CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/11
Paper 11 (Core)

General comments

Most candidates were generally well prepared for this paper and were able to make an attempt at the majority of questions. Candidates appeared to be able to complete the paper within the allotted time, with most making an attempt at the final question. The standard of presentation was good and working was usually shown when appropriate. Generally candidates were able to carry out any necessary calculations without the aid of a calculator, although some errors occurred occasionally in **Questions 7(c)** and **Question 9**.

Questions 2, **4(a)** and **10(b)** were answered particularly well with most candidates showing a good understanding of the algebra involved. Some candidates were unable to identify the required regions of the Venn diagrams in **Question 6** but in **Question 11** almost all candidates gave the correct numbers in part **(a)** and **(b)** and went on to give the correct answer for the probability in part **(c)**. The questions that candidates had most difficulty with were **Question 8,** requiring the use of $y = mx + c$ and **Question 12,** involving the transformation of graphs.

Comments on specific questions

Question 1

(a) Most candidates showed an ability to round off a number to one decimal place. A number of candidates used an incorrect method that involved rounding 6.149 to 6.15 and then rounding this to 6.2.

(b) Many candidates gave the correct answer to this part. Some candidates need to improve on rounding skills when a particular number of significant figures are required. It was quite common to see such answers as 20.6, 2.06, 21 or 200.

(c) Nearly all candidates gave an answer in the form $a \times 10^n$ and many correctly gave a as 2.3 and n as –3. Some candidates gave incorrect answers such as 0.23×10^{-2}, 2.3×10^{-4} or 23×10^{-2}.

Answers: **(a)** 6.1 **(b)** 210 **(c)** 2.3×10^{-3}

Question 2

(a) Candidates answered this well with very few errors made. The factors were not necessarily given in ascending order but any order was accepted.

(b) This was nearly always answered correctly. Many wrote down the correct answer without showing any working and others gave the factors of 15 and 21 as a preliminary step. A very small number of candidates gave an answer of 105, the lowest common multiple.

Answers: **(a)** 1, 3, 5, 15 **(b)** 3

Question 3

(a) Some candidates knew the number of lines of symmetry of a regular pentagon. Most candidates drew a diagram and attempted to identify the lines of symmetry in their diagram. Many of the diagrams were not accurate enough for the 5 lines of symmetry to be clear. It was quite common for 1 line of symmetry to be given as the answer and occasionally 4 lines of symmetry was given.

(b) Some candidates were able to identify the quadrilateral with both rotational symmetry of order 2 and no lines of symmetry. Others wrote down the name of a quadrilateral that had only one of these properties such as rectangle, rhombus or trapezium. A few candidates gave an answer that was not an example of a quadrilateral such as polygon or hexagon and quite a number of candidates omitted this part.

Answers: **(a)** 5 **(b)** Parallelogram

Question 4

(a) Most candidates showed very good algebraic skills in order to solve this linear equation. The working was set out particularly well and, as a result, very few errors were made.

(b) The majority of candidates indicated the end points on the diagram and drew a line between them. Some candidates need to focus on using the standard notation for indicating whether the end point itself is included or not. There were cases in which the candidate did not attempt to distinguish between the two end points and in other cases they were reversed.

Answers: **(a)** $x = 4$ **(b)** Correct diagram

Question 5

(a) Candidates generally answered this well, usually giving a method such as 2 x 1 – 3 for the first term. Candidates who gave incorrect answers did not often show any working. A few candidates substituted a wrong value for n and so gave terms that were not the first and second and some candidates omitted this part.

(b) This part was also answered well. A small number of candidates did not give an answer.

(c) Quite a number of candidates wrote down $2n - 3 = 44$ and then went on to give $2n = 47$ or $n = 23.5$. Not all went on to justify their conclusion; for example by stating that 47 divided by 2 does not give a whole number or that 23.5 is not a whole number. Some used an alternative method and gave three, or more, terms in the sequence (other than –1 or 1). Again, some did not complete the reasoning; in this case by stating that all the terms in the sequence were odd numbers.

Answers: **(a)** –1, 1 **(b)** 197 **(c)** Conclusion that 44 is not in the sequence with a valid explanation.

Question 6

(a) Some candidates were able to identify the area denoted by $P \cup Q$. A number of candidates confused the symbols $\cap$ and $\cup$ and so shaded the area for the intersection of P and Q. Other examples of incorrect areas that were shaded were $P \cap Q'$ and $(P \cup Q)'$.

(b) As in part **(a)** some candidates shaded the correct area and some examples of wrongly shaded areas were $P' \cup Q$, $P \cap Q$ and Q.

Answers: **(a)** Correct diagram **(b)** Correct diagram

Question 7

(a) Candidates used the angle sum of the triangle to obtain the correct answer. A small number of candidates made an arithmetic error.

(b) Candidates who focused on a single word for the answer usually gave 'similar' as required. Some gave a description of the relationship between the two triangles that often referred to the idea of enlargement.

(c) Candidates showed a very good knowledge of the concept of enlargement and used a scale factor of 3 that enabled them to give 3 x 2.5. This was nearly always evaluated correctly.

Answers: **(a)** 55° **(b)** Similar **(c)** 7.5

Question 8

(a) Candidates often showed a knowledge of $y = mx + c$. Some candidates need to improve on rearranging the given equation into a suitable form to find the gradient. In this case a good first step was to write down $y = \frac{1}{2}x + \frac{3}{2}$.

(b) A few candidates knew that the gradients of parallel lines are the same and so gave an answer that was the same as their answer to part **(a)**. Many candidates did not relate the gradient to that in part **(a)** and attempted to use $2y = x + 3$ and quite a large number omitted this part.

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

Question 9

Many candidates wrote down the area of the shaded area as a fraction of the complete circle as $\frac{20}{100}$. Most went on to obtain the correct answer but some did not use 360° for the total number of degrees and others made a calculating error in dividing 360 by 5. There were candidates who used 100 cm^2 for the unshaded area and thus gave the fraction as $\frac{20}{120}$ that led to an answer of 60°.

Answer: 72°

Question 10

(a) Some candidates wrote down 3 x 3 x 3 = 27 and used this to give the correct answer. Others wrote down the correct answer without the need to give any working. Many candidates gave an answer of 9 and, if working was shown, the answer was obtained from either 9 x 3 = 27 or 27 ÷ 3.

(b) The majority of candidates answered this correctly. A few candidates carried out a partial factorisation giving either $3(y^2 - 5y)$ or $y(3y - 15)$.

Answers: **(a)** 3 **(b)** $3y(y - 5)$

Question 11

(a) Virtually all candidates showed a good knowledge of Venn diagrams and were able to identify the number of students who play basketball only.

(b) Most candidates gave the correct answer, using either 4 + 3 or 15 – 8.

(c) This was answered well. A few gave $\frac{6}{15}$ or $\frac{2}{15}$.

Answers: **(a)** 4 **(b)** 7 **(c)** $\frac{8}{15}$

Question 12

(a) This part was sometimes omitted. Quite a number of candidates identified the transformation as a translation along the *y* axis. Some of these gave the correct answer and some gave $y + 3 = x^3$ or $y = x^3 - 3$. A few candidates gave $y = 3x^3$.

(b) Very few candidates answered this correctly. A very common answer was $y = x^2 + 3$ suggesting that candidates need to be able to recognise the case in which the translation is along the *x* axis, rather than the *y* axis.

Answers: **(a)** $y = x^3 + 3$ **(b)** $y = (x - 3)^2$

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/12
Paper 12 (Core)

General comments

The entry for this paper was small on this occasion and this should be taken into account when reading this report. The standard achieved by many candidates was very good and most showed that they had a real understanding of the topics in the syllabus. The standard of presentation was particularly good with candidates showing the appropriate working. Calculators are not permitted for this paper but candidates were usually able to carry out any necessary calculations. Candidates completed the paper within the allotted time, with virtually all making an attempt at the final question.

Questions 2, 4, 7, 9 and **11** were answered particularly well. The questions that candidates had most difficulty with were **Question 8(b)**, the range of a mapping diagram, and parts of **Question 10**, transformations.

Comments on specific questions

Question 1

(a) Most candidates were able to give the answer correct to one significant figure as required. Just a few candidates rounded to two significant figures, some giving 2500 as the answer and others then rounding 2500 to 3000. A small number of candidates used decimal places, rather than significant figures, giving an answer such as 2, 2.0 or 2.49.

(b) The majority of candidates answered this correctly. A few attempted to round the answer giving 3.5×10^4 and a few others gave an answer in a non standard form such as 356×10^3.

Answers: **(a)** 2000 **(b)** $3.56(000) \times 10^5$

Question 2

(a) Virtually all candidates answered this correctly, setting out the algebraic steps very well. A very small number of candidates made a sign error leading to $7x = 15$ for example.

(b) Again, this was almost always answered correctly. A very small number of answers were not simplified and a few candidates changed one or two signs giving either $8x + 3$ or $8x – 3$.

Answers: **(a)** $x = 3$ **(b)** $4x + 3$

Question 3

(a) Some candidates correctly calculated angle *BCD* and then gave this as the final answer. However most candidates subtracted their answer from 180° to give angle *BCA*.

(b) Most candidates used triangle *ABC* to find angle *BAC*. Most then went on to give the required bearing by giving 180° – (70° + 50°) = 60°. Some did not identify the angle required for the bearing and used 360° – (70° + 50°) to give 240°.

Answers: **(a)** 120° **(b)** (0)60°

Question 4

(a) Candidates showed an excellent understanding of the method for calculating the area of this compound figure. Most candidates calculated the area of the rectangle with dimensions 4 cm and 3 cm and then added on the area of the triangle. A few used the subtraction method and started with multiplying 5 cm by 4 cm and then subtracting the areas of the extra triangles.

(b) This was virtually always correct as candidates were able to identify the scale factor as 3 and then go on to give the new length of the base as $4 \times 3 = 12$.

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

Question 5

(a) Many candidates gave the correct answer. Some found the negative power difficult to deal with and it was quite common to see answers given as either 9 or –9.

(b) Candidates answered this very well indeed, with just a few only partially factorising the expression.

(c) This part was also answered very well. There were some candidates who divided the powers rather than subtracting, leading to an incorrect answer of x^2.

Answers: **(a)** $\frac{1}{9}$ **(b)** $4q(2p - q)$ **(c)** x^3

Question 6

A few candidates omitted this question. Most candidates correctly found the time as 5 hours, with just the odd error in subtraction seen, and then went on to use distance ÷ time successfully. The division was carried out correctly by nearly all the candidates.

Answer: 78

Question 7

(a) Virtually all candidates plotted the point C correctly at (6, 4). A very small number did not complete the parallelogram as they did not join the points.

(b) This part was always answered correctly.

(c) Many candidates gave the correct gradient either by appreciating that a horizontal line has a gradient of 0 or using the formula (change in y)/(change in x). Those using the formula sometimes gave the answer as 3 even if they had obtained $\frac{0}{3}$. A number of candidates gave the equation of the line $y = 1$, rather than the gradient.

Answers: **(a)** Parallelogram drawn with C at (6, 4) **(b)** (6, 4) **(c)** 0

Question 8

(a) This was nearly always answered correctly with candidates able to correctly substitute $x = 5$ into the given function. The more difficult calculation to find q was completed by solving $19 = 3x - 2$ or simply writing down $q = 7$.

