates to describe shaded regions of 3-set Venn diagrams in set notation. This proved to be very challenging and for many candidates the only mark was in part **(a)**. The two areas of difficulty were the need to write in set notation and to deal with 3-set Venn diagrams. It may be that 2-set Venn diagrams and given set notation with a requirement to shade in may have been more accessible to more candidates but the question was a reasonable test of an area of the syllabus.

(a) This intersection of the three sets was often correctly stated.

(b) This area was, in words, *A* and *C* but not *B* and it may be that candidates should be able to use this sort of wording before being able to put it into set notation.

(c) A similar comment applies here where the region could be described as *C* but not *A* or *B*.

(d) This part linked parts **(b)** and **(c)** but with a different order of letters. All that was needed, in addition to the letter changing, was to simply write down the union of the two previous answers. Most candidates did not see this connection and many left this part not attempted.

Answers: **(a)** $A \cap B \cap C$ **(b)** $A \cap C \cap B'$ **(c)** $A' \cap B' \cap C$ **(d)** $(B \cap C \cap A') \cup (A \cap B' \cap C')$

Question 4

(a) This was not the most straightforward of similar triangle questions. It was better tried by using algebra, as suggested by the *x* in the question. The other approach was to break the diagram into smaller right angle triangles and assuming that triangle *ACD* was isosceles. The possibility was then to use $\frac{x}{8} = \frac{2.25}{1.25}$, thus removing the need to write down an equation including x and $x + 8$. This was rarely seen and candidates should experience different approaches and different degrees of difficulty with this type of question and not to expect all questions to have a simple ratio calculation.

Some candidates used the answer of 14.4 and successfully proved that it was correct but others used a circular argument and could not be given credit for this.

(b) This question required candidates to connect part **(a)** with two cylinders with radii and heights being available from part **(a)**. The stronger candidates saw this connection and produced some very good solutions. Many found the question too demanding with incorrect radii and/or heights used or the omission of this part.

Answers: **(a)** 211

Question 5

(a) This part required the solving of a quadratic equation and various methods were seen, with good success. The use of the formula proved to be the most popular but was less helpful for the inequality in part **(b)**.

(b) Candidates should be encouraged to think of the possibility of using the graphics calculator to solve equations and this would have been a great advantage for solving the inequality, being a more visual approach. Very few candidates who used the formula correctly were able to do this part of the question.

Answers: **(a)** –0.76, 0.66 **(b)** $x < -0.76$, $x > 0.66$

Question 6

(a) Most candidates found the image of a point under a stated rotation.

(b) Most candidates found the image of a point under a stated reflection.

(c) The combination of the two transformations in parts **(a)** and **(b)** was more searching and this proved to be another area of the syllabus where a little more experience would be worthwhile.

Answers: **(a)** (–6, –2) **(b)** (2, 6) **(c)** reflection, $y = -x$

Question 7

(a) Very good sketches were produced by most candidates. Candidates knew how to set up a suitable window, using the information on the diagram. This has become less of a problem in recent papers. The other improvement with this type of graph was that very few candidates joined the branches indicating a good understanding of asymptotes. Some sketches lacked a little quality but were considered to be good enough to answer the remaining parts of the question.

(b) The three asymptotes were often correctly stated. A few candidates appeared to lack the knowledge of this concept and a few mixed up x and y in the equations of the lines, all of which were parallel to the axes.

(c) The majority of candidates successfully used the intersection facility on their calculator. One point to remember is that the normal level of accuracy is required in these questions unless otherwise stated in the question. Marks were lost by answers to less than 3 significant figures.

Answers: **(b)** $x = -2$, $x = 2$, $y = 0$ **(c)** – 2.33, 0.202, 2.13

Question 8

(a) The cosine rule for an angle was successfully applied by most candidates. Quite a number started with the formula for the square of a side but were usually still successful, although a few made errors in the re-arranging.

(b) Most candidates used the formula for the area of a triangle in terms of 2 sides and the sine of the included angle and arrived at the correct answer. A few overlooked the extra requirement to give their answer to 2 decimal places, for which there was an extra mark. Some candidates used longer methods, taking the unnecessary risk of losing accuracy.

(c) The perpendicular from *C* to *AB* was not always correctly identified. Those who did identify it were able to use simple trigonometry correctly. A common error was to find the distance from *C* to the midpoint of *AB*.

Answers: **(a)** 75.5 **(b)** 20.33 **(c)** 6.78

Question 9

(a) (i) The probability from the given table was usually correctly stated. A few candidates did not use the full total of players for the denominator, suggesting a greater need to read the information in the question more carefully.

