CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/11

Paper 11 (Core)

General comments

The majority of candidates were well prepared and were able to make an attempt at the majority of questions. The standard of presentation was very good and most candidates attempted to show working when the answer could not be written straight down. Generally candidates were able to carry out calculations without the aid of a calculator, as required in this paper, although some errors occurred occasionally in **Questions 10(b)** and **11**. **Questions 5, 7(b), 8(a),** and **10(a)** were answered particularly well. Candidates found **Questions 2(a), 9(b)** and **11** more challenging.

Comments on specific questions

Question 1

(a) Many candidates used a long method by attempting to calculate $(4-7)(4-7)$ and gave this as $4^2-7^2=16-49=-33$. Those that did use the shorter method usually wrote down $(-3)^2$ and some candidates then gave the answer to this as –9.

(b) There was a mixed response to this part. Some candidates were able to write down the correct answer and others gave the answer as $144\div 2=72$. A few candidates attempted a method involving writing down the factors of 144 but did not reach the correct answer.

Answers: **(a)** 9 **(b)** 12

Question 2

(a) Candidates find this type of question difficult and this proved to be the case on this paper, with many using one of the zeros as the first significant figure. Thus it was common to see answers such as 0.007 or 0.01. Those that did appreciate that the 7 digit is the first significant figure did not always round their answer correctly with some giving the answer as 0.00724.

(b) There was a mixed response to this part. Some candidates used their answer to part **(a)** and gave the correct standard form. Examples of incorrect answers were 725×10^{-3}, 72.5×10^{-4}, 7.25×10^{-1} and 7.25×10^{3}, together with similar incorrect answers from a wrong answer to part **(a)**. A number of candidates used 0.00724538 and so gave an answer of 7.24538×10^{-3} and this was awarded the mark on this occasion.

Answers: **(a)** 0.00725 **(b)** 7.25×10^{-3}

Question 3

(a) Many candidates were able to write down multiples of 6 but a large number did not give 6 as the first multiple. It was therefore very common to see answers of 12, 18 and 24.

(b) This was answered quite well with many candidates able to write down the correct answer. By far the most common error came from those candidates who gave an answer of 3, the highest common factor of 6 and 15.

Answers: **(a)** 6, 12, 18 **(b)** 30

Question 4

This question was answered well with the majority of candidates able to identify the correct region. Some candidates shaded an incorrect region such as the set *B*.

Answer: Correct diagram

Question 5

This was answered well with most candidates giving their answer as a fraction. Some gave their answer as a percentage and others as a decimal, both of which scored full marks. There were some candidates who gave the probability that Peter does have the winning ticket.

Answer: $\frac{999}{1000}$

Question 6

(a) There was a mixed response to this part. Those candidates who did not give the correct answer often made a sign error so it was quite common to see the first step given as $7x - 14 - 9 - 3x$. The candidates who did this step correctly were not always able to calculate $-14 - 9$ so it was quite common to see a final answer of 4 x 5 for example.

(b) Many candidates did not appear to appreciate that the left hand side of the inequality was the same as the expression in part **(a)** and so attempted this part without any reference to part **(a)**. Generally these candidates repeated the working that they had given in part **(a)**, but this was not always the case. Many who had incorrect working were still able to earn one mark by either adding 23 to both sides of the inequality or dividing both sides by 4. Quite a few candidates gave the final answer as an equation rather than as an inequality.

(c) Most candidates were able to show an understanding of the correct notation when representing a strict inequality and were thus able to score at least one mark. Some candidates drew the line in the wrong direction and others showed the line with a second endpoint; $x = 0$ was quite common.

Answers: **(a)** $4x - 23$ **(b)** $x < 6$ **(c)** Correct diagram

Question 7

(a) This was answered well. Some candidates added the two numerators and denominators giving an answer of $\frac{4x}{7}$. Some used a common denominator of 7 leading to $\frac{3x^2}{7}$ for example. Those candidates using 12 as the common denominator often went on to reach the correct answer, although a number of candidates gave an answer such as $\frac{4x}{12}$ or $\frac{3x^2}{12}$.

(b) This was answered particularly well with many candidates able to simplify both the numerical and algebraic parts correctly. Some candidates only partially simplified the expressions and examples of answers given by those who only simplified the numerical parts were $3x^{12}$, $3x^{-12}$ and $\frac{3x^7}{x^5}$. Examples of answers given by candidates who only cancelled the x^7 and x^5 were $\frac{18x^2}{6}$ and $\frac{9x^2}{3}$.

Answers: **(a)** $\frac{13x}{12}$ **(b)** $3x^2$

Question 8

(a) This was nearly always answered correctly. A few candidates made a numerical error and so gave an answer such as 36.

(b) Only a few candidates attempted to use differences to work out the order of the formula for the *n*th term. A large number did not appreciate that a quadratic expression is required and so were not able to make progress. Most candidates who did give a quadratic usually gave the correct answer with an answer of n^2 seen occasionally.

Answers: **(a)** 37 **(b)** $n^2 + 1$

Question 9

(a) This was answered quite well and many candidates were able to insert at least one pair of probabilities into the diagram. Some candidates did not attempt to calculate the probabilities of failing German or of failing French and so inserted the probabilities 0.3 and 0.6 in all three parts of the tree diagram. Some candidates did not understand that both branches on the left hand side of the tree diagram were for German and all the branches on the right side were for French. These candidates usually gave probabilities of 0.3 and 0.6 at the left hand side with probabilities of 0.6 and 0.4 at the top of the right hand side (thereby scoring 1 mark). This was followed by probabilities of 0.3 and 0.7 at the bottom of the right hand side.

(b) Many candidates identified the correct branch that is required to give the probability. In some cases the probabilities were added together rather than multiplied and those who did attempt to multiply the probabilities did not always give the correct answer. The most common error was to give $0.3 \times 0.4 = 1.2$.

Answers: **(a)** All probabilities correct **(b)** 0.12 (or equivalent)

Question 10

(a) This was answered very well. A few candidates gave the answer for the mean in this part, presumably as the result of confusing the two types of average.

(b) The majority of candidates used the correct method to find the mean. Some gave an incorrect total when attempting to add up the individual numbers but virtually all candidates carried out the division by 10 correctly.

(c) This part was also answered well. A few gave the answer as 4 to 11 without carrying out the subtraction and a small number gave 12 – 7 presumably from taking 7 as the lowest number in the list.

Answers: **(a)** 12 **(b)** 9 **(c)** 8

Question 11

Although a few candidates multiplied the distance by the time the vast majority correctly gave the distance divided by the time to earn one mark. Most were not able to obtain the correct answer in the units required. In some cases an incorrect conversion factor was used such as dividing 5200 metres by 100 to convert to kilometres or using 1.3×60 rather than $1.3 \div 60$. Most candidates who had the correct conversion for the time attempted to carry out the division rather than writing down the complete expression and carrying out some cancelling to help with the computation. It was very rare to see an expression such as $5.2 \times \frac{60}{1.3}$ for example.

Answer: 240 km/h

Question 12

(a) This was answered quite well. The most common error was to reflect the triangle in the *y*-axis.

(b) There was a mixed response to this part. The majority of candidates did attempt to carry out a translation and many did this correctly. Some confused the directions of the movement and gave a translation of $\begin{pmatrix} -10 \\ -6 \end{pmatrix}$ whilst others moved the triangle the correct number of units to the left, or the correct number down, but not both. Another error made by some candidates was to miscount the squares or occasionally to count two squares as one unit.

(c) As in part **(b)** there was a mixture of correct and incorrect responses. Some candidates rotated the triangle through 90° but in the wrong direction and others used an incorrect centre.

Answers: **(a)** (2, –2) (6, –2) (6, –8) **(b)** (–4,-8) (0, –8) (0, –2) **(c)** (2, 2) (2, 6) (–4, 6)

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/12
Paper 12 (Core)

General comments

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Comments on specific questions

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(a) Candidates find this type of question difficult and this proved to be the case on this paper, with many using one of the zeros as the first significant figure. Thus it was common to see answers such as 0.007 or 0.01. Those that did appreciate that the 7 digit is the first significant figure did not always round their answer correctly with some giving the answer as 0.00724.

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(c) Most candidates were able to show an understanding of the correct notation when representing a strict inequality and were thus able to score at least one mark. Some candidates drew the line in the wrong direction and others showed the line with a second endpoint; $x = 0$ was quite common.

Answers: **(a)** $4x - 23$ **(b)** $x < 6$ **(c)** Correct diagram

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Answers: **(a)** All probabilities correct **(b)** 0.12 (or equivalent)

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(b) The majority of candidates used the correct method to find the mean. Some gave an incorrect total when attempting to add up the individual numbers but virtually all candidates carried out the division by 10 correctly.

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Although a few candidates multiplied the distance by the time the vast majority correctly gave the distance divided by the time to earn one mark. Most were not able to obtain the correct answer in the units required. In some cases an incorrect conversion factor was used such as dividing 5200 metres by 100 to convert to kilometres or using 1.3×60 rather than $1.3 \div 60$. Most candidates who had the correct conversion for the time attempted to carry out the division rather than writing down the complete expression and carrying out some cancelling to help with the computation. It was very rare to see an expression such as $5.2 \times \frac{60}{1.3}$ for example.

Answer: 240 km/h

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(a) This was answered quite well. The most common error was to reflect the triangle in the *y*-axis.

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Answers: **(a)** (2, –2) (6, –2) (6, –8) **(b)** (–4,-8) (0, –8) (0, –2) **(c)** (2, 2) (2, 6) (–4, 6)

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/13

Paper 13 (Core)

General comments

The majority of candidates were generally well prepared and were able to make an attempt at the majority of questions. The standard of presentation was very good and the majority of candidates attempted to show working when the answer could not be written straight down. Generally candidates were able to carry out any necessary calculations without the aid of a calculator, as required by this paper, although some errors occurred occasionally in **Questions 1(a)** and **4**. **Questions 1(b), 2, 5(b)** and **6(a)** were answered particularly well. Candidates found **Questions 3(a), 10(a), 10(b)** and **11** more challenging.

Comments on specific questions

Question 1

(a) This was answered quite well. By far the most common error was to place the decimal point incorrectly and give an answer of 0.8.

(b) This was answered correctly by most candidates. Those that did make an error when writing the numbers down incorrectly assumed that 89% > 0.9 and so placed the last two elements in reverse order.