(b) Candidates found this part one of the most difficult on the paper, with only a few able to give the correct answer. Most candidates did not know how to find the range for a mapping diagram. It was common to see answers such as 2 to 19, 19 – 2 = 17, 7 – 2 and 19 – 4.

Answers: **(a)** $p = 13$, $q = 7$ **(b)** 4, 13, 19

Question 9

(a) Nearly all candidates answered this correctly. A small number correctly wrote down 2 – 5 and then made a mistake with the subtraction.

(b) This was also answered very well. A few left the answer as 2 x 60 – 5 or made an arithmetical error.

Answers: **(a)** –3 **(b)** 115

Question 10

(a) The majority of candidates identified the transformation required and wrote down 'translation'. A few did write down an incorrect name and a small number could not recall the name and so attempted to describe the transformation. Some wrote down a vector as part of the answer and used the scales correctly to give $\begin{pmatrix} -3 \\ -4 \end{pmatrix}$. Many did not use the scales and counted the squares through which the triangle had moved leading to the incorrect vector $\begin{pmatrix} -6 \\ -8 \end{pmatrix}$. A few candidates used a description rather than a vector and an answer such as '3 units to the left followed by 4 units up' was accepted for this mark.

(b) Many candidates identified the correct transformation. It is important for candidates to only give a single transformation as indicated in the question. Any mention of another transformation such as translation or reflection meant that the candidate could not receive any credit for this part. Some candidates did not attempt to describe the rotation and others only gave a partial description. This was usually an attempt at the angle which was sometimes given as 180° rather than 90° anticlockwise. Very few candidates attempted to identify the centre of rotation and (1, 0) or (1, 1) were sometimes seen rather than (0, 0).

(c) This was very well answered by most candidates. A few drew $y = 3$ rather than $x = 3$ for the reflection line and, if the reflection was carried out correctly in this line, one mark was awarded. There were a very small number who reflected the figure using an incorrect line of reflection such as $x = 2$ or the x axis.

Answers: **(a)** Translation $\begin{pmatrix} -3 \\ -4 \end{pmatrix}$ **(b)** Rotation, 90° anticlockwise, centre (0,0) **(c)** Correct reflection, points (5, 1), (5, 3), (4, 2)

Question 11

(a) Most candidates answered this correctly by stating that the correlation is negative. Some omitted this part and some referred to the correlation either changing or decreasing neither of which was precise enough to earn the mark.

(b)(i) Virtually all candidates plotted the point correctly.

(ii) Most candidates showed an understanding of drawing 'a line of best fit'. Some candidates did not draw their line through the plotted point for the mean.

Answers: **(a)** Negative **(b)(i)** Correct point plotted **(ii)** Line drawn

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/21

Paper 21 (Extended)

General comments

The majority of candidates for this paper were able to demonstrate positive achievement.

All of the questions were accessible to a large majority of the candidates, but **Questions 7**, **8** and **9** in particular required logical and concise working. The written work was usually well organised and legible. There was no evidence to suggest that the candidates did not have sufficient time to attempt the whole of the paper.

When the given answer is incorrect, there are usually marks for a correct method seen or a correct statement being made. A minority of candidates, however, showed little or no working, so consequently they either obtained full marks for a correct answer to a question or no marks for an incorrect answer. This lack of working suggested that some Centres were issuing paper to candidates for rough working. Centres should not be routinely providing candidates with paper on which to do their working, unless of course the working space for a question is found to be insufficient for any reason. In these circumstances, work on additional paper should be neat and carefully labelled and it should be attached to the question paper.

Comments on specific questions

Question 1

(a) This part was well answered, though answers of $3\sqrt{5}$ or $5\sqrt{15}$ were seen regularly.

(b) This part was well attempted. Most candidates knew that they had to multiply both the numerator and the denominator by $(5+\sqrt{3})$, but some tried to use either $\sqrt{3}$ or $(5-\sqrt{3})$. Unfortunately, the evaluation of the denominator from the correct method was not always correct.

Answers: **(a)** $5\sqrt{3}$ **(b)** $\dfrac{5+\sqrt{3}}{11}$

Question 2

(a) This part was answered extremely well. Errors were very rare.

(b) This part was well attempted. Almost all of the candidates realised that squaring was involved. The most common wrong answer was $(n-1)^2$.

Answers: **(a)** 24, 35 **(b)** n^2-1

Question 3

Most candidates had no difficulty in answering this question, and if an error was made there was usually sufficient working seen to earn one mark.

Answer: 4

Question 4

(a) This part was usually well attempted, but arithmetic errors often contributed to one or both numbers being wrong. A common wrong answer was to find 2**p** + 3**q**.

(b) This part was well answered. The error of prefixing the answer with ± was only seen very occasionally, and a few candidates left the answer as $\sqrt{25}$.

Answers: **(a)** $\begin{pmatrix} 16 \\ -3 \end{pmatrix}$ **(b)** 5

Question 5

(a) Factorising the expression did not cause too many problems, though a small number of candidates did reverse the signs. Occasionally the expression was treated as an equation, and then some candidates tried to find solutions using the formula for solving quadratic equations.

(b) Virtually all candidates knew what they were trying to do, but a sizable number of them managed to reverse the sign. It was also common to give the answer as $x = 1$.

Answers: **(a)** $(x-4)(x+1)$ **(b)** $x < 1$

Question 6

Candidates found this question difficult. They would benefit from more familiarity with sets and set notation.

(a) This involved one of the fundamental ideas of set notation and its visual representation on a Venn diagram. Many candidates were unable to define the region accurately. Many wrote it as the "union" of the two sets.

(b) The majority of the candidates failed to find the correct answer. There were several versions of the correct answer, all of which were acceptable. It was very common to see $A' \cup B$, $A \cup B'$ or $A \cap B'$ as incorrect answers.

Answers: **(a)** $A \cap B$ **(b)** $B \cap A'$

Question 7

(a) Many candidates did not understand the term "inversely", so it was very common to see $F \propto d^2$ or $F = d^2$. Even those candidates who did understand "inversely" often failed to use a constant. If k was used it was often not evaluated using the values given for F and d.

(b) In this part $k = 36$ often appeared, but it was too late to earn any credit for it in part **(a)**. It did, however, enable candidates to answer this part correctly. A follow through was allowed for certain types of answer from part **(a)**.

Answers: **(a)** $\frac{36}{d^2}$ **(b)** 4

Question 8

(a) This part was quite well attempted, but a minority of the candidates were unsure as to what was required. Candidates were required to demonstrate at some stage that $n \log a = \log a^n$ and either that $\log a + \log b = \log ab$ or that $\log a - \log b = \log\frac{a}{b}$. The common wrong answer was 2 instead of log 2, because the final step had been written in error as $\frac{\log 72}{\log 36}$ instead of $\log\frac{72}{36}$.

(b) Most candidates found this part to be very difficult. However, correct answers were seen regularly with the success being very Centre dependent. Credit was given for correct numerators, correct denominators or reciprocals of the correct answer, all of which indicated some degree of understanding.

Answers: **(a)** log 2 **(b)** $\frac{8}{27}$

Question 9

Three method steps in the correct order were required. The first step was to clear the denominators. The second was to make x^2 the subject of an equation. The final step was to find the square root. Correct answers were common, but many were then spoilt by giving the final answer as $c + d$. The first step often ended up as $d^2 = x^2 - c$. Even so, it was still possible to follow through the last two method steps.

Answer: $(\pm)\sqrt{(c^2 + d^2)}$

Question 10

(a) Many candidates treated this as a numerical exercise rather than an algebraic one, but it was only occasionally that they produced the expected numbers of 7, 6 and 2. Of those candidates who did produce algebraic expressions, only the ones in *M* and *C* were usually correct. It was common to see $x - 12$ instead of $12 - x$, and some answers involved *m* and *c* which appeared without explanation.

(b) Candidates were more successful here, though only a minority of candidates got the correct answer. It was usually unclear how they had arrived at this answer.

Answers: **(a)** $12 - x$, $11 - x$, $x - 3$ **(b)** 5

Question 11

High scoring candidates had no trouble in finding the two answers, but for many candidates their answers represented a lack of understanding. Many got one angle correct but not the other, which indicated a lack of knowledge of the cosine function. A considerable number of candidates failed to get even one angle correct, and it was not unusual to see negative answers.

Answer: 120° and 240°

Question 12

(a) Many candidates got this answer correct, but an even larger number got one aspect of it correct. It was usually the "3" that was correct in $y = 3\sin(\mathrm{f}(x))$ rather than the "2" in $y = k\sin 2x$. About a quarter of the candidates appeared to have no idea of what they were looking for.

(b) The responses to this followed a similar pattern to those in part **(a)**. Many sketched a correct curve and many had no idea what to do. The others were far more likely to draw a graph with an amplitude of 2 than to get the correct period of 360°.

Answers: **(a)** $y = 3\sin 2x$ **(b)** Correct sketch

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/22

Paper 22 (Extended)

General comments

All candidates appeared to have sufficient time to attempt all questions on this paper and were able to demonstrate positive achievement. Clear working was shown on most papers and most candidates wrote legibly in pen. Method marks could be awarded for correct working seen even when the answer was incorrect.

Candidates should not be issued with supplementary sheets of paper for rough working. Space is provided on the question paper for candidates to show working relevant to each part question. Supplementary sheets should only be used when a candidate has filled the spaces provided. Any sheets of paper should be clearly labelled with the question number and candidate details and attached to the script.

Comments on specific questions

Question 1

(a) Candidates understood how to evaluate $27^{\frac{2}{3}}$.

(b) Candidates were generally able to evaluate $9^{\frac{1}{2}}$. Simplifying $c^{\frac{1}{2}} \times c^{\frac{3}{2}}$ was more of a challenge with c^4 and $\sqrt{c^4}$ being common wrong or incomplete answers. Candidates who did not understand that the first c should be raised to the power $\frac{1}{2}$ gave the answer $3c\sqrt{c^3}$.

Answer: **(a)** 9 **(b)** $3c^2$

Question 2

(a) Candidates recognised the need to calculate 27 x 3 and usually achieved the correct answer.

(b) Many correct answers were seen, with 3^n being a common incorrect answer. Much fruitless experimentation was seen by candidates who thought that the n^{th} term should include n^3 or $3n$.

Answers: **(a)** 81 **(b)** 3^{n-1}

Question 3

Candidates who found the exterior angle of 24° first and then calculated 360 ÷ 24 demonstrated the most successful and efficient method. Some candidates were also successful by recalling the interior angle sum $(n - 2)180$. Others were unable to link $(n - 2)180$ to 156° by dividing by n. Candidates who adopted a trial and error approach were not successful.

Answer: 15

Question 4

(a) Candidates understood how to list the factors of 12.

(b) Many correct answers were seen. Others correctly found $A \cap B'$ but did not understand that it was the number of elements of the set that was required and not the set itself.

Answers: **(a)** 1, 2, 3, 4, 6, 12 **(b)** 3

Question 5

(a) Excellent knowledge that $\log_2 8 = 3$ was demonstrated by candidates. Very occasionally an incomplete answer of $8 = 2^3$ was given.