(ii) This part involved the same understanding as part **(a)** and the above comment applies here.

(b) This part required a reduced denominator and was understood by more candidates, even though it appeared to be more challenging. Most candidates answered it correctly.

(c) This was the most demanding part of this question requiring a product of three probabilities and each of these probabilities were fractions with reducing numerators and denominators. There were some very good solutions seen but there were candidates who did not multiply three probabilities and many who multiplied incorrect fractions.

Answers: **(a) (i)** $\frac{5}{40}$ **(ii)** $\frac{27}{40}$ **(b)** $\frac{3}{21}$ **(c)** $\frac{120}{5814}$

Question 10

The context of the whole of this question was found to be very challenging for many candidates. There was the need to simply break the problem down to quite straightforward shapes for which formulae are given on page 2 of the paper.

(a) (i) This part required the calculation of the difference of the areas of two circles. Many candidates appeared to be confused by the context and were unable to isolate the radii from other information. Another error was to use diameters instead of radii.

(ii) This part required the area from part **(i)** to be multiplied by the thickness of the shape. More candidates were able to do this, although some overlooked the change of units.

(b) (i) This straightforward calculation of the difference between the volumes of two spheres was successfully answered by many candidates. As in part **(a)**, the context proved to be a challenge for some candidates and there was the repeated error of using the diameter as the radius.

(ii) This final part required connecting answers from parts **(a)(ii)** and **(b)(i)**, multiplying the volume in part **(a)(ii)** by 1 000 000 and then dividing this by the volume from part **(b)(i)**. There were some very good solutions, with good efficient working shown. One misunderstanding seen was that the number 1 000 000 was taken as a volume and this was divided by the volume in part **(b)(i)**.

Answers: **(a)(i)** 2.51 **(ii)** 0.502 or 0.503 **(b)(i)** 3020 **(ii)** 166

Question 11

(a) This topic involving algebraic fractions and establishing a given quadratic equation is always challenging to most candidates and this proved to be no exception. Stronger candidates were able to deliver excellent solutions without any gaps or errors in their working. Marks were available for the fractions, even without the forming of an equation and a few candidates did earn something for this.

Many candidates attempted to solve the given equation and then state that it was proved. Others omitted this part.

(b) (i) Almost all candidates did attempt part **(b)** regardless of how difficult part **(a)** had been. This part required the candidates to factorise a quadratic expression and proved to be demanding for many. Quite a number of candidates solved the quadratic equation and put the roots back into brackets for this part and this was accepted.

(ii) The solutions to the quadratic were frequently correct, either from the factors in part **(i)** or from the formula.

(iii) This part returned to the context of the question and, as in other context situations, many candidates did not carry out the simple calculation of dividing 720 by their x, using distance divided by speed.

Answers: **(b)(i)** $(x+90)(x-80)$ **(ii)** –90, 80 **(iii)** 9

Question 12

(a) (i) The graph of the function was sketched to a good standard by most candidates. The comments for **Question 7(a)** apply here.

(ii) The intersections with the axes were usually correctly stated. Occasionally $1\frac{2}{3}$ was written as 1.6 or 1.7 when either the exact fraction or at least 3 significant figures was required.

(iii) f(0.25) was usually correctly stated. The value should have been obtained from the calculator rather than a more lengthy calculation.

(b) This inequality was a much more searching part and almost all candidates only gained part marks for this question. The greatest difficulty was in the region where the vertical asymptote crossed the line y = 4, especially as the asymptote was not mentioned in the question. Most candidates focused on solving f(x) = 4 and gave their answers around this value of x. The better sketches tended to produce better answers as the solving of the inequality becomes more visual.

(c) This inverse function question was found to be demanding and candidates did not help themselves when not simplifying expressions during the working. This created some basic errors in the working and occasionally fractions within fractions. Candidates need good algebra skills to be able to succeed in a question of this nature. There were many different solutions to this question and, in effect, marks were awarded for correct steps which went towards the answer.

(d) Most candidates used their answer to part **(c)** equal to 1, when the simplest way was to find f(1). Quite a number of candidates found $f^{-1}(1)$. The candidates need to be able to use the basic function statement $y = f(x)$ is equivalent to $x = f^{-1}(y)$.