Answers: **(a)** 0.08 **(b)** 0.745, 0.85, 89%, 0.9

Question 2

This question was answered very well. Many candidates used a step by step method which is a sensible approach for an example such as this and particularly appropriate when taking a non-calculator paper. Virtually all candidates wrote down 10% of $160 as $16 and then 5% of $160 as $8 followed by the correct answer. Those candidates using the direct approach had to calculate 160 x 15 or 16 x 15 and then ensure that the decimal point was placed in the correct position. Most candidates did this correctly but there were more arithmetic errors seen when this method was used.

Answer: 24

Question 3

(a) Candidates found this part difficult with many counting the first zero after the decimal point as the first significant figure and therefore gave an answer of 0.008. Some did understand that the first significant figure is 7 but then made the error of not putting in zeros between the decimal point and the 7 digit and gave 0.758 as the final answer.

(b) This was answered quite well. A small number of candidates gave $\frac{9}{20} = \frac{45}{100}$ and then wrote down the correct answer. It may be that those candidates who gave the correct answer without showing any working used this method. Quite a number of candidates who used the division method divided 20 by 9 so it was quite common to see an answer of 2.2 or 2.22. Those who set up the division correctly usually gave the correct answer. Some did not carry out the division completely and so gave an answer of 0.4.

Answers: **(a)** 0.00758 **(b)** 0.45

Question 4

The majority of candidates were able to make some progress with this question although not all were able to give a completely correct answer. Most candidates used the method involving converting both the given fractions to improper ('top heavy') fractions, rather than dealing with the whole numbers and the fractional parts of the mixed numbers separately.

Answer: $6\frac{5}{12}$

Question 5

(a) Most candidates were aware that any number raised to the power zero is equal to 1 and so gave the correct answer. Those that made an error gave either 7 or 0 as the answer.

(b) This part was answered well. Some candidates multiplied the two powers of x and so gave an answer of $21x^{10}$. A small number gave an answer of $10x^7$ and both of these incorrect answers earned one mark.

Answers: **(a)** 1 **(b)** $21x^7$

Question 6

(a) This was answered very well and almost all the candidates scored the mark. Incorrect answers of $a(3a - a)$ and $3 - a$ were seen occasionally.

(b) There was a mixed response to this part. Some candidates only attempted to multiply two of the four pairs and this gave answers such as $x^2 - 5$, $x^2 + 5$ or $x^2 - 4$. Those that did find the four terms did not always combine the terms in x and so gave the final answer as $x^2 - 5x + x - 5$. There were many examples of one or more sign errors. When carrying out the multiplication some gave answers such as $x^2 - 5x + x + 5$ or $x^2 - 5x - x - 5$. Examples of errors made when combining the terms in x were $x^2 - 6x - 4$ and $x^2 + 4x - 4$.

Answers: **(a)** $a(3 - a)$ **(b)** $x^2 - 4x - 5$

Question 7

There was a mixed response to this question with very few candidates getting all six parts correct. There was no common pattern to those parts that were answered correctly and those that were not. Most candidates answered at least two parts correctly.

Answer: R L B
N R L

Question 8

(a) This was answered well with most candidates showing a good understanding of the function notation. A small number of candidates did not understand the notation and put f(x) = 5 and solved the equation $3x + 2 = 5$ to give $x = 1$.

(b) This was also answered well with the majority able to write down the equation $3x + 2 = 14$ and solving it correctly. As in part **(a)** there were a few candidates who did not understand the notation and substituted $x = 14$ into the equation $3x + 2$ leading to an answer of 44.

Answers: **(a)** 17 **(b)** 4

Question 9

Most candidates showed a good understanding of a stem and leaf diagram with many scoring either 2 or 3 marks. Quite a large number did not keep a careful check to ensure that all the marks were transferred into the diagram so it was very common to see one mark omitted. There were some candidates who omitted the key and others who did this incorrectly.

Answer:

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

Correct key

Question 10

(a) Candidates found this part quite difficult. Not all the candidates gave a correct first step, usually as a result of making a sign error such as $5x + 3x = 7$. Those who correctly separated the x terms from the numbers did not always go on to give the correct answer. Some made a sign in the final answer such as $x \le 3\frac{1}{2}$ or $x > 3\frac{1}{2}$. Another error seen was $x < \frac{2}{7}$.

(b) Although candidates also found this part difficult there were a number who did make the correct first step by inverting the second fraction to give $\frac{7}{xy} \times \frac{2y}{3x}$. Some left this as the final answer but others went on to carry out the cancelling.

Answers: **(a)** $x < 3.5$ **(b)** $\frac{14}{3x^2}$

Question 11

(a) Few candidates were able to place all the numbers into the correct set on the diagram but most did have quite a few in the correct position. A common error was to place 2 in $P' \cap F$ rather than $P \cap F$ and 12 also quite frequently appeared in $P' \cap F$ or in $P \cap F$. Some candidates reversed the positions for the prime and non prime numbers.

(b)(i) The majority of candidates gave the answer as a fraction with 14 as the denominator. Errors made with the numerator came from being unable to identify $P \cap F$ on the diagram with some using $n(P \cup F)$ as the numerator.

(ii) There was a similar response to this part as in part **(b)** although in this case fewer candidates were able to identify the required set, $(P \cup F)'$.

Answers: **(a)** Correct diagram **(b)(i)** $\frac{2}{14}$ **(ii)** $\frac{7}{14}$

Question 12

(a) This part was answered well. Some of the candidates were able to write down the correct answer without any working but most were able to recall the formula for the co-ordinates of the midpoint. The question asked for the co-ordinates of one of the end points which made the substitution, and subsequent calculation, rather more difficult than a question asking for the co-ordinates of the midpoint. The majority of candidates did this very well with sign errors made infrequently.

(b) Generally candidates found this part difficult. Those who chose not to write down a formula for the gradient, rarely gave the correct answer. A number of candidates made sign errors and incorrect answers such as 2 and $y = 2x$ were seen.

(c) There was a mixed response to this part of the question. It was noted that quite often those candidates who completed the right angled triangle using *CD* as the hypotenuse were able to write down the lengths of the other two sides of the triangle and go on to use Pythagoras to find *CD*. Candidates gave $\sqrt{3^2 + 4^2}$ rather than using the 3, 4, 5 property of this triangle but the standard of calculation required to complete the question was good. Those attempting to use the formula giving the hypotenuse in terms of the co-ordinates were less successful as sign errors were sometime made.

Answers: **(a)** (7, 2) **(b)** $\frac{1}{2}$ **(c)** 5

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/21
Paper 21 (Extended)

General comments

Candidates were well prepared for the paper and showed excellent algebraic skills. Candidates used their time efficiently and attempted all of the questions. There were, however, instances of careless use of notation or numerical slips which could have been avoided.

Comments on specific questions

Question 1

Candidates demonstrated an excellent knowledge of how to solve simultaneous equations. The occasional errors seen were usually simple sign errors.

Answer: $x = 5$, $y = –1$

Question 2

Many candidates knew and used the formula speed = distance ÷ time, rearranging correctly. There were some errors where a correct original formula was rearranged incorrectly. Mistakes in converting the time of 0.3 hours to minutes were common and included 0.3 hours = 30 mins, and 0.3 hours = 20 minutes. Candidates who correctly found 18 minutes usually went on to calculate the arrival time correctly.

Answer: 08 13

Question 3

Most candidates competently rearranged the given formula. There was evidence that in some cases, although correct steps were used, poor notation such as $r = \frac{\sqrt{2A}}{\pi}$ spoilt the answer.

Answer: $(\pm)\sqrt{\frac{2A}{\pi}}$

Question 4

(a) Pythagoras' theorem was used well to give $h^2 = 4^2 + 6^2$ and hence $h = \sqrt{52}$. Some candidates then made errors when attempting to simplify $\sqrt{52}$, which was not required in this question. Others estimated $\sqrt{52}$ as a decimal and hence did not score full marks since an exact value of h was required.

(b) Many correct answers were seen using the efficient method that $\frac{g}{12} = \frac{\sqrt{5}}{3}$. Some candidates deduced that the third side was 8 and then used Pythagoras' theorem to give $g = \sqrt{12^2 - 8^2}$, a less efficient but still effective method. Errors seen included inversion of the correct cosine expression. i.e. $\cos\theta = \frac{\sqrt{5}}{3} = \frac{12}{g}$.

Answers: **(a)** $\sqrt{52}$ **(b)** $\sqrt{80}$

Question 5

Many candidates correctly sketched the new maximum point. Most candidates did not understand that $y = 2\text{f}(x)$ should still cut the x-axis at the same positions as $y = \text{f}(x)$. Candidates would benefit from more experience of this type of question.

Question 6

(a) Many candidates did not demonstrate a thorough understanding that modulus is always a positive value. It was common to see answers of 3 and –1, which had been derived from $|2+1|$ and $|-2+1|$.

(b) Many candidates successfully expanded the brackets but were then unable to correctly simplify their expression. Common errors included $3 \times \sqrt{2} \times \sqrt{2} = 5$, and a final answer that was incomplete of $6 + 2\sqrt{2} - 1$.

Answers: **(a)** 1, 3 **(b)** $5 + 2\sqrt{2}$

Question 7

(a) Candidates found this question challenging. A common incorrect answer in part **(i)** was 4 for n(S) and in part **(ii)** $\text{n}(S \cup F') = 5$ from an incorrect Venn diagram.

(b) Candidates demonstrated a better understanding in this part, with many correct answers seen.

(c) Candidates often understood that $\frac{2}{\text{n}(S)}$ was required.

Answers: **(a)(i)** 6 **(ii)** 7 **(b)** $\frac{7}{12}$ **(c)** $\frac{2}{6}$

Question 8

This question was done very well by the majority of candidates. However, some candidates made sign errors. Candidates would be well-advised to check their answers by multiplying out their brackets to ensure they get the original expression.

Answers: **(a)** $(x+8)(x-6)$ **(b)** $(y+2z)(x-3)$

Question 9

Candidates who began with $y = \frac{k}{\sqrt{x}}$ usually went on to give a completely correct solution. A common error was $y = \frac{1}{\sqrt{x}}$ and this soon left candidates unable to proceed further.

Answer: $(\pm)1.2$

Question 10

(a) Nearly all candidates gave the correct answer.

(b) There were many fully correct answers seen. Candidates who failed to score full marks often correctly identified the second differences of 2 and went on to connect this to a quadratic sequence of the type $an^2 + bn + c$ but were unable to complete the question fully. Candidates who wrote out the square number sequence and compared it to the given sequence had most success.

Answers: **(a)** 33 **(b)** $n^2 - 3$

Question 11

This question proved to be the most demanding on the paper. Only the very best candidates recognised the need to cube the length scale factor to calculate the volume of water held. Answers of 640 and 160 from 6/3 and 3/6 were frequently seen. A few candidates incorrectly used the area scale factor.