(b) Many correct, clearly presented solutions were seen. Some candidates misunderstood the question, interpreting it as $3\log 2 - (\log 4 + 2\log 5)$, but still demonstrated good knowledge of, and were able to gain credit for, $\log a^b = b\log a$, $\log a + \log b = \log ab$ and $\log a - \log b = \log \frac{a}{b}$.

Candidates should avoid writing $\log 8 - \log 4 = \frac{\log 8}{\log 4} = \log 2$.

Answers: **(a)** 3 **(b)** log 50

Question 6

Candidates made a good start to this simplification by multiplying by $\frac{a-3}{a}$. Fewer candidates spotted that $a^2 - 9$ could be factorised to $(a + 3)(a - 3)$ to complete their solution. Some incorrect cancelling was seen, leading to $\frac{3a}{a} = 2a$, for example, and some candidates unnecessarily tried to create a common denominator for the two fractions.

Answer: $\frac{3}{a+3}$

Question 7

(a) Candidates were very successful in finding $\mathbf{p} + \mathbf{q}$.

(b) Many correct answers were seen with confident use of Pythagoras' Theorem. Errors seen included $|\mathbf{p}| + |\mathbf{q}|$ and $|\mathbf{p} - \mathbf{q}|$ Some candidates appeared unfamiliar with the modular notation and would benefit from more practice on this topic. Candidates should be aware that $\sqrt{25} = \pm 5$ is inappropriate in the context of vector length.

Answer: **(a)** $\begin{pmatrix} 3 \\ -4 \end{pmatrix}$ **(b)** 5

Question 8

(a) Candidates who replaced $\sqrt{8}$ by $\sqrt{4\times 2}$ went on confidently to achieve a successful simplification. The role of the square number as a factor should be stressed to candidates. Attempts to replace $2\sqrt{8}$ with $\sqrt{32}$ faltered when the square number factor, 16, was not then used to replace 32.

(b) The method for rationalising the denominator by multiplying numerator and denominator by 3 + $\sqrt{2}$ had clearly been well taught and many correct solutions were achieved. Some candidates made errors such as $3\sqrt{2}\ (3+\sqrt{2}) = 9\sqrt{2} + 3$ and $(3-\sqrt{2})(3+\sqrt{2}) = 9 + 2$. Occasionally, candidates tried to rationalise by using $(3-\sqrt{2})$ instead of $(3+\sqrt{2})$.

Answers: **(a)** $12\sqrt{2}$ **(b)** $\dfrac{9\sqrt{2}+6}{7}$

Question 9

Candidates understood very well that a line perpendicular to $y = 2x + 5$ would have a gradient of $\dfrac{-1}{2}$. The most successful candidates went on to substitute (2, 3) into $y = \dfrac{-1}{2}x + c$ to find $c = 4$ and then rearranged the equation to the form $ax + by = d$ to get $\dfrac{1}{2}x + y = 4$. The final step of multiplying through to ensure that a was an integer was often overlooked. Candidates who tried to rearrange $ax + by = d$ first were less successful, usually incorrectly getting $y = d - \dfrac{a}{b}x$ and then either $y = d + \dfrac{1}{2}x$ or $y = d - \dfrac{1}{2}x$.

Some candidates did not appreciate the need to rearrange the equation at all and wrote $\dfrac{-1}{2}x + by = d$.

Answer: $a = 1$, $b = 2$, $d = 8$, or positive multiples of these.

Question 10

Candidates demonstrated excellent skills at forming and solving simultaneous equations. The majority of candidates achieved fully correct solutions.

Answers: (a) $2m + 3p$ **(b)** $m = 2$, $p = 3$

Question 11

An answer of $\dfrac{\sqrt{3}}{2}$ and knowledge that $x = 150°$ was common. Few candidates were able to bring the two facets together to get $\cos x = \dfrac{-\sqrt{3}}{2}$. Both CAST and sketches of the sine and cosine curves were used to some good effect.

Answer: $\dfrac{-\sqrt{3}}{2}$

Question 12

(a) Many candidates were able to sketch the correct shaped curve with a maximum at $y = 4$. It must be emphasised that both the x and y intercepts must be correctly labelled on a sketch to achieve full marks.

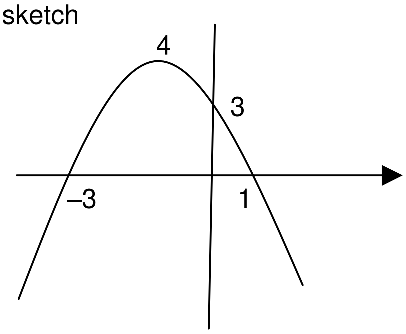
(b) The most efficient method seen to find a and b used $y = a(x - -3)(x - 1)$ and the y intercept (0, 3) to give $3 = a(0 - -3)(0 - 1)$ and hence $a = -1$. Using either (1, 0) or (–3, 0) in $f(x) = ax^2 + bx + 3$ to give $0 = -1 + b + 3$ or $0 = -9 - 3b + 3$ was then well executed.

Setting up and then solving a pair of simultaneous equations by substituting (–3, 0), (1, 0) and/or (1, 4) in $f(x) = ax^2 + bx + 3$ was also a successful method.

In all cases numerical slips and/or sign errors were the main reason for incorrect answers.

(c) Only candidates with correct sketches were successful here. From these, many correct answers were seen. Some candidates gave the range of x for which $f(x) \geq 0$. Others had reversed the inequality symbol in an otherwise correct answer.

Answers: **(a)** sketch **(b)** $a = -1$ $b = -2$ **(c)** $f(x) \leq 4$



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 and use a suitable level of accuracy. A full awareness of the syllabus requirements with the graphics calculator is essential.

General comments

The paper proved to be challenging for many of the candidates. The marks were well spread out across the range of grades since some questions were quite straightforward whilst others were found to be very discriminating. All candidates appeared to have sufficient time to complete the examination. Although there appeared to be adequate working space throughout the paper, it is disappointing to report that a number of candidates felt the need to use supplementary sheets. Supplementary sheets should only be issued to candidates if they have insufficient working space for a particular question.

The work was often clear and tidy with good methods and working shown. The front cover of the paper is quite clear about the need to show relevant working and candidates do have a responsibility to show how they arrive at their answers. There is a need to show working in most questions on this type of paper and candidates may earn method marks even when an answer is incorrect. Candidates also need to be aware that occasionally a correct answer without any working may not carry full marks.

Candidates must ensure that they work to an appropriate degree of accuracy and must realise that approximating to 3 figures, or fewer, during a calculation will often lead to inaccurate answers.

The responses to the questions involving the use of graphics calculators were extremely varied. Some Centres had clearly prepared their candidates thoroughly and candidates scored good marks in the question involving graph sketching and interpretation. Candidates do need to appreciate the uses of such an important tool, especially beyond the graph questions. The syllabus contains a list of requirements for the graphics calculator and this includes the statistics capabilities. Candidates should be advised that, in statistics, one mark answers are often an indication that a calculator is expected to be used, especially when there is only one mark for the mean. The graphics calculator has the potential to be used in other areas, particularly equation solving, including simultaneous equations.

There was significant variation in answers to questions involving basic skills, with some candidates making elementary errors in manipulating fractions and ratios. Candidates can improve in the more challenging parts of the syllabus such as interpreting graphs, indices, trigonometry, mensuration, probability, information from cumulative frequency curves and equations of straight lines.

Comments on specific questions

Question 1

(a) (i) The simplification of a ratio was generally well done. Candidates need to know that the ratio should be reduced completely.

(ii) The calculation of one quantity as a percentage of another proved difficult for many candidates who reversed the two quantities.

(b) The calculation of a second quantity, given the first quantity and their ratio was usually successfully carried out.

(c) The division of a given amount in a given ratio was usually successfully completed.

Answers: **(a)(i)** 6 : 7 **(ii)** 117 **(b)** 21 **(c)** 15

Question 2

(a) (i) The simplifying of the given product was usually correctly performed, although some candidates added the coefficients instead of multiplying, and a few candidates misread the question as requiring them to factorise.

(ii) The simplifying of the given quotient was less well done, with similar errors to part **(i)**. Candidates who correctly dealt with the coefficients and with the indices sometimes forgot to write the letter x in their answer.

(iii) Many candidates did not complete this product fully, either cancelling partially but not multiplying, or multiplying but not cancelling fully.

(b) Most candidates began correctly by finding the common denominator, but many answers were spoilt by combining the two terms in the numerator into one incorrect term.

Answers: **(a)(i)** $48x^7$ **(ii)** $5\,x^{-12}$ or $\frac{5}{x^{12}}$ **(iii)** $\frac{4x}{t}$ **(b)** $\frac{4c+5d}{10}$

Question 3

(a) Most candidates wrote down the correct time.

(b) Candidates were aware that they must divide the distance by the time taken but many were unable to convert a time in hours and minutes into a decimal number of hours.

(c) Many candidates were able to calculate the cost in 2011 correctly. A common error was to calculate the increase in cost from 2009 to 2010 and assume that the increase from 2010 to 2011 would be the same amount.

Answers: **(a)** (0)1 10 **(b)** 22.39 to 22.44 **(c)** 44.1(0)

Question 4

(a) (i) Many candidates correctly identified the transformation as a reflection. Candidates must remember to use the correct mathematical term rather than informal words such as mirror or flip. The axis of reflection was not always identified correctly using the equation of the line.

(ii) Most candidates identified the transformation as a rotation, without always being able to identify the angle or the centre of rotation.

In both parts **(i)** and **(ii)** there is still a tendency among some candidates to refer to a second transformation.

(b) (i) Many candidates drew the correct translation of triangle *W*. There were two frequent errors, drawing a translation by $\begin{pmatrix} 0.5 \\ -1.5 \end{pmatrix}$ and drawing a translation by $\begin{pmatrix} -3 \\ 1 \end{pmatrix}$. This highlights the need to ensure that candidates take into account the scale of the grid as well as being aware of the correct order of the components of a vector.

(ii) This part of the question proved to be a good discriminator. Many candidates were able to draw a triangle half the size of triangle *W* but without placing it in the correct position.

Answers: **(a)(i)** Reflection $y = -1$ **(ii)** Rotation (0, 0) 90° (anticlockwise)

(b)(i) Triangle at (2, – 2), (6, – 2), (6, 0) **(ii)** Triangle at (0.5, 0.5), (2.5, 0.5), (2.5, 1.5)

Question 5

(a) (i) Most candidates gave the correct result.

(ii) Many candidates had difficulty with this simple algebraic manipulation, some failing to understand that the result from part **(i)** was not relevant in part **(ii).**

(b) The appearance of these simultaneous equations in the form "$y =$" should have indicated to candidates the possibility of using the graphics calculator and the intersection facility. This method was never seen. Most candidates preferred to add the two equations, but many forgot that the left hand side of the result would be $2y$ and not y. The third method, of equating $2x - 7$ and $3 - 2x$ was chosen by some but again, errors in algebraic manipulation meant that the correct answers were rarely obtained.

Answers: **(a)(i)** – 23 **(ii)** $\frac{y+8}{3}$ **(b)** 2.5, – 2

Question 6

(a) Many candidates were able to read off the median from the graph.

(b) Most candidates understood the need to find the upper and lower quartiles but fewer completed the process by finding the difference.