Answers: **(a)(ii)** $(-1\frac{1}{4}, 0)$ $\left(0, 1\frac{2}{3}\right)$ **(iii)** 1.71 **(b)** $x < -1\frac{3}{4}$, $x > -1\frac{1}{2}$ **(c)** $\dfrac{3x-5}{4-2x}$ **(d)** $1\frac{4}{5}$

Question 13

(a) The estimate of the mean was usually calculated correctly, using mid-values of intervals. The statistics function on the graphics calculator is expected to be used in this type of question so not much working is necessary. One of the 3 marks was for the requirement to round to the nearest integer and a number of candidates did not carry this out.

(b) (i) The frequency density table was usually completed correctly. Some candidates omitted this part suggesting that more work was needed in this part of the syllabus and the same could be stated about those who multiplied the frequency by the interval width.

(ii) Histograms is a topic which has seen considerable improvements recently. The frequency densities from part **(i)** were followed through into this part and this was made more possible by leaving the vertical scale to the candidate. The column widths were usually correct and many candidates gained full marks for this part.

Answers: **(a)** 38 **(b)(i)** 0.6, 3.4, 4, 12, 8.4, 0.4

Question 14

(a) (i) Most candidates were able to complete the scatter diagram by plotting the remaining 6 points. A few problems were seen as a result of the horizontal and vertical scales being quite different.

(ii) The correlation was usually correctly stated to be positive and this was the only description that was accepted. Answers such as linear, increasing or fuller descriptions of how one changed with the other did not earn any marks. Candidates should know key words for correlation and in this case the key word was positive.

(b) (i) The mean of 10 individual temperatures was usually correctly calculated.

(ii) The mean of 10 individual incomes was usually correctly calculated.

(c) (i) The equation of the regression line did not appear to be understood by some candidates as this part often went unanswered. Many did give the correct equation, with a few losing at least one of the marks by not using at least 3 significant figures.

(ii) This part depended on having an answer to part **(i)** and those with such an answer were usually able to substitute into it correctly.

(iii) This part also depended on having an answer to part **(i)** and again those with such an answer were usually able to substitute into it correctly.

(iv) The aim of this part was to assess candidates' ability to explain the difference between interpolation and extrapolation, although such vocabulary was not expected. There were few fully clear explanations but many candidates gave adequate reasons to earn one or both marks.

Answers: **(a)(ii)** positive **(b)(i)** 22.3 **(ii)** 436 **(c)(i)** $19.8x - 4.78$ **(ii)** 410 or 411 **(iii)** 628 or 629

Question 15

(a) This exponential sequence was found to be straightforward in finding the next term but very challenging when finding the n th term. Most candidates answered the next term correctly and those familiar with this type of sequence were able to write down a correct expression for the n th term. Understandably $6\times3^{n-1}$ was a common answer and this earned full marks. Several inappropriate methods were seen, with finding differences the most common.

(b) As in part **(a)** the next term was found easily. The n th term proved to be quite searching although more candidates than in part **(a)** appeared to find the best strategy, which was either to start with a quadratic or to find the differences, leading to a quadratic.

Answers: **(a)** 1458, 2×3^n **(b)** 29, $n^2 - n - 1$

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/05

Paper 5 (Core)

Key Message

Candidates should be reminded that, in order to do well on this paper, they need to show all relevant working and communicate their answers and reasoning clearly.

General Comments

All but the very weakest candidates gained more than half the marks in this paper with many showing very good investigative skills. Candidates appeared well prepared for this type of investigative task. The level of communication was of a high standard and many candidates gave a full account of the processes they used. However, in a small minority of cases, candidates seemed unaware that communication skills were important. While many fine papers were seen very few managed to achieve the maximum score, the last question requiring a high degree of sophistication in analysing all the possibilities.

Comments on Specific Questions

Question 1

(a) Nearly all candidates scored full marks here. Some sensibly went back and corrected answers once the pattern had been spotted.

(b) This was a key question since the investigation of general rectangles and their diagonals required an understanding of this relationship. Most candidates were successful in finding the connection and writing it as an equation although there were some who only wrote the expression $x + y – 1$, for which no credit was given.

Answer: $x + y = S + 1$ (or its equivalent)

(c) A large majority of candidates were able to identify the three possibilities. This question offered an opportunity for communication, which most took, with the better candidates reducing their equation to $x + y = 7$. More care from some candidates in showing their substitution method would have gained credit and incorrect mathematical writing (such as $5 + 2 = 7 – 1 = 6$) was not given the communication mark.