Answer: 40

Question 12

Parts **(a)(i)** and **(a)(ii)** were very well done. In part **(ii)**, some candidates made an error of $q = \frac{1}{3}$ or $q = -\frac{1}{3}$.
In part **(b)**, candidates demonstrated a good knowledge of the log rules. However, numerical slips such as $3^2 = 6$ and $2^5 = 64$ were made by quite a few candidates. Occasionally a candidate wrote in error, log 9 + log 32 = log 41. Some candidates showed fully correct work to reach log *y* = log 288 but then concluded that *y* = log 288.

Answers: **(a)(i)** 4 **(ii)** –3 **(b)** 288

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/22
Paper 22 (Extended)

Key message

In order to gain high marks in this paper, candidates need to have developed a good understanding of the whole syllabus and be confident working without a calculator. They also need to ensure that they show all relevant working in their answers.

General comments

All candidates appeared to have sufficient time to attempt all questions on this paper. Clear, organised working was shown on most scripts and most candidates wrote legibly. Method marks could be awarded for correct working seen even when the answer was incorrect. Most candidates used the spaces provided for their working out. Where supplementary sheets were necessary, work which was clearly set out and labelled with the question number could be marked, but candidates should be reminded that a jumble of disorganised rough work cannot be considered. They must clearly select their chosen method to avoid ambiguity or contradictions. Candidates demonstrated a sound, broad knowledge of topics tested on this paper. In a number of questions whilst topic knowledge was good, errors seen were from incorrect processing of negative numbers.

Comments on specific questions

Question 1

(a) The most successful candidates on this question dealt with the negative power first in one clear step, writing $\frac{1}{49^{\frac{1}{2}}}$ and then following on with a correct square root evaluated. Candidates are expected to recognise and evaluate the square root of a square number. Common incorrect answers seen included 7 and –7 where the negative index was either ignored or misinterpreted.

(b) Once again the most successful candidates adopted a step by step approach, dealing with the negative power first by writing $\frac{1}{x^2} = 4$ or $x^2 = \frac{1}{4}$. Candidates who began with $x^2 = \frac{1}{4}$ almost always went on to achieve correct answers. Some candidates did not recall that a square root can have a negative value and hence after giving $\frac{1}{2}$ as one solution appeared to guess at the other, offering either 2 or –2. Alternatively the second solution was left blank. Candidates who began with $\frac{1}{x^2} = 4$ sometimes faltered when trying to make x^2 the subject and once again gave solutions of 2 and –2. Candidates who showed no intermediate steps usually wrote 2 and –2 apparently disregarding the negative index. A few candidates gave incomplete answers, stopping at $\frac{1}{\sqrt{4}}$ and $\frac{-1}{\sqrt{4}}$ or $\sqrt{\frac{1}{4}}$ and $-\sqrt{\frac{1}{4}}$.

Answers: **(a)** $\frac{1}{7}$ **(b)** $\frac{1}{2}$ and $\frac{-1}{2}$

Question 2

(a) Overall, candidates showed excellent skills at factorising. The sign error giving $(3x + 2)(2x - 1)$ did occur occasionally. Candidates' working showed that sometimes they overlooked the possibility of using $3x$ and $2x$ in the brackets and considered only options that used $6x$ and x. A few candidates disregarded the coefficient of x^2 altogether and factorised $x^2 - x - 2$ only or incorrectly took 6 out as a common factor to produce $6(x - 2)(x + 1)$ or similar.

(b) The majority of candidates used their factorised expression from part **(a)** to obtain solutions to the equation efficiently. A few candidates began again with the quadratic formula, some successfully, but others making sign errors.

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

Question 3

(a) Candidates understood how to obtain $2p - 3q$ and many correct answers were seen. Errors occurred from incorrect processing of negative numbers. $\begin{pmatrix}4\\6\end{pmatrix} - \begin{pmatrix}-9\\15\end{pmatrix}$ was often seen but then followed by $\begin{pmatrix}-5\\-9\end{pmatrix}$ or $\begin{pmatrix}-5\\-21\end{pmatrix}$.

(b) Once again many candidates demonstrated a clear understanding of what was required, getting as far as $\sqrt{2^2 + 3^2}$ leading to the correct answer. Some candidates made the numerical error $4 + 9 = 15$. Candidates must be urged to read the question carefully as attempts to find $|2p - 3q|$ were seen.

Answers: **(a)** $\begin{pmatrix}13\\-9\end{pmatrix}$ **(b)** $\sqrt{13}$

Question 4

Candidates found extending the given sequence straightforward after identifying the first differences and recognising the square numbers. Some numerical errors such as $31 + 25 = 46$ were seen.

Answers: 56, 92

Question 5

(a) Overall candidates struggled to factorise the expression completely. A common first step seen was $p(q - y) + x(y - q)$ which then led to confusion as to how to progress, with answers of $(p + x)(q - y)$, $(p + x)(y - q)$ and even $(p + x)(q - y)(y - q)$ following. Having established the first bracket, the need to repeat this same expression in the next bracket and adjust the sign of the common factor to ensure correct signage of each term had not been fully understood by candidates.

(b) The majority of candidates successfully took out a common factor of 2 to reach $2(16c^2 - 25d^2)$ and retained the factor of 2 throughout. Attempts to factorise $16c^2 - 25d^2$ were less successful with $2(4c - 5d)^2$, $2(16c + 25d)(16c - 25d)$ and $2\left(\sqrt{(16c)^2} - \sqrt{(25d)^2}\right)\left(\sqrt{(16c)^2} + \sqrt{(25d)^2}\right)$ all seen.

Answers: **(a)** $(q - y)(p - x)$ **(b)** $2(4c - 5d)(4c + 5d)$

Question 6

(a) (i) Candidates understood amplitude.

(ii) Many correct periods were seen either as 180° or less commonly as π. The error, 2, was also common.

(b) Candidates were competent at sketching $y = 3\sin 2x$ based on a good recall of $y = \sin x$. Labelling of the y-axis was good showing clearly the intended amplitude of the curve. Candidates who had given period = 2 in part **(a)(ii)** still went on to sketch a correct curve. Candidates should be encouraged to extend their curve over the full range required, in this case $0 \le x \le 360$. A few candidates began their curve at (0, 3).

Answers: **(a)(i)** 3 **(ii)** 180°

Question 7

Candidates showed an excellent understanding of solving simultaneous equations algebraically and set their work out in a clear organised way. The method of elimination was most popular but the method of substitution was also seen and was equally successful. Occasionally numerical slips were in evidence and after clear, efficient algebraic work a final error such as $2q = 5$ then $q = \frac{2}{5}$ or $-p = 1$ then $p = 1$ were seen.

Answers: $p = -1$, $q = 2.5$

Question 8

Many candidates worked comfortably with this direct proportion question beginning with $y = kx^2$ and following through to a completely correct solution. Some candidates evaluated k correctly from $108 = k \times 3^2$ but then incorrectly used $y = 12x$ to continue. Candidates who began by writing $y = x^2$ were unable to progress and offered a confused mixture of substitutions using 3, 108 and 300.

Answers: $x = 5$

Question 9

This question proved to be a challenging one for the majority of candidates. Many candidates did recognise the need to use average speed = total distance/total time. Errors were seen in their attempts to find total distance, since candidates found it difficult to process the information of speed 8 km/h for 45 minutes and used the distance for this section as 8 instead of 6, giving a total distance of 29 km. Candidates were more successful in finding the total time of 2 hours. Errors seen with regard to the total time included incorrect decimal use such as 0.15 + 1 + 0.45 to give 1.6 hours followed by laborious attempts to divide by 1.6. Alternatively candidates used time in minutes and attempted long division, rarely with success.

Other candidates attempted to find the speed for each part of the training session and then averaged their 3 values. Average speed = $\frac{4+20+8}{3}$ or $\frac{1+20+8}{3}$ were common incorrect calculations seen.

Answers: 13.5

Question 10

Candidates used a variety of approaches to solve this equation. The need to use a common denominator or to multiply throughout by 14 or even 98 was recognised in the vast majority of solutions. Carrying out the process accurately was more problematic with many candidates trying to do too many steps all in one go. The most common difficulty was dealing correctly with the subtraction of 3(*x* – 1). The expression $2x + 6 - 3x - 3 = 14$, or the equivalent fraction, was seen repeatedly. Candidates who showed a step by step approach first, such as $\frac{2(x+3)-3(x-1)}{14} = 1$ or $2(x+3)-3(x-1) = 14$, were able to gain method marks. Other errors seen included $2(x+3)-3(x-1) = 1$ and $\frac{14(x+3)-21(x-1)}{98} = 1$ followed by $14(x+3)-21(x-1) = 1$.

Answers: x = –5

Question 11

(a) Candidates were competent at applying the rules log*a* + log*b* = logab, and log*a* – log*b* = $\log\frac{a}{b}$.

(b) Many correct answers were seen but also errors such as y^3 or $\log_3 y$.

(c) Many correct answers were seen but also only partially simplified answers such as $\frac{3\sqrt{3}}{\sqrt{3}}$ or $\sqrt{9}$.

Answers: **(a)** log 6 **(b)** 3^y **(c)** 3

Question 12

(a) Many correct answers were seen with most candidates showing the intention to calculate $\frac{2-6}{6--2}$.

Errors usually came from incorrect processing of the negative numbers to give, for example, $\frac{-4}{4}$ or $\frac{4}{8}$. Other candidates correctly calculated $\frac{-4}{8}$ and then lost the negative sign to write $\frac{1}{2}$ or inverted their answer to give –2. Only a minority of candidates incorrectly used gradient = $\frac{x}{y}$.

(b) In this multi-step question most candidates showed clear, organised working out. The majority of candidates recognised the need to find the co-ordinates of the midpoint *D* and were able to do this accurately. Many went on to correctly find the gradient of *CD* to be $\frac{3}{2}$ although, once again, sign errors were also evident. Candidates need to be more precise in their conclusion. For example, 'the gradients are not reciprocals' should be more accurately stated as 'the gradients are not negative reciprocals'. Although some candidates did not specifically state that the gradients should be negative reciprocals they clearly stated that the gradient of a line perpendicular to *AB* would have gradient = 2 which demonstrated good knowledge of the gradient property of perpendicular lines and was sufficient for the needs of the question.

A few candidates stated immediately that a perpendicular line to *AB* would have equation $y = 2x + c$ and used *C*(–2, –2) (or *D*(2, 4)) to determine a value for *c*. They then demonstrated that the co-ordinates of *D* (or *C*) did not satisfy the equation and hence that *CD* was not perpendicular to *AB*. When clearly set out this approach was an acceptable alternative solution.