(c) Many candidates were able to read off the number of candidates with a mark of 20, although an answer of 11 from a mis-reading of the vertical scale was quite common. Fewer candidates completed the question to find the number required.

Answers: **(a)** 27 **(b)** 8 **(c)** 88 or 89

Question 7

(a) Many candidates calculated the volume of the pyramid correctly. Those who did not either used the formula incorrectly, or made an error in finding the base area.

(b) (i) Most candidates calculated the area of the triangle correctly.

(ii) Many candidates forgot that this pyramid had a square base and multiplied the area of triangle *PBC* by 3. The area of the base was often then not added on.

Answers: **(a)** 400 **(b)(i)** 65 **(ii)** 360

Question 8

(a) (i) Most candidates measured the angle correctly.

(ii) Most candidates answered correctly. Those who obtained a decimal answer did so after inaccurate measuring of the angle. This should have prompted them to check their measuring.

(iii) A large number of candidates gave the answer 28, suggesting that they had mis-read or misunderstood the question.

(b) Many candidates completed the table correctly. Those who did not should have realised that the same number of candidates had 0, 1 and 5 coins since those sectors of the pie chart had the same angle.

(c) (i) In this part, candidates were expected to use the graphics calculator, and no working was expected. In such a case it would be useful for candidates obtaining answers greater than 5 to be aware that this was impossible and to check their calculations.

(ii) Most candidates gave the correct answer, either from their table or from the pie chart.

(iii) Many candidates gave the correct answer. Candidates need to know that the data must be in order to be able to locate the median.

Answers: **(a)(i)** 135° **(ii)** 12 **(iii)** 24 **(b)** 4, 4, ..., ..., 12, 4
(c)(i) 2.9375 or 2.938 or 2.94 **(ii)** 4 **(iii)** 3.5

Question 9

(a) Many candidates had difficulty with this part, giving the answer 220.

(b) Candidates were expected to realise that the angle inside the right-angled triangle was 40° and that the answer could be obtained using simple trigonometry. Of those who did find the angle, too many used the wrong trigonometrical ratio.

(c) (i) Most candidates made a creditable attempt at drawing the line *PR* in the correct position.

(ii) Although there were some good answers, many candidates did not recognise the symmetry of the triangle *PQR* which would make this bearing straightforward. From some of the answers given, it would also seem that some candidates were finding the bearing of *P* from *R* rather than the reverse.

Answers: **(a)** 320 **(b)** 77.1(3...)
(c)(i) *R* shown on diagram to make triangle *PQR* look isosceles **(ii)** 220

Question 10

This was one of the more demanding questions on the paper, with many candidates scoring fewer than half marks.

(a) (i) Answers varied from $y = 3$ to co-ordinates of a point on line 1.

(ii) Again, answers varied from $x = 2$ to co-ordinates.

(iii) More candidates saw that the gradient of this line was –1, and some were able to complete the equation correctly.

(b) (i) Most candidates wrote down the *y*- co-ordinate correctly while many thought that the *x*- co-ordinate was 6.5. A few candidates reversed the correct numbers.

(ii) Again the *y*- co-ordinate was correct in many scripts but the *x*- co-ordinate caused a great deal more difficulty.

(iii) Many candidates tried to find the distance between two points, not always quoting a correct formula. In this case it would have been simpler for them to use Pythagoras' theorem.

Answers: **(a)(i)** $x = 3$ **(ii)** $y = 2$ **(iii)** $x + y = 8$
(b)(i) (6, 2) **(ii)** (4.5, 2) **(iii)** 4.24

Question 11

(a) (i) Most candidates wrote down the right size for the angle but very few gave the correct reason. Long explanations were not required - just the word semicircle was acceptable, as was the phrase "subtended by diameter".

(ii) Again the size of the angle was no problem for most candidates, but their reasons usually caused the loss of the mark. Stating that *UTV* was a tangent was not sufficient, reference to the radius was also needed.

(b) (i) Many candidates did not recognise that *ATO* was an isosceles triangle.

(ii) Candidates did not remember that the angle at the centre is twice the angle at the circumference.

(iii) There was a little more work required in this part, but it followed logically from the work done earlier.

(c) (i) Most candidates successfully extended the required lines to find the position of *X*.

(ii) Again, this answer should have been simple to find from the work done earlier in the question, but many candidates could not get the correct answer.

Answers: **(a)(i)** 90° and semicircle **(ii)** 90° and tangent/radius **(b)(i)** 40° **(ii)** 80° **(iii)** 140°
(c)(i) *AB* and *UV* extended to meet at *X* **(ii)** 10°

Question 12

(a) Many candidates drew good sketches of the two curves. Candidates must remember that the sketch should extend across the complete domain, especially for the graph of $y = 2^x$.

(b) Too many candidates gave these answers to 2 significant figures. The rubric at the front of the question paper is clear that if an answer is not exact it should be given to 3 significant figures.

(c) There were some correct answers to this equation. Candidates need to know that the solution is the *x*- co-ordinate of the point of intersection and one of the requirements on the syllabus is to find such a point using a graphics calculator.

(d) The answer to this was expected in the form of an inequality giving the least and greatest values of the function for the given domain. It is unfortunate that in Mathematics the word "range" has two different usages but candidates must be encouraged to recognise the appropriate one from the context of the question.

Answers: **(b)** – 1.41, 1.41 **(c)** – 1.53 **(d)** $0.25 \le y \le 4$

Question 13

(a) Most candidates completed the first branch of the tree correctly. There were many incorrect answers for the second bead probabilities, with even the denominators decreasing. Since there are 10 beads left in the bag, the remaining denominators must all be 10.

(b) (i) Many candidates successfully selected the correct fractions to use but many added them instead of multiplying. Moreover the adding was done incorrectly with $\frac{7}{11}+\frac{6}{10}$ often giving an answer of $\frac{13}{21}$. Although adding was an incorrect operation in this context, it must be pointed out that manipulation of fractions is a basic skill which should be mastered by this stage.

(ii) Few candidates completed the final part of the question successfully, adding together the products of the relevant pairs of fractions. A few more picked out one of the pairs of fractions which were required, but once again failed to multiply them correctly.

Candidates who gave their answers in decimal or percentage form frequently used only 2 significant figures thereby losing accuracy.

Answers: **(a)** $\frac{4}{11}, \frac{4}{10}, \frac{7}{10}, \frac{3}{10}$ **(b)(i)** $\frac{42}{110}$ **(ii)** $\frac{56}{110}$

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/32
Paper 32 (Core)

Key Message

To succeed in this paper candidates need to have completed full syllabus coverage, make their working clear and use a suitable level of accuracy. It is also necessary to be aware of the graphics calculator skills which can be tested in this paper.

General comments

The paper proved to be very accessible and it is pleasing to report that the overall performances were successful. Only a small number of candidates found the paper to be too difficult. The marks were well spread out across the range of grades since some questions were found to be very straightforward whilst others were quite discriminating. Almost all the candidates should have found this paper to be a positive experience. There appeared to be adequate working space throughout the paper and all candidates had sufficient time to complete the examination.

The work was usually clear and tidy with good methods and working shown. The front cover of the paper is quite clear about the need to show relevant working and candidates do have a responsibility to show how they arrived at their answers. There is a need to show working in most questions on this type of paper and candidates may earn method marks when an answer is incorrect. Candidates also need to be aware that occasionally a correct answer without any working may not be awarded full marks.

Candidates need to be aware of working to an appropriate degree of accuracy and that approximating to 3 figures during a calculation will often lead to inaccurate answers.

The responses to the questions involving the use of graphics calculators were extremely varied. Some Centres had clearly prepared their candidates thoroughly and candidates scored good marks in the question involving graph sketching and interpretation. Candidates do need to appreciate the uses of such an important tool, especially beyond the graph questions. The syllabus contains a list of requirements for the graphics calculator and this includes the statistics capabilities. Candidates should be advised that one mark answers are an indication that a calculator is expected to be used, especially when there is only one mark for the mean. The graphics calculator has the potential to be used in other areas, particularly equation solving, including simultaneous equations.

Questions involving basic knowledge and skills in all areas were well answered. Candidates can improve in the more challenging parts of the syllabus such as interpreting graphs, indices, inequalities, trigonometry, mensuration, information from cumulative frequency curves and equations of straight lines.

Comments on specific questions

Question 1

(a) The simplification of a ratio was generally well done. Candidates need to know that the ratio should be reduced completely.

(b) This ratio question was also very well done.

(c) The division of a given amount in a given ratio was usually successfully carried out.

(d) The reduction of the algebraic fraction to its lowest terms was well done by the stronger candidates. Others need to improve their work on dividing the numerator and denominator by the same amounts, whether numerical or algebraic.

(e) The calculation of a fraction of a given amount was usually successfully completed.

(f) The calculation of a percentage of a given amount was also usually successful.

(g) This reverse fraction question proved to be more challenging and candidates need to know that the numerator gives the number of parts equal to the given amount.

Answers: **(a)** 3 : 5 **(b)** 12 **(c)** \$9, \$21 **(d)** $\frac{2}{y}$ **(e)** \$210 **(f)** 9 kg **(g)** \$50

Question 2

(a) (i) The mode from a list of values was usually correctly found.

(ii) The median from the same list of values was usually correct. Candidates need to know that the data must be in order to be able to locate the median.

(iii) The range from the list of values was usually well done. Candidates need to know that the range must be calculated by subtracting the smallest value from the largest value. It is not simply the stating of the smallest value to the largest value.

(iv) The upper quartile of the list of values was also quite well done. Candidates can improve in locating this value which depends on whether or not the number of items of data is even or odd.

(v) The mean was usually correctly stated.

In parts **(i)** to **(v)** many candidates did not use the graphics calculator. The fact that each of these parts had only one mark should have encouraged candidates to use the calculator.

(b) The bar graph was generally well done. Candidates need to remember to label the values in the middle of the base of each column.

(c) The pie chart was usually correctly completed. Candidates should improve the drawing of accurate angles using a protractor.

(d) (i) The probability of a simple event was usually correctly done.

(ii) The probability of a certain event was usually identified, although often left as a fraction without reducing it to 1. The mark was still given to such cases.

In part **(d)** candidates need to know that the denominator in the probability fraction is the number of candidates and not the number of sectors on the pie chart.

(e) This percentage question based on a reduced number of candidates was more challenging with many candidates giving 6 out of 10 as opposed to 6 out of 9,

Answers: **(a)(i)** 33 **(ii)** 35.5 **(iii)** 6 **(iv)** 37 **(v)** 35.1

(b) Heights of 1, 3, (0), 1, 2, 1, 2 **(c)** Angles of 72˚, 36˚, 72˚ with 2˚ accuracy.

(d)(i) 0.3 **(ii)** 1 **(e)** 66.7

Question 3

(a) There were many good solutions to this completion of a Venn diagram. Candidates need to check the definition of the Universal set in a question and not include members in other sets which do not belong to this Universal set.

(b) The four parts of part **(b)** tested knowledge of set notation and concepts. These parts turned out to be quite good discriminators with strong candidates being successful. Other candidates need to be more familiar with notation as intersection and union symbols were often mixed up. Also the n( ) needs to be recognised as the number of elements of a set and not a list of the elements.