Answer: $x = 6$ $y = 1$
$x = 5$ $y = 2$
$x = 4$ $y = 3$

Question 2

This question required candidates to complete a table for rectangles the dimensions of which had common factors. An example of how this was done and the relevant diagram were provided in the question. Candidates had to understand the method and so complete the table for the rectangles given. The common factors (2, 2, 5, 13) were found by many, although a sizeable number thought that the common factor of 13 and 13 was 1. Some candidates used 2 as a common factor throughout and so could not receive credit for the "basic rectangles" (3 by 1, 4 by 3, 5 by 3, 1 by 1). Since a strict follow-through was used to mark this question many candidates (even after a previous error) gained marks for the subsequent calculation and the four multiplications.

Answer: (final column): 6, 12, 35, 13

Question 3

Candidates had to investigate how many squares a diagonal would pass through when there were 18 squares in a rectangle. To do so they had to first discover the possible dimensions of the rectangle. Half of the marks in this question were awarded for doing so. A significant number of candidates did not take 1 by 18 as a possibility and so could not find the correct maximum.

Most candidates favoured using their original formula, which gave 8 and 18. Only a few noticed that the 3 by 6 rectangle required the method using a common factor. The opportunity for communication was only granted if a candidate showed how the minimum of 6 could be obtained numerically. Although rarely seen, there were some very good explanations for finding 6, such as extending the table in **Question 2**.

Some resorted to diagrams and were able to find the correct answers.

Answer: 6, 18

Question 4

This was a challenging question to explore. Most candidates, using the simple equation from **Question 2**, were able to gain a mark for finding the 4 by 1 rectangle. Communicating how this came from that formula was given credit. Several extraneous answers were seen, often when reversing the numbers, candidates not realising that these give identical rectangles. Only those few candidates who had thought further and considered the role of common factors were able to gain the marks for the other two possibilities.

Answer: 3 by 2, 4 by 1, 4 by 2, 4 by 4

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/06

Paper 6 (Extended)

Key Message

When a question says "Show that…." or "Explain why…." candidates should realise that a full explanation is required.

General Comments

Overall candidates appear well prepared for this paper and most were able to show good mathematical skills in their work.

Not reading the question carefully caused many candidates to lose marks. This was seen especially in Part A in **Questions 2(a)(iii), 2(c)** and **3(a)(ii)**.

In Part A the large majority of candidates showed a very good approach to the investigation in which it was required to explore different possibilities. Nearly all candidates showed a willingness to communicate their ideas and many good arguments were seen. Some candidates do though need to be more aware of bad form when writing mathematical statements. For example, 8 + 5 = 13 – 1 = 12 was seen quite often.

Part B, though less well done than Part A, showed an improvement in understanding the context and algebra was used with confidence. While a high percentage showed the good skills in using the graphics calculator there were still some who did not use one and so had little chance of success after the first few questions. Communication again was very good and indeed many candidates made full use of the answer space when explaining their work. There are a few candidates who need to remember that good mathematical communication is being assessed in this paper and answers alone are usually insufficient.

Comments on Specific Questions

Part A

Question 1

In this introduction to finding the necessary numerical values hardly any candidates made errors.

Answer: **(a)** 2 **(b)** 6

Question 2

(a) Candidates were required to express answers algebraically and the large majority had no problem with this. The most common error was in not simplifying their expression, as instructed, in part **(iii).**

Answer: **(i)** $x - 1$ **(ii)** $y - 1$ **(iii)** $x + y - 2$

(b) This question was very well answered. Some, who had made a slip in part **(a)**, were able to recover here and full marks were seen in most cases. This question set up the formula which was essential for the rest of the investigation.

Answer: **(i)** $N + 1$ **(ii)** $x + y - 1$

(c) This question allowed candidates to check their results so far. The word "clearly" indicated the emphasis given to showing the formula was correct. A significant number merely stated that a diagonal went through 12 squares when it was expected that candidates would show this by marking the relevant squares in some way. A number of candidates did not follow the instruction that the formula in part **(b)(ii)** had to be used. It was important that candidates checked this formula and not work from first principles again.

Answer: 8 + 5 – 1 = 12

Question 3

(**a) (i)** As in **Question 2(c)** a clear indication of the 12 squares counted was required. Most candidates shaded the relevant ones though a very large number of candidates did not indicate anything on the diagram. The question pointed to the fact that the formula did not apply when common factors were present.

(ii) Many candidates made good use of the answer space and showed how the 9 by 6 rectangle was an enlargement of the 3 by 2 one. Some developed good notation to explain their method. The question required showing the use of the 3 by 2 rectangle. Those, who instead, used the result $S = x + y$ – common factor were not answering the question and received no credit at this stage.