A minority of candidates believed that perpendicular lines should have the same gradients.

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

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/23
Paper 23 (Extended)

Key message

In order to gain high marks in this paper, candidates need to have developed a good understanding of the whole syllabus and be confident working without a calculator. They also need to ensure that they show all relevant working in their answers.

General comments

All candidates appeared to have sufficient time to attempt all questions on this paper. Clear, organised working was shown on most scripts and most candidates wrote legibly. Method marks could be awarded for correct working seen even when the answer was incorrect. Most candidates used the spaces provided for their working out. Where supplementary sheets were necessary, work which was clearly set out and labelled with the question number could be marked, but candidates should be reminded that a jumble of disorganised rough work cannot be considered. They must clearly select their chosen method to avoid ambiguity or contradictions. Candidates demonstrated a sound, broad knowledge of topics tested on this paper. In a number of questions whilst topic knowledge was good, errors seen were from incorrect processing of negative numbers.

Comments on specific questions

Question 1

(a) The most successful candidates on this question dealt with the negative power first in one clear step, writing $\frac{1}{49^{\frac{1}{2}}}$ and then following on with a correct square root evaluated. Candidates are expected to recognise and evaluate the square root of a square number. Common incorrect answers seen included 7 and –7 where the negative index was either ignored or misinterpreted.

(b) Once again the most successful candidates adopted a step by step approach, dealing with the negative power first by writing $\frac{1}{x^2} = 4$ or $x^2 = \frac{1}{4}$. Candidates who began with $x^2 = \frac{1}{4}$ almost always went on to achieve correct answers. Some candidates did not recall that a square root can have a negative value and hence after giving $\frac{1}{2}$ as one solution appeared to guess at the other, offering either 2 or –2. Alternatively the second solution was left blank. Candidates who began with $\frac{1}{x^2} = 4$ sometimes faltered when trying to make x^2 the subject and once again gave solutions of 2 and –2. Candidates who showed no intermediate steps usually wrote 2 and –2 apparently disregarding the negative index. A few candidates gave incomplete answers, stopping at $\frac{1}{\sqrt{4}}$ and $\frac{-1}{\sqrt{4}}$ or $\sqrt{\frac{1}{4}}$ and $-\sqrt{\frac{1}{4}}$.

Answers: **(a)** $\frac{1}{7}$ **(b)** $\frac{1}{2}$ and $\frac{-1}{2}$

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(a) Overall, candidates showed excellent skills at factorising. The sign error giving $(3x + 2)(2x - 1)$ did occur occasionally. Candidates' working showed that sometimes they overlooked the possibility of using $3x$ and $2x$ in the brackets and considered only options that used $6x$ and x. A few candidates disregarded the coefficient of x^2 altogether and factorised $x^2 - x - 2$ only or incorrectly took 6 out as a common factor to produce $6(x - 2)(x + 1)$ or similar.

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Answers: 13.5

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Candidates used a variety of approaches to solve this equation. The need to use a common denominator or to multiply throughout by 14 or even 98 was recognised in the vast majority of solutions. Carrying out the process accurately was more problematic with many candidates trying to do too many steps all in one go. The most common difficulty was dealing correctly with the subtraction of 3(x – 1). The expression $2x+6-3x-3=14$, or the equivalent fraction, was seen repeatedly. Candidates who showed a step by step approach first, such as $\frac{2(x+3)-3(x-1)}{14}=1$ or $2(x+3)-3(x-1)=14$, were able to gain method marks. Other errors seen included $2(x+3)-3(x-1)=1$ and $\frac{14(x+3)-21(x-1)}{98}=1$ followed by $14(x+3)-21(x-1)=1$.

Answers: x = –5

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Answers: **(a)** log 6 **(b)** 3^y **(c)** 3

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A minority of candidates believed that perpendicular lines should have the same gradients.

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

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/31

Paper 31 (Core)

Key Message

To succeed in this paper, candidates need to have completed full syllabus coverage, show their working clearly and use a suitable level of accuracy. In addition, they should be familiar with the use of the graphics calculator for the relevant topics.

General comments

Many candidates seemed reluctant to show their working fully, and where their answer was wrong or given to the wrong accuracy, this resulted in a score of zero. Quoting a general formula is not adequate working; the relevant values must be inserted into the formula to gain method marks.

Candidates must ensure that they work to appropriate levels of accuracy throughout a question, so as to obtain an accurate three figure answer. Premature approximation in the course of a calculation can lead to a wrong answer in that part, and in subsequent parts, of the question.

It was clear that many of the candidates were uncertain in the use of the graphics calculator, both in the questions requiring graphs of functions and in the statistical questions. In the graph sketching questions, functions were often entered incorrectly or inappropriate windows were used for the range of values given. Candidates should be aware that when a statistical process which would normally require a number of processes carries only one mark, this is an indication that the graphics calculator should be used.

It was clear that most candidates had sufficient time to complete the paper and there was no lack of space for their working. It is therefore regrettable that some Centres found it necessary to issue all their candidates with spare paper.

The earlier questions, with the exception of the algebra question, were found to be more accessible to all candidates, but many candidates struggled with the later questions.

Comments on specific questions

Question 1

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

(b) Many candidates listed the elements of the required intersection, indicating a lack of understanding of the notation n( ).

(c) This was usually correct.

(d) This was usually correct. A very small minority of candidates gave their answers as a ratio. It is worth reminding candidates that fractions are the best format for probabilities. If percentages or decimals are used, they should be given to 3 significant figures.

(e) Some candidates gave the correct answer, although many did not use the correct denominator and a few used 13 as the numerator.

Answers: **(a)** A, B, C, D, K, L, M **(b)** 6 **(c)** 10 **(d)** $\frac{5}{20}$ **(e)** $\frac{6}{13}$

Question 2

(a) (i) There were many excellent answers clearly showing the required result, but some candidates struggled to set out a convincing argument.

(ii) This was usually correct.

(b) Nearly all candidates obtained the correct answer.

(c) Nearly all candidates obtained the correct answer.

(d) This was usually correct.

Answers: **(a)(ii)** 2450, 2240 **(b)** 105 **(c)** 920 **(d)** 1715

Question 3

(a) Most candidates obtained the correct answers, usually by the elimination method, although substitution was used successfully by some. There was little evidence of the use of graphics calculators but this is understandable in view of the layout of these particular equations.

(b) (i) This was not very well done, with many candidates either only factorising partially, or finding the correct common factors of the two terms but making errors inside the brackets.

(ii) Many completely incorrect methods were seen. Where candidates made a successful start to the rearrangement, they were often unable to complete the process.

(c) Many candidates were able to deal with either the numerical part or the algebraic part of this product but not both. There was also some confusion of the rules of indices with answers such as $5x^2$ or $12x^3$.

Answers: **(a)** $x = -1, y = 2$ **(b)(i)** $2\pi r(r + h)$ **(ii)** $h = \frac{S - 2\pi r^2}{2\pi r}$ **(c)** $6x^3$

Question 4

(a) (b) Nearly all candidates plotted the points correctly and found the co-ordinates of the midpoint.

(c) Many candidates wrote down the correct vector, although there were some who tried to combine the co-ordinates of *P* and *Q* in this answer.

(d) There were many correct answers but some candidates used run/rise, while others showed a lack of understanding of gradient.

(e) While many candidates gained the follow through mark for repeating the previous answer, some gave the negative and others the reciprocal.

(f) While many candidates gained a mark for having the correct gradient in their equation, many were unable to find the correct value for the *y*-intercept. A small number did not give a full equation: the "*y* =" was a required part of the answer.

Answers: **(b)** (3, 5) **(c)** $\begin{pmatrix} 2 \\ 4 \end{pmatrix}$ **(d)** 2 **(e)** 2 **(f)** $y = 2x - 7$

Question 5

(a) (i) Many candidates looked at the labelling on the cumulative frequency axis and gave an answer of 25 instead of reading off the correct answer of 24.

(ii) Although many candidates gave the correct answer, there were many whose answers were out of range, or who showed a lack of understanding of what the median is.

(iii) Again there was evidence of a lack of understanding, with many candidates giving a difference between two cumulative frequencies instead of two masses.

(b) This part was often correct or qualified for the follow through mark using the candidate's answer to part **(a)**.

Answers: **(a)(i)** 24 **(ii)** 56 – 57 **(iii)** 9 **(b)** $\frac{8}{24}$ or $\frac{9}{24}$

Question 6

(a) (i) The lack of vocabulary was surprising. There were many answers of parallelogram, as well as a variety of other geometrical words.

(ii) This was usually correct.

(iii) This was usually correct, although some candidates assumed triangle *ABC* to be isosceles.

(iv) This was usually correct.

(b) The absence of a diagram made the question more challenging. 540° and 72° were commonly seen. A number of candidates found the interior angle of a square or a hexagon, while some tried to use the values of angles in part **(a)** in their calculations.

Answers: **(a)(i)** trapezium **(ii)** 51 **(iii)** 82 **(iv)** 129 **(b)** 108

Question 7

(a) (i) This was often correct. However, some candidates did not notice that *AC* was a diameter and assumed *BC* to be equal to *BA*.

(ii) This was usually correct.

(iii) This was often correct, although here the isosceles triangle was not always recognised.

(b) This was very challenging to the majority of candidates. Many attempted to find the chord *AB* rather than the arc, and often used Pythagoras' theorem in spite of the lack of a right angle.

(c) This was also found to be difficult, with many candidates assuming a right angle at *O* in the triangle *COB*.

Answers: **(a)(i)** 90 **(ii)** 90 **(iii)** 110 **(b)** 10.2 **(c)** 6.08

Question 8

(a) (i) Most candidates were successful here.

(ii) Most candidates made the mistake of including the two sides of 18cm in their perimeter as well as 4, and sometimes 6 lots of 6cm. There were a few calculations of area in this part.

(b) Most candidates found the area of the rectangular part of the paper successfully, although some added on only one triangle area.

Answers: **(a)(i)** 6 **(ii)** 108 **(b)** 571 or 571.2

Question 9

This question proved very challenging to most candidates.

(a) Many candidates found the volume of a whole sphere. A number mis-read what was required and tried to find the volume of the cone instead.

(b) Similarly in this part, either the area of a whole sphere, or the surface area of the cone were found.

(c) The need for Pythagoras' theorem here was not always recognised.

(d) Quite a number of candidates correctly used the formula with their answer to part **(c)**. If they had no answer in part **(c)**, the perpendicular height was frequently used instead.