Answers: **(b)(i)** {2, 4, 6} **(ii)** {1, 2, 3, 4, 6, 8, 9, 10} **(iii)** {1, 3, 9} **(iv)** 4

Question 4

(a) This calculation of an angle using trigonometry was often well answered. Candidates need to recognise when data in right-angled triangles is appropriate for this topic and Pythagoras' Theorem is not always the method. Candidates also need to avoid approximating during the working as it may lead to an answer outside of the acceptable range. There is no need to write a trigonometric value in the working and so a full calculator value can be used throughout.

(b) The same comments as in part **(a)** apply to this part involving the calculation of a length using trigonometry.

Answers: **(a)** 46.2˚ **(b)** 12.3 m

Question 5

(a) (i) Most candidates calculated the area of the triangle correctly.

(ii) The area of the sector proved to be more challenging and candidates need to be aware that this topic is on the syllabus. There was also the need to realise that this part only asked for the area of the sector and the triangle should not have been involved at this stage.

(iii) The difference between the answers to parts **(i)** and **(ii)** was usually correctly calculated.

(b) (i) Almost all candidates applied Pythagoras correctly and gave answers to at least 3 significant figures. A large number of candidates gave an answer to only 2 significant figures without a more accurate answer being seen. There is need for a full awareness of the level of accuracy required on this paper.

(ii) The stronger candidates were successful in calculating the perimeter of the shaded region. There were also many candidates who took the region to be a semi-circle and used half of the length of the chord in part **(i)** to be its radius.

Answers: **(a)(i)** 18 cm^2 **(ii)** 28.3 cm^2 **(iii)** 10.3 cm^2 **(b)(i)** 8.49 cm **(ii)** 17.9 cm

Question 6

(a) (i) Most candidates correctly answered this question on an angle using alternate angles.

(ii) Many gave the correct reason for their answer to part **(i)**. Candidates do need to know that a parallel line property was required and that stating two lines were parallel was insufficient.

(b) (i) Most candidates used the straight line to correctly calculate the required angle.

(ii) Most candidates used the isosceles triangle correctly to calculate the required angle.

(iii) Most candidates found the correct size of this angle and, as there were several ways of doing this, no reasons were required.

Answers: **(a)(i)** 80˚ **(ii)** alternate angles **(b)(i)** 100˚ **(ii)** 50˚ **(iii)** 50˚

Question 7

(a) Almost all candidates gave the correct co-ordinates of a given point.

(b) Most candidates gave a correct column vector. There is a need to pay attention to which component is written first as well as the signs of the components.

(c) (i) Many candidates were able to find the correct gradient from the diagram provided. There were a number of incorrect answers, often without working, and it was difficult to give credit for a correct method.

(ii) The equation of a straight line is a more challenging topic at this level and this question turned out to be a discriminating question for the stronger candidates. Candidates need to know that a full equation, including *y*, is needed and that the constant term was available from information on the diagram.

Answers: **(a)** (3, –4) **(b)** $\begin{pmatrix} -3 \\ 5 \end{pmatrix}$ **(c)(i)** $\frac{2}{3}$ **(ii)** $y = \frac{2}{3}x + 1$

Question 8

This was probably the most demanding question on the paper, although candidates' curve sketching is improving.

(a) There were many very good sketches from candidates who clearly knew how to set up the ranges of *x* and *y* on their calculators. Candidates need to improve on this particular aspect and must realise that inappropriate domains and ranges will lead to curves which may be difficult to interpret. There is also the need to use brackets when typing the function into the calculator and a large number of candidates had the function $y = \frac{10}{x} - 3$ rather than the function given in the question.

(b) (i) Candidates often omitted the drawing of the asymptote. This may have been through the need for an understanding of asymptotes or because their curves did not allow one to be drawn.

(ii) This part requiring the equation of the asymptote really required the asymptote to be drawn in part **(i)** and the outcome was a rather limited number of correct answers.

(c) (i) The parabola was often correctly drawn.

(ii) There were some correct answers to this equation. Candidates need to know that the solution is the *x*- co-ordinate of the point of intersection and one of the requirements on the syllabus is to find such a point using a graphics calculator, and not by using the Trace facility. There is no need for any complicated algebraic manipulations into another equation.

Answers: **(b)(ii)** $x = 3$ **(c)(ii)** 4.16

Question 9

(a) (i) Most candidates successfully calculated the volume of the cylinder.

(ii) The conversion into litres was usually correct although a number of candidates gave the answer to only 2 significant figures.

(b) (i) This reverse calculation of a height from a given volume was generally well done.

(ii) The most common answer was 60 instead of 6. This indicated the need to be aware of metric units including centilitres. A method mark was awarded for the division to compensate for problems with units.

Answers: **(a)(i)** 1810 cm^3 **(ii)** 1.81 litres **(b)(i)** 13.3 cm **(ii)** 6

Question 10

(a) The writing of an inequality from a number line proved to be rather testing and perhaps was unexpected. Candidates are required to use appropriate inequality symbols and not to be confused between < and ≤.

(b) There were many very good solutions to the simultaneous equations, usually including good clear working. Candidates needed to re-arrange an equation to be able to follow their preferred method, which was almost always elimination. The substitution method could have been applied without any re-arrangement and a simple re-arrangement of the first equation into $y = 1 - 2x$ would have set up the possibility of using the graphics calculator and the intersection facility. This method was never seen.

(c) (i) The factorising was often well done. A number of candidates omitted this question and a few others replaced π by a numerical value.

(ii) This part depended on a correct answer to part **(i)** and many of those who were successful in part **(i)** went on to succeed in this part. A number of candidates did not realise the connection between the two parts and found the re-arranging too difficult. Candidates could be more aware of how parts of questions are linked.

Answers: **(a)** $-2 \le x < 1$ **(b)** $x = 1.5$, $y = -2$ **(c)(i)** $r(\pi + 2)$ **(ii)** $\frac{P}{\pi + 2}$

Question 11

(a) Almost all candidates calculated a correct estimate from the given probability.

(b) (i) Almost all candidates completed the tree diagram correctly.

(ii) This part involving the probability of two events was much more searching and candidates need to know when probabilities should be multiplied.

(iii) This part was even more challenging involving the addition of two products. There were some fully correct answers from the stronger candidates and a large number of candidates gave one of the products as their answer, thus gaining some credit.

(iv) This part was also quite demanding as candidates had to determine which product of the given probabilities would give the required fraction. They then had to interpret this into a statement. There were many good answers to this part from candidates whose mother tongue is not English.

Answers: **(a)** 12 **(b)(ii)** $\frac{9}{49}$ **(iii)** $\frac{24}{49}$

Question 12

(a) This calculation of a mean from a frequency table, using mid-values, proved to be very challenging. Candidates need to know that this topic is on the syllabus at this level and that the graphics calculator can be used by typing in the mid-values and the frequencies. Some candidates ignored the instruction about using mid-values and used one of the boundaries of each interval or even the interval widths. A few others calculated the mean of the 6 frequencies.

(b) (i) Most candidates were able to complete the cumulative frequency table.

(ii) Most candidates were able to complete the curve by joining the two portions already drawn by a line passing through the two points from part **(i)**.

(iii) There were some correct answers for the inter-quartile range. Candidates need to know that the quartiles are found by using the frequency axis but are not the frequencies themselves. A very common answer was 75 – 25 = 50.

Answers: **(a)** 50.8 **(b)(i)** 45, 80 **(iii)** 14 to 16

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/41
Paper 41 (Extended)

Key Message

To succeed in this paper, candidates need to have completed full syllabus coverage, including a full awareness of graphics calculator skills which can be tested in this paper. It is also important to show clear methods and to understand that answers without working are not guaranteed full marks.

General Comments

The paper proved accessible to most of the candidates with the overall standard being quite high. The paper differentiated well with marks ranging from single figures to full marks. There were, however, a small number of candidates for whom entry at core level would have been a much more rewarding experience.

There was evidence that some candidates appeared unused to questions which expected the use of a graphics calculator. Sketches in **Question 9** were often poor and many could not find the equation of the regression line in **Question 7** or the mean in **Question 12**.

Most candidates obeyed the instruction about working and sketches in the rubric on the front page, with just a few producing answers without justification. There was no evidence of time being a problem as all candidates appeared to finish the paper.

Accuracy was normally acceptable but a few candidates prematurely approximated an answer they were going to use later in a question. Candidates should realise that, to find an answer correct to 3 significant figures, it is necessary to work to at least 4 significant figures, and Examiners expect to see the accurate working.

Comments on Specific Questions

Question 1

Most candidates responded well to this first question. The most common errors in part **(a)** were to find the increase as a percentage of 28 m or to give the answer correct to the nearest whole number instead of correct to 3 significant figures. In part **(b)** most middle ability and stronger candidates were successful but weaker candidates did not recognise the 'reverse percentage' and found 80% of 25.2 m. In part **(c)(i)** the majority recognised the cumulative percentage increase but some treated it as simple increase and found the increase in 1 year and multiplied it by 3. Similarly in part **(ii)** some treated it as a simple percentage increase but most who recognised the cumulative increase were successful.

Answers: **(a)** 11.1% **(b)** 21 m **(c)(i)** 34.7 m **(ii)** 5.9 or 6 years

Question 2

This question was answered well by almost all the candidates. In part **(a)** most drew perfectly acceptable curves with the local maximum at the origin. In parts **(b)** and **(c)** also, most were able to understand what was required. Some candidates produced decimal answers which, whilst being close to the correct answers, were not exact. Candidates should realise that it is expected that they will use the 'solve' function on their calculators rather than the 'trace' function. The latter is dependent on the scale used in the window and the pixels of the screen.

Answers: **(a)** Correct cubic curve **(b)** 0 and 3, **(c)** (0, 0) and (2, -4)

Question 3

In part **(a)(i)**, most candidates gave a fair description of the transformation with the most common omissions being the direction or the centre. Generally candidates were less successful in part **(ii)** with rotation being a fairly common answer. In both parts, despite the bold 'single', some candidates gave combinations of transformations. These scored zero.

Part **(b)(i)** was the best answered part of the question with just a few getting mixed up with the directions of the translation. In part **(ii)**, most of the better candidates understood stretch but frequently used other invariant lines such as $x = 1$. Weaker candidates often drew enlargements.

Answers: **(a)(i)** Rotation 90° clockwise about (0, 0) **(ii)** Reflection in $y = -x$
(b)(i) Triangle vertices (–5, 3), (–2, 3), (–2, 5) **(ii)** Triangle vertices (1.5, 1), (6, 1), (6, 3)

Question 4

Most candidates gained some marks on this question but only the best scored full marks. In part **(a)(i)** 120 was a common answer. In part **(a)(ii)** large numbers of candidates did not know the total angle of a pentagon, often using 360°. In part **(iii)** most candidates were able to find angle *EBA* but many omitted to find angle *EBC*. In part **(b)** many lacked the appreciation that angle *PSR* was half angle *POR* or that angles *PSR* and *PQR* were supplementary.

Answers: **(a)(i)** 60°, **(ii)** 135° **(iii)** 110° **(b)(i)** 75° **(ii)** 105°

Question 5

The most successful attempts to part **(a)** were from those candidates who found the equation of *AB* and substituted $y = 9$ into it. Unfortunately some of these attempts were spoilt by incorrect gradients being found. Many candidates gained the mark for finding the midpoint but many made little further progress. The gradient was often incorrectly found, although some were able to attempt an equation with their wrong gradient. Many found the gradient of the line joining *O* to the midpoint. Generally candidates found this question to be one of the more difficult questions on the paper.