(b) For this part any correct method could be used and there were a significant number who preferred $S = x + y$ – common factor. There was an opportunity for communication here which those candidates who employed a valid method usually gained. Even if the method was incomplete, some credit was given for finding the number of squares crossed by the diagonal in the reduced rectangle. Arithmetical errors spoilt some responses to this question.

Answer: **(i)** 180 **(ii)** 90

Question 4

This was a challenging question with which to finish the investigation and required comprehensive analysis of the situation when 6 squares were crossed by a diagonal. The popular answer was to identify only those three rectangles for which $x + y - 1 = 6$. There was another opportunity for communication in showing how the values of x and y could be found, for example by considering $x + y = 7$. While many candidates were able to gain one mark here only the more perceptive realised that rectangles with common factors for the lengths of the sides had to be considered as well. Of the few such candidates who investigated further some did not feel that a square is also a rectangle and so discarded 6 by 6 as a possibility.

Answer: 4 by 3, 5 by 2, 6 by 1; 6 by 2; 6 by 3; 6 by 6.

Part B

Question 1

A very large number of correct responses were seen. On this occasion, the few who did not round to the nearest metre were not penalised in this question. There was an opportunity for communication by showing the method. It was a requirement though that the communication be correct and statements such as $500^2 + 300^2 = \sqrt{340000}$ were not given credit. However the large majority of candidates gained the communication mark in this question.

Answer: 583 metres

Question 2

Almost all candidates gained the mark for this question which, together with **Question 1**, set the limits for the length of the tunnel.

Answer: 800 m

Question 3

(a) "Explain why…." questions still cause some difficulty for candidates. However many wrote at length about the process required to arrive at the given model and a significant number gained full credit for this question. It was insufficient to simply state that $\frac{500-x}{2}$ was the required time for drilling through normal rock. Candidates needed to make clear from where the numerator and denominator came and indicate the relationship with the formula $t = d/s$.

(b) Many reasons for the time being different were offered and any that did not question the accuracy of the information given in the question received credit. In particular no credit was given for answers that suggested the drill went in a different direction or that it sometimes went slower. Candidates were expected to relate the model to the context. Some good reasons that were seen were for instance: "The drill might break and time is needed to replace it"; "More time is needed to set the drill in another direction at *P*".

(c) Most candidates were able to draw a correct graph using the graphics calculator. A continuous curve (not a polygon) was necessary. Some care was expected when showing an approximate position of the *T*-intercept and so an intercept close to 500 or 600 did not receive credit.

(d) This question tested skill in using the graphics calculator to find a minimum and then round off the results as stated in the question. Those who had typed the correct function into their calculator in part **(c)** usually gained the full marks. Errors in rounding to the required accuracy were penalised in this question.

Answer: **(i)** 173 metres from *B* **(ii)** 510 hours

Question 4

(a) A good number of candidates were successful in this question. A very common error was multiplication by 2000 and by 3000 from candidates who did not notice that *n* was also in thousands. Only multiplication by 2 and by 3 were required.

(b) (i) This question required skill using the graphics calculator since the window used in **Question 3** was no longer suitable. It was mainly the better candidates who were able to produce the correct answer. A common error was to use the value of $x = 173$ which gave a minimum for the time and not the cost.

(ii) Credit here was given for answers that followed on correctly from the candidate's answer in part **(i)**. While the question required candidates to write out the answer in full, many did not include the thousands in their answer.

Answers: **(i)** 106 metres **(ii)** \$ 1 350 000 (or \$ 1350 thousand)

Question 5

(a) The word *Investigate* requires more than just trying out one length $AB > 500$. There is the implication that a conclusion must be made rather than just one or two calculations made. So candidates needed to look for a generalisation. Only the strongest candidates were able to do this and state that the position of *P* remained fixed for all lengths larger than 500. Communication was given credit here and some showed thoughtful work using their graphics calculator and describing how different values for *AB* had resulted in the graph of the function of *T* being translated vertically upwards.

(b) Two methods of approach were seen. The most common was to use the minimum value for *x*, found in part **(a)** to be constant at 173, and substitute this into the equation $T = \frac{d-x}{2} + \sqrt{90000 + x^2}$. It was important in doing so to retain accuracy to at least one decimal place. Otherwise rounding to three significant figures would not be demonstrated. Another method was to use the set of results for *d* and the minimum time *T* found in part **(a)**. These could then be substituted into $T = \frac{d}{2} + 260$ to check that the equation was satisfied. Of those who chose this method, many only substituted one set of values, often from **Question 3(d)**. At least three sets of values were expected in order to strengthen the case that the relationship was linear.