(e) The use of similar figures was only rarely seen, with most candidates trying to use volume in some way, or at the simplest, giving an answer of 9 cm.

Answers: **(a)** 46(.0) **(b)** 49.2 or 49.3 **(c)** 10.2 **(d)** 89.6 or 89.7 **(e)** 7

Question 10

(a) There were very few correct sketches seen here and frequently no labelling. Some candidates drew scale diagrams, but again without indicating the lengths in either cm or m. The 120° was usually indicated from the first line drawn and not from a north line.

(b) Without a correct diagram, it was difficult for many candidates to realise either that this was a right-angled triangle or the position of the 90°. A few candidates did find a correct angle in the triangle and some of these went on to give the correct three figure bearing.

Answers: **(b)** (0)51.8

Question 11

The general comments already state that core candidates need more experience with a graphics calculator. This whole question was found to be very difficult. One important point is that most parts will depend on a correct sketch. The use of an incorrect equation is very expensive as the Examiner does not know what has been typed into the calculator.

Many candidates omitted the whole question.

Those who had a good sketch usually then went on to score quite highly. One exception is those who used a trace facility rather than those listed in the syllabus. This will rarely give the required accuracy of zeros, intersections and turning points.

In part **(d)**, most candidates who drew a sketch were able to gain this mark for a vertical translation of their sketch.

Answers: **(b)** (– 2, 1) and (1, – 0.35) **(c)** 0, 1.81 **(d)** their graph moved up 3 units

Question 12

This was a more accessible question but again many candidates did not use their graphics calculator. Parts **(a)** and **(b)** were only one mark each and often a lot of working was seen for little available credit.

(c) This was often correct.

(d) (i) This was usually correct although a number of answers were "weak" or "strong" but omitted the required "positive".

(ii) In spite of the very strong hint, the line of best fit was usually drawn without passing through the mean point.

(iii) This was usually correct as the range of answers was generous.

Answers: **(a)** 3820 or 3817 **(b)** 3800 **(c)** $\frac{3}{7}$ **(d)(i)** positive **(iii)** 3200 - 3500

Question 13

The comments for **Question 11** also apply here.

(a) The brackets in the equation were there to help candidates at this level but appeared to be often ignored and incorrect sketches were seen.

(b) This proved to be a very challenging part of the syllabus and correct answers were rare.

(c) This was often the only mark gained in this question

(d) As in **Question 11**, trace was often used or poor accuracy given.

Answers: **(b)** $x = 2$, $y = 0$ **(d)** (0.697, –2.3(0)), (4.3(0), 1.3(0))

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/32
Paper 32 (Core)

Key Message

To succeed in this paper, candidates need to have completed full syllabus coverage, show their working clearly and use a suitable level of accuracy. In addition, they should be familiar with the use of the graphics calculator for the relevant topics.

General comments

Many candidates seemed reluctant to show their working fully, and where their answer was wrong or given to the wrong accuracy, this resulted in a score of zero. Quoting a general formula is not adequate working; the relevant values must be inserted into the formula to gain method marks.

Candidates must ensure that they work to appropriate levels of accuracy throughout a question, so as to obtain an accurate three figure answer. Premature approximation in the course of a calculation can lead to a wrong answer in that part, and in subsequent parts, of the question.

It was clear that many of the candidates were uncertain in the use of the graphics calculator, both in the questions requiring graphs of functions and in the statistical questions. In the graph sketching questions, functions were often entered incorrectly or inappropriate windows were used for the range of values given. Candidates should be aware that when a statistical process which would normally require a number of processes carries only one mark, this is an indication that the graphics calculator should be used.

It was clear that most candidates had sufficient time to complete the paper and there was no lack of space for their working. It is therefore regrettable that some Centres found it necessary to issue all their candidates with spare paper.

The earlier questions, with the exception of the algebra question, were found to be more accessible to all candidates, but many candidates struggled with the later questions.

Comments on specific questions

Question 1

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

(b) Many candidates listed the elements of the required intersection, indicating a lack of understanding of the notation n( ).

(c) This was usually correct.

(d) This was usually correct. A very small minority of candidates gave their answers as a ratio. It is worth reminding candidates that fractions are the best format for probabilities. If percentages or decimals are used, they should be given to 3 significant figures.

(e) Some candidates gave the correct answer, although many did not use the correct denominator and a few used 13 as the numerator.

Answers: **(a)** A, B, C, D, K, L, M **(b)** 6 **(c)** 10 **(d)** $\frac{5}{20}$ **(e)** $\frac{6}{13}$

Question 2

(a) (i) There were many excellent answers clearly showing the required result, but some candidates struggled to set out a convincing argument.

(ii) This was usually correct.

(b) Nearly all candidates obtained the correct answer.

(c) Nearly all candidates obtained the correct answer.

(d) This was usually correct.

Answers: **(a)(ii)** 2450, 2240 **(b)** 105 **(c)** 920 **(d)** 1715

Question 3

(a) Most candidates obtained the correct answers, usually by the elimination method, although substitution was used successfully by some. There was little evidence of the use of graphics calculators but this is understandable in view of the layout of these particular equations.

(b) (i) This was not very well done, with many candidates either only factorising partially, or finding the correct common factors of the two terms but making errors inside the brackets.

(ii) Many completely incorrect methods were seen. Where candidates made a successful start to the rearrangement, they were often unable to complete the process.

(c) Many candidates were able to deal with either the numerical part or the algebraic part of this product but not both. There was also some confusion of the rules of indices with answers such as $5x^2$ or $12x^3$.

Answers: **(a)** $x = -1$, $y = 2$ **(b)(i)** $2\pi r(r+h)$ **(ii)** $h = \frac{S - 2\pi r^2}{2\pi r}$ **(c)** $6x^3$

Question 4

(a) (b) Nearly all candidates plotted the points correctly and found the co-ordinates of the midpoint.

(c) Many candidates wrote down the correct vector, although there were some who tried to combine the co-ordinates of *P* and *Q* in this answer.

(d) There were many correct answers but some candidates used run/rise, while others showed a lack of understanding of gradient.

(e) While many candidates gained the follow through mark for repeating the previous answer, some gave the negative and others the reciprocal.

(f) While many candidates gained a mark for having the correct gradient in their equation, many were unable to find the correct value for the *y*-intercept. A small number did not give a full equation: the "*y* =" was a required part of the answer.

Answers: **(b)** (3, 5) **(c)** $\begin{pmatrix} 2 \\ 4 \end{pmatrix}$ **(d)** 2 **(e)** 2 **(f)** $y = 2x - 7$

Question 5

(a) (i) Many candidates looked at the labelling on the cumulative frequency axis and gave an answer of 25 instead of reading off the correct answer of 24.

(ii) Although many candidates gave the correct answer, there were many whose answers were out of range, or who showed a lack of understanding of what the median is.

(iii) Again there was evidence of a lack of understanding, with many candidates giving a difference between two cumulative frequencies instead of two masses.

(b) This part was often correct or qualified for the follow through mark using the candidate's answer to part **(a)**.

Answers: **(a)(i)** 24 **(ii)** 56 – 57 **(iii)** 9 **(b)** $\frac{8}{24}$ or $\frac{9}{24}$

Question 6

(a) (i) The lack of vocabulary was surprising. There were many answers of parallelogram, as well as a variety of other geometrical words.

(ii) This was usually correct.

(iii) This was usually correct, although some candidates assumed triangle *ABC* to be isosceles.

(iv) This was usually correct.

(b) The absence of a diagram made the question more challenging. 540° and 72° were commonly seen. A number of candidates found the interior angle of a square or a hexagon, while some tried to use the values of angles in part **(a)** in their calculations.

Answers: **(a)(i)** trapezium **(ii)** 51 **(iii)** 82 **(iv)** 129 **(b)** 108

Question 7

(a) (i) This was often correct. However, some candidates did not notice that *AC* was a diameter and assumed *BC* to be equal to *BA*.

(ii) This was usually correct.

(iii) This was often correct, although here the isosceles triangle was not always recognised.

(b) This was very challenging to the majority of candidates. Many attempted to find the chord *AB* rather than the arc, and often used Pythagoras' theorem in spite of the lack of a right angle.

(c) This was also found to be difficult, with many candidates assuming a right angle at *O* in the triangle *COB*.

Answers: **(a)(i)** 90 **(ii)** 90 **(iii)** 110 **(b)** 10.2 **(c)** 6.08

Question 8

(a) (i) Most candidates were successful here.

(ii) Most candidates made the mistake of including the two sides of 18cm in their perimeter as well as 4, and sometimes 6 lots of 6cm. There were a few calculations of area in this part.

(b) Most candidates found the area of the rectangular part of the paper successfully, although some added on only one triangle area.

Answers: **(a)(i)** 6 **(ii)** 108 **(b)** 571 or 571.2

Question 9

This question proved very challenging to most candidates.

(a) Many candidates found the volume of a whole sphere. A number mis-read what was required and tried to find the volume of the cone instead.

(b) Similarly in this part, either the area of a whole sphere, or the surface area of the cone were found.

(c) The need for Pythagoras' theorem here was not always recognised.

(d) Quite a number of candidates correctly used the formula with their answer to part **(c)**. If they had no answer in part **(c)**, the perpendicular height was frequently used instead.

(e) The use of similar figures was only rarely seen, with most candidates trying to use volume in some way, or at the simplest, giving an answer of 9 cm.

Answers: **(a)** 46(.0) **(b)** 49.2 or 49.3 **(c)** 10.2 **(d)** 89.6 or 89.7 **(e)** 7

Question 10

(a) There were very few correct sketches seen here and frequently no labelling. Some candidates drew scale diagrams, but again without indicating the lengths in either cm or m. The 120° was usually indicated from the first line drawn and not from a north line.

(b) Without a correct diagram, it was difficult for many candidates to realise either that this was a right-angled triangle or the position of the 90°. A few candidates did find a correct angle in the triangle and some of these went on to give the correct three figure bearing.

Answers: **(b)** (0)51.8

Question 11

The general comments already state that core candidates need more experience with a graphics calculator. This whole question was found to be very difficult. One important point is that most parts will depend on a correct sketch. The use of an incorrect equation is very expensive as the Examiner does not know what has been typed into the calculator.

Many candidates omitted the whole question.

Those who had a good sketch usually then went on to score quite highly. One exception is those who used a trace facility rather than those listed in the syllabus. This will rarely give the required accuracy of zeros, intersections and turning points.

In part **(d)**, most candidates who drew a sketch were able to gain this mark for a vertical translation of their sketch.