Answers: **(a)** –4 **(b)** $y = \frac{4}{3}x - \frac{7}{3}$

Question 6

This question proved a valuable source of marks for most candidates. The majority of candidates were well versed in the use of the correct area formula, Cosine Rule, Pythagoras' Theorem and the Sine Rule. In all parts a few candidates used right angle techniques instead of the correct rules but these were relatively rare. In part **(a)(ii)**, of those using the Cosine Rule, there were occasional errors in substitution and some writing of 130 – 126cos110 as 4cos110 but these were rare. Candidates using the Cosine Rule should be encouraged to let the calculator do the whole calculation as the order of operations will then be correct. Part **(a)(ii)** proved the most difficult part as it appeared that many candidates did not appreciate which angle was required, although they clearly had the skills to do the question. In part **(b)** almost all candidates were able to use Pythagoras' Theorem to find *QS* and most of them knew that the Sine Rule was necessary to find angle *QRS*. Some, however, were unable to transform the formula correctly.

Answers: **(a)(i)** 29.6 cm^2 **(ii)** 13.2 cm **(iii)** 120° **(b)** 45.1°

Question 7

In part **(a)** almost all candidates were able to plot the points correctly with just a few reversing the coordinates. Most knew that the correlation was negative, some giving a strength as well which, although not required, was not penalised for being more than one word. Most clearly knew how to find the equation of the regression line on their graphics calculator although some failed to give the answers for *a* and *b* accurately enough. A number of candidates drew a line of best fit by eye and found the equation of that line. Although most were able to use their equation in part **(d)** a significant number did not appreciate the context and lost the mark through not rounding the answer to a whole number.

Answers: **(a)** Points plotted **(b)** Negative **(c)** $i = -1.14c + 96.8$ **(d)** 20 or 21

Question 8

Part **(a)** was answered well by the vast majority of candidates. The usual response to part **(b)** was to multiply 550 by $\frac{3}{4}$ rather than $\left(\frac{3}{4}\right)^3$ although some used $\left(\frac{3}{4}\right)^2$. In part **(c)** most divided by other powers of 10 than 10^3.

Answers: **(a)** 9 cm **(b)** 232 cm^3 **(c)** 0.55 litres

Question 9

The sketches here were not as well done as the one in **Question 2**, and this question was found to be the most difficult question on the paper. Most candidates were able to get the correct shape for part **(a)(i)** but had clearly not adjusted the 'window' on their calculator using the numbers given on the axes. On this occasion this was not penalised provided there was enough of the curve in the 1st and 4th quadrants. Most were able to obtain the coordinates of the x-intercept although here too some appeared to use the 'trace' function rather than the 'solve' function. It appeared that the asymptote was generally appreciated but was frequently given as $y = 0$ rather than $x = 0$. The domain of f(x) often included $f(x) \le 1$ but a lower bound was often included. In part **(b)**, only the best candidates achieved the correct answer and it was usually unclear where it came from. It was expected that candidates would draw $y = \frac{10 - x}{x}$ on their graphics calculators and show this on their sketch. This was extremely rare, which led to the part mark being awarded only very rarely. In part **(c)** the domain was done well by the best candidates but others were confused as to which way round the inequalities should be. There were two possible ways that candidates could have approached part **(d)**, by entering $y = \log(x + 1)$ into their calculators or by using their knowledge of the transformation of graphs. Many either translated by the vector $\begin{pmatrix} 1 \\ 0 \end{pmatrix}$ instead of $\begin{pmatrix} 0 \\ -1 \end{pmatrix}$ or drew $y = x + 1$.

Answers: **(a)(i)** Correct sketch **(ii)** (1, 0) **(iii)** $x = 0$ **(iv)** $f(x) \le 1$ **(b)** 2.40 **(c)** $0 \le g(x) \le 1$ **(d)** Correct curve.

Question 10

In part **(a)(i)** most candidates were able to calculate the curved surface area of the cylinder but many added either both ends or neither instead of the required one end, since the question stated that the tank was open at the top. In part **(ii)**, although almost all knew that it was necessary to multiply by 2.4, most divided by 10, 100 or 1000 rather than 10 000, to convert square cm to square metres. Part **(b)(i)** was extremely well done with almost all candidates obtaining the correct answer from the volume. Part **(ii)** was also well done. Occasional errors occurred through only dividing by 60 once or not being able to convert decimals of an hour to minutes.

Answers: **(a)(i)** 22 600 cm^2 **(ii)** \$5.43 **(b)(i)** 351 600 to 352 000 cm^3 **(ii)** 12 h 13 min

Question 11

This question was very well done even by some otherwise weaker candidates. Both parts of **(a)** and **(b)(i)** and **(ii)** were well done and the vast majority recognised the conditional probability and changed the probabilities accordingly for the second card. The usual error in **(b)(i)** was to add instead of multiply. This was sometimes repeated in part **(iii)**. Also here, some forgot the reverse way of doing it or, having found the probability of both orders, forgot to add them. Part **(c)** proved more difficult. Most recognised that it was necessary to multiply three fractions together and the denominators were usually correct. The mistakes were usually made in the numerators with one or more incorrect. That said, there were many correct solutions.

Answers: **(a)(i)** $\frac{2}{7}$ **(ii)** 7 **(b)(i)** $\frac{1}{6}$ **(ii)** $\frac{5}{7}, \frac{1}{6}, \frac{5}{6}, \frac{2}{6}, \frac{4}{6}$ correctly placed **(iii)** $\frac{1}{21}$ **(iv)** $\frac{10}{21}$
(c) $\frac{4}{21}$

Question 12

Many parts of this question were done very well. Parts **(a)** and **(c)** were very rarely incorrect with just a few candidates not appreciating what was needed for cumulative frequency. Part **(b)** was probably the worst done part. It was expected that candidates would put the midpoints of the intervals and frequency into their graphical calculator and let the calculator do the calculation. Many just added the midpoints and divided by 5 or did not use the midpoints at all. Most were able to draw good cumulative frequency curves in part **(d)** with just a few using the start or the midpoint of the interval and a few drawing cumulative bar charts. Many of the answers were read off correctly although a few gave 60 for the median and struggled with the inter-quartile range. Some mis-interpreted the scales and a few, having read off at 40 g in part **(iv)**, omitted to take the answer from 560. It was fairly common to see 600 taken as the total frequency.

Answers: **(a)** 120, 90, 180 **(b)** 58.75 g **(c)** 180, 290, 380 **(d)** Correct curve
(e)(i) $58 \leq med < 60$ g **(ii)** 43 to 46 g **(iii)** 29 to 36 g **(iv)** 440 to 460 g

Question 13

The best candidates produced some very impressive proofs in part **(a)** although others, as expected, found this difficult. Some were able to gain a method mark for multiplying out the brackets correctly. In part **(b)** most used the quadratic formula rather than their graphics calculator for the solutions. Many of these were successful although sign errors were fairly frequent, as was missing the instruction to give the answers correct to 2 decimal places. Those few candidates using the graphics calculator often omitted to show their sketches. In part **(c)** many candidates did some correct trigonometry. Some used both of their solutions to part **(b)**, despite the negative solution producing a non-viable square. The simple method was to use the tangent ratio, but some used Pythagoras' Theorem and sine or even the Sine Rule.

Answers: **(a)** Correct Proof **(b)** 3.56 and – 0.56 **(c)** 39.4°

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/42

Paper 42 (Extended)

Key Message

To succeed in this paper, candidates need to have completed full syllabus coverage, including a full awareness of graphics calculator skills which can be tested in this paper. It is also important to show clear methods and to understand that answers without working are not guaranteed full marks.

General comments

The paper proved to be very accessible and it is pleasing to report that the overall performances were successful. There appeared to be adequate working space throughout the paper and all candidates had sufficient time to complete the examination. It is pleasing to report that very few supplementary sheets were needed.

The work was usually clear and tidy with good and appropriate methods showing accurate working. The front cover of the paper is quite clear about the need to show relevant working and candidates do have a responsibility to show how they arrived at their answers. There is a need to show working in most questions on this type of paper and candidates may earn method marks when an answer is incorrect. Candidates also need to be aware that occasionally a correct answer without any working may not carry full marks.

Candidates need to be aware of working to an appropriate degree of accuracy and that approximating to 3 figures during a calculation will often lead to inaccurate answers. Almost all candidates in this examination demonstrated good practice in this respect, usually holding necessary values in their calculators.

Most Centres had clearly prepared their candidates thoroughly in the use of graphics calculators and candidates scored good marks in the question involving graph sketching and interpretation, particularly the sketching. Candidates do need to appreciate the uses of such an important tool, especially beyond the graph questions. The syllabus contains a list of requirements for the graphics calculator and this includes the statistics capabilities. In statistics, candidates should be advised that one mark answers are often an indication that a calculator is expected to be used. The graphics calculator has the potential to be used in other areas, particularly equation solving, including simultaneous equations but most candidates in this examination did not demonstrate an awareness of this. It is also important to add that the graphics calculator has many functions which go beyond this syllabus and the use of these may lead to candidates writing down answers without the supporting working. It is advisable that candidates focus on the graphics calculator applications listed in the syllabus.

Questions involving basic knowledge and skills in all areas were well answered. Candidates can improve in the more challenging parts of the syllabus such as interpreting graphs, writing down the line of regression from the graphics calculator, conversion of units of area, angle properties in circles, deriving a given equation from given information, frequency density, variation and transformations of graphs.

Comments on specific questions

Question 1

(a) (i) This demonstration of an answer using given ratios was very well answered.

(ii) The calculation of a percentage change was usually correctly carried out. Candidates do need to know that, in this type of question, it is always the original amount that becomes the denominator in the calculation. Candidates must give the final answer to 3 significant figures and working with 109.6 leading to an answer of 9.6 scored the two method marks only.

(b) The calculation of an amount following a percentage change was also very well answered.

(c) There were many correct answers to this reverse percentage question. This is a much more challenging type of percentage question. A large number of candidates calculated 65% of the given number and added it to the given number i.e. calculated 165% of the given number instead of equating the given number to 165%.

Answers: **(a)(ii)** 9.63 **(b)** 4389 **(c)** 700

Question 2

(a) The required transformation names and descriptions were usually correct. Candidates need to know that the transformation names to be accepted are those stated in the syllabus. Words such as “move”, “slide”, “translocation”, “flip” and “mirror” are not accepted. In part **(i)** the description should have been a column vector but some leeway was given here. In part **(ii)** the description could only be the equation of a straight line.

(b) The enlargement was usually correctly drawn. Candidates do need to enlarge about the given centre and, in this question, this was not the origin.

(c) Most candidates gave the correct answer “similar”. “Equal”, “identical” and “congruent” were quite common errors and “proportional” was not accepted as it was considered to be ambiguous and the syllabus does contain similar figures.

Answers: **(a)(i)** Translation $\begin{pmatrix} -7 \\ 3 \end{pmatrix}$ **(ii)** Reflection $x = 3.5$ **(c)** Similar

Question 3

(a) Most candidates successfully found the number of candidates in the various sets, which were described in words in the question.