Answers: **(b)** (– 2, 1) and (1, – 0.35) **(c)** 0, 1.81 **(d)** their graph moved up 3 units

Question 12

This was a more accessible question but again many candidates did not use their graphics calculator. Parts **(a)** and **(b)** were only one mark each and often a lot of working was seen for little available credit.

(c) This was often correct.

(d) (i) This was usually correct although a number of answers were "weak" or "strong" but omitted the required "positive".

(ii) In spite of the very strong hint, the line of best fit was usually drawn without passing through the mean point.

(iii) This was usually correct as the range of answers was generous.

Answers: **(a)** 3820 or 3817 **(b)** 3800 **(c)** $\frac{3}{7}$ **(d)(i)** positive **(iii)** 3200 - 3500

Question 13

The comments for **Question 11** also apply here.

(a) The brackets in the equation were there to help candidates at this level but appeared to be often ignored and incorrect sketches were seen.

(b) This proved to be a very challenging part of the syllabus and correct answers were rare.

(c) This was often the only mark gained in this question

(d) As in **Question 11**, trace was often used or poor accuracy given.

Answers: **(b)** $x = 2$, $y = 0$ **(d)** (0.697, –2.3(0)), (4.3(0), 1.3(0))

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/33
Paper 33 (Core)

Key Message

To attain high marks in this paper, candidates need to

- have a good knowledge of the whole syllabus
- show all the relevant working in their answers
- use an appropriate level of accuracy
- use a graphics calculator efficiently and in the way outlined in the syllabus

General comments

There were many very good scripts which showed good methods and accurate answers. In fact a few candidates would probably have performed reasonably well at the extended level. The paper was accessible for most candidates and there was sufficient time to attempt all questions.

Two areas for improvement are the use of a graphics calculator and the need to show working. There are many candidates who found the graphics calculator difficult to use, often typing in incorrect equations and often not using available functions. In spite of the above comment about scripts showing good methods, there was a large number of candidates who simply wrote down answers. This loses the opportunity to be awarded possible method marks when an answer is incorrect, sometimes from miscopying from a calculator.

Comments on specific questions

Question 1

(a) This time calculation was well done.

(b) This time calculation was also well done. The difference in times between London and Dubai was an added challenge for some candidates.

(c) The total cost of 4 tickets was usually answered correctly. A few candidates found the cost of either one ticket or two tickets.

(d) Most candidates converted the money correctly by dividing by the exchange rate. A few candidates multiplied by the exchange rate.

Answers: **(a)** 11 15 **(b)** 17 50 **(c)** 8192 Dirhams **(d)** £545.45

Question 2

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

(ii) The combined probability presented many candidates with a real challenge and this question was a real discriminator. The stronger candidates correctly multiplied 0.8 by 0.8. Working such as 0.8 + 0.8 or 0.8 × 2 was seen quite often, even though it gave an answer greater than 1. Many candidates appeared to need more practice with combined probabilities and to develop an understanding of when to multiply probabilities and when to add them.

(b) (i) The mode from the frequency table was usually correct. A few candidates gave the frequency instead of the value of the mode.

(ii) The median was a more challenging question as the middle values needed were the 45th and 46th. As these were both the same there was no need to find the mean. Many candidates identified the median correctly. A few candidates gave the answer of 57.5, completely ignoring the frequencies.

(iii) Identifying a quartile is a further challenge and many candidates found this part difficult. From 90 values of data, the upper quartile was the 68th value from the frequency table.

(iv) The total of all the eggs collected in 90 days required the use of the sum of the products. Many candidates did this correctly. A few candidates again ignored the frequencies in the table.

(c) This mean from a frequency table with continuous data was another discriminating question. There were some good thorough answers. A number of candidates did not use the mid-values of the intervals. Most candidates carried out the calculation without using the statistics facility of their graphics calculator and did a lot of work for only 2 marks.

Answers: **(a)(i)** 0.2 **(ii)** 0.64 **(b)(i)** 56 **(ii)** 57 **(iii)** 58 **(iv)** 5147 **(c)** 57.8 litres

Question 3

(a) The total area of a rectangle and two triangles was well answered by most candidates.

(b) (i) Most candidates applied Pythagoras' Theorem correctly.

(ii) The perimeter of the shape was also calculated successfully by most candidates. Some candidates omitted a length or included an internal length.

Answers: **(a)** 150 cm^2 **(b)(i)** 13.5 cm **(ii)** 72.5 cm

Question 4

(a) Most candidates correctly stated reflection. Fewer candidates gave the correct equation of the reflection line.

(b) Most candidates also correctly stated rotation and many candidates gave the correct angle and centre of rotation. A few candidates did not indicate that the 90° was clockwise.

(c) The drawing of the enlargement was a more challenging question, especially with the centre of enlargement not being on the object shape. There were many correct answers and many enlargements of scale factor 2 with an incorrect centre.

Answers: **(a)** reflection, $x = -1$ **(b)** rotation, 90° clockwise, (3, 1)
(c) image with vertices at (3, – 4), (– 1, – 4), (– 1, 2)

Question 5

(a) Most candidates knew that speed is distance divided by time, and gave a correct answer.

(b) (i) Most candidates were able to substitute the two values into a formula successfully.

(ii) The re-arrangement of the formula was more difficult and proved to be a discriminating question. The stronger candidates answered the question correctly. Other candidates were unable to carry out the necessary steps of re-arranging terms and dividing correctly.

(iii) The idea of this question was to substitute values into the answer to part **(ii)**. Those with a correct answer to part **(ii)** were able to do this easily. A few candidates used the original formula and showed enough working to arrive at the given answer. Those who used the given answer could not earn the mark since the value of this answer was correct to 3 significant figures and would not give D =400.

Answers: **(a)** 9.26 m/s **(b)(i)** 338 or 339 **(ii)** $\frac{D-2s}{2\pi}$

Question 6

(a) Core candidates do have difficulties with graph sketching and this question proved to be no exception. There is a clear need for practice and experience in setting up a correct window and in typing in equations correctly. This particular equation did not require brackets and so there were many good sketches. The candidates who had incorrect sketches were unlikely to gain any marks in parts **(b)** and **(d)**. A large number of candidates either omitted this question or drew an incorrect sketch.

(b) The candidates with a correct answer to part **(a)** usually found the correct co-ordinates of the minimum point. A few candidates only gave the answers to 2 significant figures and need to know that, unless a question states otherwise, the usual accuracy applies to this type of question. A few other candidates appeared to use the tracing facility of the calculator and there is the need to realise that this method is almost certain to give very inaccurate answers.

(c) Most candidates were able to sketch the straight line correctly and for many candidates the 2 marks in this part were the only marks gained.

(d) The candidates with correct sketches were usually able to go on and use the intersection facility on the calculator. As in part **(b)** 2 significant answers were seen and there was evidence of some candidates again using the tracing facility.

Answers: **(b)** (1.38, – 2.35) **(d)** 0.833, 2.69

Question 7

(a) (i) Many candidates used Pythagoras' Theorem correctly with one of the given sides being the hypotenuse. A few candidates treated the unknown side as the hypotenuse. A few candidates gave only a 2 significant figure answer.

(ii) The volume of the cone was usually correctly calculated. Occasionally an answer was out of range as a result of using a rounded answer from part **(a)**. Candidates should be aware of the need to use at least 4 figures in the working.

(b) (i) Most candidates succeeded in calculating the curved surface area of the cone. A few used the perpendicular height instead of the given slant height.

(ii) The total surface area of the cone and the hemisphere was more difficult. There were many correct answers but a common error was to add part **(i)** to the area of a sphere instead of a hemisphere. The range of acceptable answers was quite generous but it is worth pointing out that as well as keeping at least 4 figures in the working, candidates should always use the calculator value of π, as indicated on the front cover of the paper.

Answers: **(a)(i)** 9.22 cm **(ii)** 348 cm^3 **(b)(i)** 207 cm^2 **(ii)** 433 or 434 cm^2

Question 8

(a) (i) This was another curve sketch to start the question and did require two pairs of brackets when typing the equation into the calculator. The brackets were given in the question to help candidates. There were many good sketches with the branches of the hyperbola well positioned. There were also incorrect sketches and as in **Question 6** many marks tended to be lost in the rest of the question.

(ii) The intersection with the *x*-axis was easily identified by those candidates with correct sketches.

(iii) The intersection with the *y*-axis was easily identified by those candidates with correct sketches.

(iv) Asymptotes are quite a difficult topic for any level and this part proved to be very difficult and certainly discriminated amongst the stronger candidates. A number of candidates found the correct asymptote parallel to the *y*-axis but the asymptote parallel to the *x*-axis proved to be less successfully answered. Many candidates omitted this part.

(b) (i) This sketching of a given quadratic function proved to be more successful than the hyperbola in part **(a)**. Many correct sketches were seen.

(ii) The transformation of the given graph onto the graph in part **(i)** was usually seen as a translation although occasionally this vocabulary appeared to be unknown. The translation vector was seen less frequently. Many candidates gave a sufficiently clear description of this vector and this was accepted. A number of candidates were aware of the translation when *x* is replaced by *x* + 3, without the need for the sketch.

Answers: **(a)(ii)** (– 3, 0) **(iii)** (0, – 1.5) **(iv)** $x = 2$, $y = 1$ **(b)(ii)** translation, $\begin{pmatrix} -3 \\ 0 \end{pmatrix}$

Question 9

(a) (i) The question instructed candidates to use trigonometry and there were many correct answers using either the sine or cosine ratio. A few candidates used tangent. A number of candidates omitted this question.

(ii) The comments in part **(i)** also apply here. An alternative to trigonometry was to now use Pythagoras and this was accepted.

(b) (i) These two distances were simply the answers in part **(a)** added to 5km and 6km respectively. Most candidates who had attempted part **(a)** did this correctly. A few candidates did not connect these two additions.

(ii) This part depended on having answers to part **(i)** and then on recognising the need to use the tangent ratio as well as understanding bearings. Only a few candidates reached these stages and few correct answers were seen. The candidates who did succeed in this part were almost certainly amongst the highest scorers on this paper.

Answers: **(a)(i)** 7.52 km **(ii)** 2.74 km **(b)(i)** 12.52 km, 8.74 km **(ii)** 055.1°

Question 10

(a) The majority of candidates plotted the three points correctly to complete the scatter diagram.

(b) Most candidates gave the word negative. Any further wording, such as strong or weak, was usually able to be ignored

(c) The mean value of the 10 given values was usually correctly calculated.

(d) The mean point was usually correctly plotted.

(e) Most candidates drew an acceptable line of best fit, which had to go through the mean point. Quite a number of lines did miss the mean point and a number of candidates drew a freehand line.