(b) Many candidates demonstrated good knowledge of set notation and were equally successful in this part. There were some difficulties seen with the notation and another error was to give the numbers of figures in the sets instead of the numbers of candidates.

(c) This probability question using information in the Venn diagram was extremely well answered with all candidates using correct probability notation.

(d) This probability question using information in the Venn diagram with the denominator no longer being from the universal set was also extremely well answered.

Answers: **(a)(i)** 7 **(ii)** 52 **(iii)** 3 **(iv)** 14 **(b)(i)** 88 **(ii)** 15 **(c)** 0.4 **(d)** $\frac{37}{85}$

Question 4

(a) (i) The straightforward calculation of a time taken to cover a given distance with a given speed was almost always correctly answered. A few weaker candidates did multiply the distance by the speed.

(ii) The addition of five times in minutes and seconds and then obtaining a time of the day was usually correctly answered. Incorrect answers tended to come from slips in the working and not from any misunderstandings, although a small number of candidates added 50 seconds to 50 seconds to make 1 minute.

(b) The calculation of an angle using the cosine rule was generally well answered. Candidates should understand that if a question is worded in this way i.e. calculate the angle and show that it rounds to a given value, then there will be an accuracy mark for a more accurate value than the 3 figure value given. Candidates who started with the formula for the angle tended to be more successful than those who started with the formula for the square of a side. Candidates who gave a correct answer to 4 figures or more but without showing any working were only awarded 2 marks out of 3.

(c) This part, asking for the area of a non right-angled triangle was very well done and most candidates did show their working clearly. This was necessary since the angle included between the two sides was very close to 90° and the 3 figure answer using $\frac{1}{2}$ base × height was the same as when using the correct formula.

(d) (i) The required point was almost always correctly placed and the new line was almost always correctly drawn. A freehand line was acceptable as only a sketch was asked for.

(ii) The calculation of an angle in the newly formed triangle was usually correct. Candidates needed to use the angle given in part **(b)** and not use an incorrect one if this occurred in part **(b)**.

(iii) Almost all candidates realised the need to use the sine formula for a side in the newly formed triangle and the calculation was usually carried out successfully. A small number of candidates believed the angle in part **(b)** now to be a right-angle and used the tangent ratio.

Answers: **(a)(i)** 32 **(ii)** 15 07 **(b)** 91.79…. **(c)** 4000 **(d)(ii)** 68.2 **(iii)** 29.5

Question 5

(a) Most candidates stated positive, often with extra details such as strong, but the mark was still earned for positive. A few candidates omitted the word positive and thus did not earn the mark for this part.

(b) This question on co-ordinates from mean values was usually correctly answered. A few candidates gave the co-ordinates reversed and a few others gave integer answers.

(c) Candidates need to remember that 3 figure accuracy is required throughout the paper unless otherwise stated. A large number of candidates lost one of the 2 marks by giving an answer of $0.72x + 1.16$.

(d) (i) This reading of information from the table was usually well answered.

(ii) This was a challenging probability question involving the product $\frac{3}{10}\times\frac{2}{9}$ and many candidates were successful. A frequent error was $\frac{3}{10}\times\frac{3}{10}$ and a number of candidates could not make a reasonable attempt at this question.

Answers: **(a)** positive **(b)** (4.5, 4.4) **(c)** $0.719x + 1.16$ **(d)(i)** 3 **(ii)** $\frac{6}{90}$

Question 6

(a) The sketch was extremely well done by most candidates. This was much improved on last year's similar situation. Many more candidates were able to set up a suitable domain and range on their calculators and many more gave sketches which gave them a possibility of finding the asymptotes.

(b) The recognition of asymptotes was another improvement on last year but it has continued to be a difficult concept. Many candidates omitted this part and others mixed up the x and y in the equations. The vertical asymptotes were more easily recognised than the horizontal one with many candidates giving the latter as $y = 0$.

(c) This local maximum point was usually recognised, although a frequent error was answers very close to (0, 0) suggesting that candidates traced along the curve instead of using the calculator's turning point facility.

(d) (i) The range of a function continues to cause most candidates some difficulty and many answers gave an indication of little or no understanding. Candidates must distinguish between domain and range as the domain was a frequent answer. Other answers ignored the information available from the vertical asymptote and the maximum point.

(ii) This was another challenging short question involving an equation having no solution and was usually only successfully answered by those who had a correct range in part **(i)**.

Answers: **(b)** $x = 2$, $x = -2$, $y = 1$ **(c)** (0, 0) **(d)(i)** $y \le 0$, $y > 1$
(ii) Any value of k in the interval $0 < k \le 1$

Question 7

(a) (i) Almost all candidates gave the correct surface area of this compound shape.

(ii) There were many correct conversions from mm^2 into cm^2 but there were also many candidates who divided by 10.

(b) (i) Almost all candidates gave the correct volume of this compound shape.

(ii) Almost all candidates continued to multiply the volume by the mass of 1 mm^3 of gold and by the cost of 1 gram of gold and arrived at the correct answer.

Answers: **(a)(i)** 1020 **(ii)** 10.2 **(b)(i)** 2600 **(ii)** 1600

Question 8

(a) Most candidates demonstrated their knowledge of opposite angles of a cyclic quadrilateral together with application of angles on a straight line and angles in a triangle. A few candidates treated the cyclic quadrilateral as a parallelogram but were able to gain the 2 follow through marks using the straight line and triangle.

(b) (i) Most candidates realised that they needed to apply the tangent-radius property.

(ii) This was a much more challenging part involving finding an angle at the centre of the circle from an isosceles triangle and then using the angle at the circumference. The candidates who drew the extra lines on the diagram were probably more successful. The candidates who were familiar with the angle in the alternate segment property were able to carry out this calculation more directly but this was not the expected method as it is not on the syllabus.

Answers: **(a)** 70, 80, 108 **(b)(i)** 26 **(ii)** 64

Question 9

(a) Many candidates successfully calculated the overall average speed of a two part journey by dividing the total distance by the total time, after calculating the two separate times. Errors included finding the average of the two speeds, finding only the total time and giving a 2 figure answer.

(b) (i) It was hoped that candidates would connect this expression for the total time taken with the numerical equivalent already performed in part **(a)**. Many candidates did do this successfully but others changed their method of distance divided by speed, presumably being distracted by a letter representing a speed. A large number of candidates went further than necessary by adding the two fractions so that the expression became a single fraction. Any errors in this process were ignored but correct single fractions became very useful in part **(ii)**.

(ii) This was possibly the most difficult question on the paper, proving an equation from the extra information given and using the answer to part **(i)**. The most direct way was to realise that 9 km at 4.5 km/h would take 2 hours and equate this to the answer to part **(i)**. Candidates who did this usually went on to complete the proof without any errors or omissions. Candidates who used the 9 and the 4.5 separately gave themselves considerably more algebra to do but many completed the proof successfully. A common misunderstanding was to solve the equation and then state it as though it had been shown.

(iii) Most candidates chose to use the quadratic equation formula whilst a few used the graphics calculator. In both cases, candidates often gained full marks, either by careful use of the formula given in the question paper or by showing a sketch from the calculator. A fairly common error was to overlook the instruction for 2 decimal places. Candidates who only gave the answers could only score 2 of the 3 marks. This also applied to those who simply wrote "polysmlt" or some other facility on their calculator which does not allow working to be shown and is not on the syllabus. As stated earlier it is strongly advised that candidates focus on the list of calculator functions prescribed in the syllabus.

(iv) Most candidates correctly divided the 5 km by their positive answer to part **(iii)**. A few thought that the positive root from part **(iii)** would be the required answer to this part, as is often the case in this type of question.

Answers: **(a)** 2.57 **(b)(i)** $\frac{5}{x}+\frac{4}{x+2}$ **(iii)** – 1.31, 3.81 **(iv)** 1.31

Question 10

(a) The interval containing the median was usually correctly stated. A small number of candidates wrote down the mid-value of this interval.

(b) The calculation of a mean using a calculator was much improved this year, especially considering that this question required the use of mid-values. There were many correct answers simply stated in the answer space gaining full marks. The extra mark in this question was for using mid-values and this was awarded to candidates who wrote these down but gave an incorrect answer. Candidates should be advised that since the working space was very small and the number of marks was only 2 then the statistics facilities on the calculator were to be used. The full calculation without using these facilities was seen on a number of scripts.

(c) The two frequency densities were usually correctly given. Candidates need to know the method of dividing the frequency by the interval width and not the reverse of this, which was quite a common error. Other errors, less frequently seen, were using the mid-value of an interval instead of the width.

Answers: **(a)** $250 \le d < 300$ **(b)** 270.5 **(c)(i)** 1.12 **(ii)** 0.1

Question 11

This was found to be one of the more challenging questions and certainly discriminated throughout the higher grades. There were some excellent answers, including to the very difficult part **(d)**. Candidates need to know how to interpret information given in a variation question and commence with a correct expression.

(a) As already stated there were some very good solutions in finding a correct inverse variation expression. Candidates need to know that, in these cases, a constant needs to be introduced and then found. The other important aspect is to apply inverse and square root correctly. Common errors were to give directly proportional to the square root, give the square root plus or minus a constant and to find the constant's value but then revert to k in the answer.

(b) This part involving a simple substitution was usually correctly answered and the mark was also available in certain follow through cases.

(c) The re-arrangement of the expression from part **(a)** was usually correctly done and again follow through marks were allowed in certain cases. Candidates need to use the expression which contains the numerical value of the constant and not have k in the expression at this stage.

(d) This was a difficult final part and only the stronger candidates were successful. The methods of replacing y by $0.5y$ or by using numbers in the expression from part **(a)** proved to be equally effective. A very common error was to attempt the use of y and $0.5y$ (or numbers) in a different expression, usually $0.5y = kx$.

Answers: **(a)** $y = \frac{6}{\sqrt{x}}$ **(b)** 1 **(c)** $\frac{36}{y^2}$ **(d)** 4

Question 12

(a) The calculation of the length of the diagonal of the cuboid was usually correct. Candidates need to hold an accurate value to the first step of the working in order to attain a final answer correct to 3 figures. The length of the diagonal of one of the faces of the cuboid was the square root of 125 and, if rounded to 11.2, the final answer would be 12.3, which was outside the accepted range. Candidates need to be familiar with 3-D questions and understand the difference between the diagonal of a face and the diagonal of the solid.

(b) The required angle was usually correctly calculated, generally by using right-angled trigonometry.

(c) Many candidates recognised the angle between the two planes as a straightforward angle between two lines in one of the faces and went on to calculate this angle correctly. This part met with more success than parts **(a)** and **(b)**, even though parts **(a)** and **(b)** actually named the length and angle required, thus needing less interpretation.

Answers: **(a)** 12.2 **(b)** 24.0 to 24.2 **(iii)** 26.6

Question 13

(a) f(– 2) was usually correctly evaluated and candidates should be expected to perform such a simple substitution without a calculator, since when a calculator is used incorrectly to calculate the square of a negative number it gives a negative number and many candidates accept this.

(b) This part, involving finding the value of the variable for a given value of the function was usually answered correctly. The two answer spaces provided a guide that the answer could be positive or negative and this probably caused the candidates to be more careful than they had been in part **(a)**.

(c) The sketching of the graph of the function and the graphs of two transformations of the graph was very well done. Candidates need to be aware of the difference between $f(x + k)$ and $f(x) + k$.

(d) Many candidates demonstrated that they were familiar with this topic, connecting functions with transformations, and they described the transformations clearly. Candidates need to know that the syllabus requires correct vocabulary and clear descriptions. The two transformations in this part should have been treated in the same way as **Question 2**.

Answers: **(a)** 4 **(b)** – 3, 3 **(d)(i)** Translation $\begin{pmatrix}1\\0\end{pmatrix}$ **(ii)** Stretch, factor 2, *x*-axis invariant.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/05
Paper 5 (Core)

Key Message

To do well in this paper, candidates need to ensure that their explanations are clearly written. They should also ensure that they read and answer each question fully.

General comments

This paper introduced Pick's Theorem by asking candidates to find the connection between an algebraic expression and the area of different polygons. Candidates were then asked to show they understood how to apply Pick's Theorem. The later parts of the task asked candidates to hence investigate which quadrilaterals were possible for certain given areas.

The great majority of candidates were able to express Pick's equation correctly and so made significant progress with the final investigation. In several parts Examiners looked for efforts in communicating how results were obtained and nearly all candidates are to be commended on gaining a mark for communication in this paper. There were very many excellent scripts seen.

Comments on specific questions

Question 1

This question led candidates into the idea of observing points enclosed or touched by polygons on a grid and the areas of those polygons. Most candidates correctly entered the missing numbers into the table. A few had difficulty calculating the areas which suggested they had not followed the worked examples carefully.

Answer:

Figure	p	i	A	$p + 2i - 2$
Q	4	0	1	2
R	10	2	6	12
S	14	4	10	20
T	8	2	5	10
U	8	5	8	16
V	16	5	12	24
W	18	2	10	20
X	8	1	4	8
Y	9	1	$4\frac{1}{2}$	9

Question 2

This question contained the key to the investigation, which most candidates were able to spot, even if there were occasional errors in their table in **Question 1**. A few candidates failed to write the connection and just wrote $\frac{p+2i-2}{2}$ which could not be given credit.

Answer: $p + 2i - 2 = 2A$

Question 3

The large majority of candidates had little difficulty in finding $p = 18$ and $i = 15$ and so used Pick's Equation to get $A = 23$. To gain full marks candidates were expected to show that this gave the same result as found using the usual formulae for areas of triangles and rectangles. Alternatively a "counting squares" approach was possible. Several candidates interpreted the question as just requiring Pick's Equation to be applied and so omitted the second part of the argument.

Question 4

This question repeated the shape given at the start of the paper. Even if that was not recognised, most candidates correctly identified $p = 7$ and $i = 4$ and used Pick's equation successfully to find the area of the polygon. A mark for communication was given to the many candidates who showed how Pick's Equation had been used.

Answer: $6\frac{1}{2}$ (squares)

Question 5

(a) Candidates were asked to investigate possible pairs of values for p and i.

Only one of the three possible pairs was required, the most popular being $p = 8$ and $i = 1$. A communication mark was awarded for many candidates who clearly stated that $2p + i - 1 = 4$ and showed work using this equation. Some candidates revealed a less than structured approach to this task.

Answer: $p = 10$, $i = 0$ or $p = 8$, $i = 1$ or $p = 4$, $i = 3$

(b) There were many different correct responses to this question as candidates found a wide variety of ways in which to draw an appropriate quadrilateral. It was insufficient to produce any quadrilateral of area 4 – it had to be the quadrilateral for which p and i had been identified algebraically in part **(a)**. A common error was to overlook the word *quadrilateral*.

Question 6

This question was the most abstract and as such the most challenging for the candidates. Statements were sometimes too vague to be given credit.

Question 7

Most candidates were successful in finding one or more possible pairs and were able to show that they had understood the method of investigation. A communication mark was awarded for demonstrating a clear use of $2p + i - 1 = 6$. Only the most able candidates were able to see the pattern in the relationship between p and i and so find all six pairs; $p = 14$, $i = 0$ was the pair most often omitted. Several candidates did not take account of the information from **Question 6** and offered $p = 2$, $i = 6$ as a possible pair.

Answer						
$p =$	4	6	8	10	12	14
$i =$	5	4	3	2	1	0

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/06

Paper 6 (Extended)

Key Message

In order to do well in this paper, candidates should remember to allow sufficient time to answer the Modelling question. They should also ensure that they read and answer each question fully.

General comments

The paper was divided into two parts: Investigation and Modelling.

For the Investigation there were many fine scripts and overall candidates are to be commended for showing good qualities of communication and excellent work in investigating the different possibilities.

In the Modelling question candidates were required to explain the origin of the model and here more detail was required. Often candidates had difficulty expressing ideas precisely enough and providing valid reasons.

The extent to which some candidates explored the Investigation suggests that time may have been too pressing for them to give full justice to the Modelling question. Candidates should be aware of the advice given at the beginning of each part and spend 45 minutes on each section.

Comments on specific questions

Section A Investigation

Question 1

(a) Nearly all candidates were able to fill in the table correctly, comparing area with dots on the perimeter of a polygon. Any errors seen were in calculating the areas.

Answer:

A	1	2	3	4	5	6
p	4	6	8	10	12	14

(b) The large majority of candidates derived the formula for p correctly and so understood the relationship between dots and area.

Answer: $2A + 2$

(c) The algebraic manipulation expected here was successfully done by most candidates. Occasionally more attention to form was desirable as some wrote $p - \frac{2}{2}$ for the answer.

Answer: $\frac{p-2}{2}$

(d) The large majority of candidates had little difficulty in finding $p = 6$ and so used their equation to get $A = 2$. To gain full marks candidates were required to show that this gave the same result as that found using the usual formula for the area of a triangle. Several candidates interpreted the question as only requiring their equation to be applied and omitted the second part of the argument.

Question 2

(a) Nearly all candidates answered this correctly.

Answer: 2, 3, 4

(b) In this question candidates had to state clearly that the increase in i and the corresponding increase in A were equal. Many candidates were less exact and only noted that the increase in i increased A without quantifying this. A more abstract skill was being tested here and candidates found that more challenging.

(c) A number of correct answers were seen here and for a full answer a communication mark was awarded. Several candidates believed that p had to be even or at least 4.

Answer: $p > 2$ (p an integer)

Question 3

As in **Question 2**, the main loss of marks was due to candidates not comparing the result from Pick's Equation with the result from calculating areas using the usual formulae for rectangles and triangles. A "counting squares" method of finding areas was correctly used by some candidates. Most candidates identified $p = 12$ and $i = 10$ to give $A = 15$.

Question 4

This question repeated the polygon given at the start of the paper. Even if not recognised, most candidates correctly identified $p = 7$ and $i = 4$ and used Pick's Equation correctly to find the area of the polygon. A mark for communication was given to many candidates who showed clearly how Pick's Equation had been applied. Nearly all candidates received full marks for this question. Even if **Question 1** had been answered incorrectly candidates could now use Pick's equation as given in **Question 2**.

Answer: 6.5

Question 5

(a) In this question Examiners looked for a strategy to find all the possibilities and so, for instance, the observation that $2p + i = 5$ was given credit for communication. The question did not indicate the number of possibilities and deliberately left this for investigation. There was a good response to this: most candidates found at least one other possibility and many candidates found all the other three.

Answer: $p = 10$ $i = 0$, $p = 8$ $i = 1$, $p = 4$ $i = 3$

(b) This part asked for quadrilaterals that would fit what had been found algebraically. Candidates showed good skills here and discovered a very wide variety of quadrilaterals that satisfied the conditions. Too many candidates overlooked the word *quadrilateral* in the question and gave answers using polygons with more than 4 sides or using triangles.

Section B Modelling

Question 1

(a) (i) The explanation given by many candidates lacked detail. While most were aware of a formula for the amount using compound interest it was necessary to explain the appearance of the 1.05 and the power of 10 by using basic ideas of percentage increase and repeated multiplication.

(ii) This was answered correctly by nearly every candidate.

Answer: **(ii)** \$1628.89 or \$1630

(b) Most candidates understood that the power gave the number of years and so were able to gain full marks.

Answer: $\$1000 \times 1.05^y$

(c) (i) The intention was to guide the candidates towards the model seen later on the page.
Most were able to equate their answer for part **(b)** to 2000 and thereby show the result given.

(ii) Two methods were apparent. Some rewrote the equation as $y = \log_{1.05}2$ and used the graphics calculator to determine *y*. The majority used the result that $y = \dfrac{\log 2}{\log 1.05}$.

A trial and error approach was not given credit.

Some candidates used the opportunity to explain how this result was found using the basic laws of logarithms and so gained credit for communication.

Since 14.2 had been given in the question, it was essential that candidates showed an answer (such as 14.207) that would round to 14.2. Candidates are advised that, whenever checking a result which is given to three figures, they should show that they have calculated it to more significant figures.

(d) (i) As in part **(a)(i)** candidates had difficulty providing the necessary details. In this case a clear indication of the origin of the expression $1+\dfrac{x}{100}$ was required.

(ii) The great majority of candidates produced a good sketch and indicated that the axes were asymptotes. Some candidates drew the graph by joining up points they had calculated. This suggests that their graphics calculator was either not available or they were unfamiliar with its use. It is important to realise that efficient use of a graphics calculator is vital for this paper.

Question 2

(a) The majority identified the correct model, the appropriateness of which might have been checked using the graphics calculator.

Answer: B

(b) Those who had identified the correct model in part **(a)** usually found *k* correctly. *k* should have been rounded to the nearest 10. Several ignored this instruction but in this case were not penalised.

Answer: $y = \dfrac{70}{x}$

Question 3

This straightforward application caused little difficulty and allowed candidates to appreciate how simple it was to apply their model. No credit was given if candidates used the original model.

Answer: 35 years

Question 4

(a) (i) The result here came directly from the calculator and nearly all candidates gained credit.

Answer: 10.2 years

(ii) The great majority answered this correctly. It let candidates appreciate that their simple model was indeed very accurate.

Answer: 10 years

(b) Most gained the mark which was found by subtracting their answers to part **(a)**.

Answer: 0.2 years

Question 5

(a) A wide range of answers was seen in this question which required effective use of the graphics calculator. The window used for part **(d)(ii)** of **Question 1** did not give a suitable sketch and therefore candidates were expected to scale the diagram so that the features of the graph were clear. More practice with non-familiar functions might improve performance on such a question.

(b) Few correct answers were seen here, usually because of an incorrect or missing graph in part **(a)**.

Again a graphics calculator was valuable in answering this question. Some candidates gave the maximum point rather than the maximum value of y.

Answer: 0.31 years

Question 6

Candidates were being asked to look critically at their model and, in particular, to assess its accuracy over the whole range of positive percentage increases up to 100%. This important aspect of modelling set candidates a challenge as it was necessary to adjust the window on their graphics calculator to see what happened when the rate of increase was between 0% and 2%. Only the very best candidates discovered that, while the model is accurate to within 0.31 years for rates between 2% and 100%, it becomes extremely inaccurate as the rate approaches 0% with, in fact, a difference in values approaching (negative) infinity as the rate approaches 0%.