(f) Most candidates read from their line correctly. There was the occasional mis-read of the scale as one square represented 2 units on the vertical axis.

Answers: **(b)** negative **(c)** 19.2 **(f)** reading from 36 days

Question 11

(a) (i) Almost all candidates found the next two terms of this linear sequence.

(ii) The *n*th term proved to be more challenging. There were many correct answers. A number of candidates were unable to identify the sequence in any way, often omitting this part.

(b) The *n*th term was n^2 and most candidates did recognise this.

(c) (i) This was a discriminating question requiring the recognition that the differences were increasing by 2 each time or, even better, the recognition that each term of this sequence was the sum of the corresponding terms in the two earlier sequences in the question.

(ii) This part followed on from part **(i)** and the question instructed candidates to use earlier answers. Many candidates were able to add the two *n*th terms whilst others could not see the connection.

Answers: **(a)(i)** 27, 31 **(ii)** $4n+3$ **(b)** n^2 **(c)(i)** 63 **(ii)** n^2+4n+3

Question 12

(a) (i) This required the use of angles on a straight line and angles in a triangle and many candidates attained the correct answer. Candidates who completed most of the angles on the given diagram of a trapezium and its diagonals were usually able to not only answer this part correctly but also the three following parts. Some angles may not have been needed but they often act as a check and this approach is to be recommended.

(ii) The alternate angle property was usually recognised.

(iii) The interior angles property between parallel lines was a little more difficult to recognise. Many candidates recognised the alternate angles but not this property. The diagonals did make this property a little less obvious.

(iv) There were two ways of finding this angle, either angles in a triangle or alternate angles, and so many candidates found this accessible and gave a correct answer.

(b) The use of sides of similar triangles appeared to be well understood and this question was generally well answered. A few candidates arranged the ratios incorrectly and found *CO* to be shorter than *AO* when the diagram, although not to scale, clearly showed that this could not be possible.

Answers: **(a)(i)** 20° **(ii)** 36° **(iii)** 50° **(iv)** 30° **(b)** 5.7 cm

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/41

Paper 41 (Extended)

Key Messages

- Sufficient working needs to be shown in order to gain method marks, especially if the final answer is incorrect.
- Answers need to be given to the required degree of accuracy.
- Candidates need to be familiar with the expected uses of a graphics calculator, particularly the statistics functions.

General Comments

The paper proved accessible to most of the candidates and the overall standard was quite high. There were, however, a small number of candidates for whom entry at core level would have been a much more rewarding experience.

There were a few candidates who appeared unused to questions which expected the use of a graphics calculator. These candidates completed the sketch graphs by plotting and often showed no familiarity with the use of the statistics functions on the calculator.

Most candidates showed sufficient working with just a few producing answers without justification. There was no evidence of time being a problem as all candidates appeared to finish.

In some cases the questions stated the required accuracy and this was often ignored or perhaps forgotten. In most other cases the required accuracy was given although some candidates did not work accurately enough to achieve the required number of figures in the answer. The general guidelines about 3 figure accuracy mean that candidates should work to at least 4 significant figures and return to the more accurate version when using that answer in a later part.

Comments on Specific Questions

Question 1

Most candidates knew the methods for this question. In part **(a)(i)**, the main problem was one of accuracy with many candidates giving answers to more than the required 2 significant figures. A few also made decimal place errors. In part **(a)(ii)**, either the 2 significant answer or a more accurate one was accepted. Most candidates were successful but some gave answers such as 162×10^6. Most candidates were successful with part **(b)**, although some divided the wrong way. Due to the percentage being less than one, the 3 significant figure rule was relaxed here and 0.48 was accepted but not 0.5. In part **(c)**, the vast majority of candidates divided by 1.69 instead of 2.69. Weaker candidates often found 69% of 6.78×10^9 and subtracted.

Answers: **(a)(i)** 160 000 000 **(ii)** 1.6×10^8 **(b)** 0.482 % **(c)** 2 520 000 000

Question 2

Better candidates did all three parts very well indeed. Part **(a)** was usually correct with most candidates using the expected method with the tangent ratio. Some used longer methods such as Sine Rule or even finding *PQ* and then using Pythagoras. In part **(b)** too, long methods were sometimes used when simply using the two standard area formulae of ½ × base × height and ½*bc* sin *A* would have sufficed. A few used the latter formula with incorrect sides and some used the former for the non right-angled triangle. In part **(c)**, weaker candidates often tried to use right-angle triangle techniques or Sine Rule. Even those who recognised Cosine Rule often went from 405 – 324cos*A* to 81cos*A*. That said, there were many correct solutions.

Answers: **(a)** 8.39 cm **(b)** 130 cm^2 **(c)** 12.8 m

Question 3

Part **(a)(i)** produced a mixed response. The majority of candidates used the digits 5 and 3 but these were often the wrong way round and/or the sign was incorrect. Part **(a)(ii)** was marked on a follow through basis so many were able to retrieve the situation here. Weaker candidates, however, often did not know this standard method. The transformations were usually described well with just a few missing out parts of the description or making errors such as $y = 5$. A few gave a combination of transformations and so were awarded no marks.

Answers: **(a)(i)** $\begin{pmatrix} 5 \\ -3 \end{pmatrix}$ **(ii)** 5.83 **(b)(i)** Reflection in $x = 5$ **(ii)** Enlargement, scale factor 3, centre (0, 0)

Question 4

It was expected that candidates would use the statistics functions on their calculator in part **(a)** but many did not. The method for mean from a frequency distribution was often not known and even some who did, used incorrect mid-points such as 9.5, 24.5 etc. Many candidates drew frequency diagrams instead of cumulative frequency diagrams and hence scored zero for both parts **(b)** and **(c)**. The better candidates did produce some good cumulative frequency diagrams and were able to obtain most of the answers in part **(c)**. A few poor curves did lead to answers outside the required ranges.

Answers: **(a)** 29.4 s **(b)** Correct graph **(c)(i)** $27 \le t < 30$ s **(ii)** 12 to 15 s
(iii) 100 – correct reading

Question 5

Most candidates picked out the correct formulae to use but the most common error was to use the whole sphere in parts **(a)(i)** and **(b)(i)**. Most gained the marks for part **(a)(ii)** on a follow through basis although some divided by 1.15 instead of multiplying and others divided by 100 instead of 1000 to convert to kilograms. In addition to using the whole sphere, another common error in part **(b)(i)** was to use the perpendicular height of the cone instead of the slant height, which needed to be calculated. In part **(b)(ii)**, some candidates divided the wrong way and others omitted or were unable to round to 2 decimal places.

A few candidates showed too little working to gain method marks when calculations went awry.

Answers: **(a)(i)** 1810 cm^3 **(ii)** 2.08 kg **(b)(i)** 744 cm^2 **(ii)** $0.11

Question 6

This question proved difficult for many candidates. The better candidates marked up the correct angles using the circle theorems but this was all too rare. Even better candidates often gave the obtuse angle instead of the reflex angle in part **(a)(ii)**.

Answers: **(a)(i)** 86° **(ii)** 188° **(iii)** 4° **(b)** 46°

Question 7

Part **(a)** was well done. Most candidates did not know what was required in part **(b)(i)** and common answers were $8.5x$, $15.75x$ and $\frac{3x}{2}$ from $x + \frac{x}{2}$. Those who did know what was required often failed to simplify their answer. This meant that part **(b)(ii)** was rarely correct although some candidates managed to recover. Those who knew what was required in part **(c)** were usually successful. Others could not find the necessary distances.

Answers: **(a)** 68.6 km/h **(b)(i)** $9x$ **(ii)** 80 km/h **(c)** 5 : 1

Question 8

There were some excellent sketches, although the behaviour of the function around the origin was often unclear and sometimes curves looked more like cubics. The answers to part **(a)(ii)** were often correct although ± 1.1 was fairly common. The turning point was usually correct but some candidates lost one or both marks through giving inaccurate answers to fewer than 3 significant figures. Better candidates realised that they could use symmetry in part **(v)** to produce the answer 0.5 but just a few used their calculators to produce one of the other answers. The idea of rotational symmetry did not seem to be known by the vast majority of candidates. Most were using bilateral symmetry ideas. Even those who recognised the rotational symmetry used the language of transformations rather than the language of rotational symmetry. On this occasion this was accepted but in future the language of rotational symmetry, including order of rotational symmetry, may be required. The equation in part **(b)(i)** was very rarely correct with $y = \frac{x}{5}$ being the most common incorrect answer, this of course meant that part **(ii)** was also rarely correct. Part **(iii)** was, however, often correct, presumably from plotting $y = x^5 - x^3 + \frac{x}{5}$. Here unfortunately many gave answers correct to 2 significant figures rather than the required 3.

Answers: **(a)(i)** Correct sketch **(ii)** –1, 0, 1 **(iii)** (0.775, – 0.186) **(iv)** 0.5
(v) Rotational symmetry, of order 2, about (0, 0)
(b) (i) $y = -\frac{x}{5}$ **(ii)** Line through (0, 0) cutting curve 5 times **(iii)** ± 0.851, 0

Question 9

The first part of this question was done quite well although some thought a simple fraction such as $\frac{2}{5}$ or $\frac{4}{11}$ would suffice, whilst others added rather than multiplied the probabilities.

In part **(b)** most of the candidates failed to realise that the product of three probabilities, not two, was required. Even when they did use three probabilities, probability without replacement seemed not to be well understood. The final part differentiated well between the best candidates, but many were unable to make any progress at all.

Answers: **(a)** $\frac{4}{15}$ **(b)** $\frac{1}{5}$ **(c)** 3

Question 10

There were many excellent sketches although some candidates used plotting rather than using their calculator for the sketches. In parts **(b)** and **(c)**, only the better candidates knew what was required. $y = -4$ was common in part **(b)** and a lower limit of –3 in part **(c)(i)**. Many failed to realise that there was any limit at all on the range in **(c)(ii)**. Many were able to give a decimal solution to part **(d)** but hardly any candidates understood what was meant by an <u>exact</u> solution. Even those who reached the exact solution often followed it by a decimal answer showing they did not understand what was required.

Answers: **(a)** Correct sketch **(b)** $y = -3$ **(c)(i)** $-2.75 \le f(x) \le 1$
(ii) $f(x) > -3$ **(d)** $\frac{\log 3}{\log 2}$ or $\log_2 3$

Question 11

Parts **(a)** and **(b)** were fairly well done although some only found f(5) in part **(a)** and made sign errors in part **(b)**. In part **(c)** most equated the functions but many made errors in reaching a quadratic with 0 on one side, although many middle and high ability candidates were successful. The vast majority used the formula method rather a sketch and the solve function on their calculators. Despite some sign errors, many correct solutions were achieved although some failed to round to 2 decimal places. A number of candidates included no working or sketches and so lost marks. Better candidates did part **(d)** well and even weaker ones often gained a part mark for making some progress. There was some impressive algebra from stronger candidates in part **(e)** but many failed at the last hurdle with $x - 1 + 2x + 3$ becoming $3x - 2$.

Answers: **(a)** –9 **(b)** –4 **(c)** –0.73, 2.73 **(d)** $\frac{x-3}{2}$ **(e)** $\frac{3x+2}{(2x+3)(x-1)}$

Question 12

A high proportion of candidates scored full marks for part **(a)** but were less successful in applying the boundaries to locate the correct region R and thus were not able to answer part **(c)** correctly. One of the common errors was to plot $y = 5$ instead of $x = 5$ and plot a line with a gradient of +2 in part **(iii)**.

Answers: **(a)** Correct lines **(b)** Correct Region **(c)** $h = 3$, $k = -1$

Question 13

Most candidates plotted the points correctly although there were some scale errors and some candidates omitted this part. Negative correlation was usually seen although some missed one of the words and some weaker candidates failed to appreciate what was required. The means were usually correct although some gave 12 instead of 11.9. Candidates should realise that the mean of a discrete data set is not necessarily discrete. Many lost marks in part **(d)** by not giving the coefficients to at least 3 significant figures. Some candidates did not appear to know how to use the statistics functions on their calculator for this part. Part **(e)** was usually correct. In general, candidates drew the regression line as a line of best fit by eye rather than plotting the means and one other point. Since part **(g)** was marked on a follow through basis, most gained the mark although some failed to round the answer to the nearest whole number.

Answers: **(a)** Points plotted **(b)** Negative Correlation **(c)(i)** 47 **(ii)** 11.9
(d) $y = -0.312x + 26.6$ **(e)** 16.6 **(f)** Line drawn
(g) Reading off at $x = 43$ to nearest whole number

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/42

Paper 42 (Extended)

Key message

Candidates should have a full understanding of the whole syllabus and be fully practised with multi-step questions. It is extremely important to be able to communicate by showing working and giving reasons whenever necessary. The graphics calculator has an important role in this paper and the list in the syllabus indicates the requirements.

General comments

The paper proved to be accessible to all but a very small number of candidates and the 2 hours 15 minutes was more than sufficient time for candidates to complete the paper. Most candidates demonstrated a full understanding of the syllabus and supported this knowledge by showing their methods clearly. The majority of candidates also worked to a suitable level of accuracy. The graph sketching continues to improve, although domain and range is a topic found to be very challenging. There is still a tendency for many candidates to use long methods in some statistics questions, overlooking the functions available in the graphics calculator, which are listed in the syllabus. The graphics calculator can also be used in some other questions, usually algebraic situations, but most candidates appear to prefer the more traditional approaches. The experience of this examination will have been a positive one for most of the candidates.

Comments on specific questions

Question 1

(a) This straightforward percentage question was almost always correctly answered.

(b) (i) This second straightforward percentage question was also almost always correctly answered.

(ii) This reverse percentage question was more discriminating and whilst most candidates identified the given amount as 104%, there were candidates who found 4% of the given amount and either added it or subtracted it from that amount.

(c) This ratio question was extremely well answered.

Answers: **(a)** 510 **(b)(i)** 12.5% **(ii)** 155 tonnes **(c)** 3000

Question 2

(a) (i) This circle geometry question was well answered.

(ii) This second circle geometry question was well answered.

(b) (i) Most candidates answered this isosceles triangle question correctly.

(ii) This part required more thinking than part **(a)** or part **(b)(i)**. The successful candidates drew a line parallel to *PQ* on their diagram and then used angles on a straight line together with angles in a triangle. A number of candidate joined *QS* and, if used, this was considered to be an incorrect method, since the angles *RQS* and *RSQ* could not be known.

(c) (i) Most candidates saw the right angles between the radii and the tangents and then went on to use angles in a quadrilateral.

(ii) This part required candidates to either draw lines from *A* and *B* to make a cyclic quadrilateral or to use the reflex angle *AOC*. This was a more challenging task and many candidates omitted this part. Others gave the answer of 70°, which was half of the obtuse angle at *O*.

(iii) This calculation of the length of a chord was very well answered. All possible methods were seen and the use of the sine rule or cosine rule, particularly the latter, was seen more often than right-angled triangle trigonometry. All methods met with a good rate of success.

Answers: **(a)(i)** 125° **(ii)** 35° **(b)(i)** 35° **(ii)** 80° **(c)(i)** 40° **(ii)** 110° **(iii)** 9.40 cm

Question 3

The whole of this question used standard form and most candidates were comfortable with this notation, either working throughout in this form or by converting to ordinary numbers. Some of the stronger candidates worked without the 10^n part and then put this back in for their final answers. Parts **(a), (b)** and **(c)** could have been done using median, minimum value, maximum value and mean on the graphics calculator but most candidates preferred to do their own working, perhaps thinking that typing 6 standard form numbers into the calculator would take more time.

(a) The median was usually correctly stated.

(b) This was well answered. There is the difficulty of distinguishing between a range in statistics and a range of a function and a number of candidates did not find the difference between the highest and lowest values of the list in this question and simply stated these two values.

(c) The mean was usually correctly evaluated but the rounding to 2 significant figures was often overlooked.

(d) This question to find a single new value when the new mean was given was more discriminating. There were many very good answers with sound methodical working seen. The method required the multiplication of the new mean by 7 and a number of candidates were unable to carry out this first step.

Answers: **(a)** 9.95×10^{-5} **(b)** 1.1×10^{-5} **(c)** 9.9×10^{-5} **(d)** 1.05×10^{-4} or 1.06×10^{-4}

Question 4

Most candidates demonstrated a good understanding of functions and supported this with good manipulative skills.

(a) This question requiring the substitution of –2 into a function was very well answered.

(b) The answer to this question was –3 and 3, from the square root of 9, and a large number of candidates only gave the positive answer.

(c) A “show that” question requires all steps to be clearly seen and so the first mark was for simply showing that the x in $x^2 - 5$ was to be replaced by $x - 2$. This was a method mark and so the following working depended on this being seen. Candidates need to know that “find” is usually a little less rigorous than “show that”. Overall the question was well answered.

(d) This question solving an equation formed by equating the answer to part **(c)** to one of the original functions was generally well done. There were a few sign slips in solving the equation.

Answers: **(a)** – 1 **(b)** –3, 3 **(d)** 1

Question 5

This question was broken up into steps requiring trigonometry and Pythagoras. Many candidates answered it very well or at least gained marks in the earlier parts. There were a number of complicated methods seen when right-angled triangles were available. For example some candidates used triangle *AFB* and this made the question much more difficult than necessary. Nevertheless some of these more complicated methods still gained full marks.

Candidates who did not use at least 4 figures in their working were very likely to lose the accuracy marks in parts **(a)(ii)**, **(c)** and **(d)**.

(a) (i) Most candidates calculated the length correctly, using Pythagoras. A few added the squares instead of subtracting when one of the given sides was the hypotenuse.

(ii) Most candidates also answered this trigonometry question well. The efficient method was to use the cosine ratio with the given 12m and 18m and many candidates used this. Other methods involved using the answer to part **(i)** which presented the risk of inaccuracies in later answers. The sine rule was frequently seen in this right-angled triangle and, although this was a longer method, the success rate was just as high as for the more efficient methods. Even the cosine rule was occasionally seen.

(b) Another "show that" question and, again, many answers omitted a necessary step. The requirements were to use a correct trigonometrical method and to obtain an answer in the range 29.95 to 30.05, thus showing the 30.0 to 1 decimal place. A small number of very strong candidates worked with exact values and arrived at exactly 30, which was more than acceptable. A number of candidates found the length in part **(c)** and used it in this part. If they found the length without using the 30.0 then this was perfectly acceptable but if they used the 30.0 this was accepted for part **(c)** but could not earn anything in part **(b)**.

(c) The required length was the hypotenuse of a right-angled triangle and yet many candidates chose trigonometry to answer this question, carrying out more working for only a possible 2 marks.

(d) Candidates were instructed to use the cosine rule in this part and there were many good answers, especially when triangle *BEP* was used.

Answers: **(a)(i)** 13.4 m **(ii)** 48.1° or 48.2° **(c)** 32.8 or 32.9 m **(d)** 14.3 m

Question 6

(a) As stated earlier, graph sketching has improved greatly and this question saw very good skills in this respect. Most candidates used a correct frame on their calculator and looked carefully at important intersections and asymptotic behaviour. One important skill which can be overlooked is the entering of the function into the calculator. If a candidate types in an incorrect function, usually by omitting vital brackets, then many marks are likely to be lost in the question. It is impossible for the Examiner to guess at any errors that may have been made.

(b) The equation of the asymptote was generally well answered. The errors seen included $y = 1$, answer of 1 and y not equal to 1. All these answers suggested an understanding of an asymptote but candidates must be accurate with their answers.

(c) Domain and range is a very challenging topic and this question was no exception. This part was often omitted and only the better candidates used the y values of the turning points. Those who reached this far often lost the marks by giving incorrect inequalities or giving answers to 2 significant figures.

(d) Finding the zeros of the function proved to be much more accessible and many candidates gained full marks. Some candidates used algebra instead of the calculator but still earned the marks.

(e) The sketching of a straight line was usually correct.

(f) The co-ordinates of the points of intersection were usually correct. One mark was often lost by ignoring the instruction about 3 decimal places. Some incorrect answers indicated that a trace had been used and candidates are advised that tracing is rarely sufficiently accurate and is never expected in this examination.

Answers: **(b)** $x = 1$ **(c)** $y \le -5.83$, $y \ge -0.172$ **(d)** 2, 3 **(f)** (– 1.414, – 6.243), (1.414, 2.243)

Question 7

(a) This simple interest question proved to be more challenging than anticipated. There were many correct answers from good clear working, sometimes using a simple interest formula and sometimes breaking the question down into a straightforward percentage problem. The most common error was to use the amount of $588 as the interest, which led to 37.3% per year. Such a high rate of interest was accepted by a large number of candidates.

(b) This compound interest question was well answered and most candidates correctly used 1.05^8. A few candidates overlooked the instruction about the nearest $100 and a few subtracted the $10 000.

Answers: **(a)** 4 **(b)** $14 800

Question 8

(a) (i) Most candidates understood that a number of elements was required and answered this correctly.

(ii) Most candidates understood that a number of elements was required and recognised the correct subset. A number of candidates indicated a need for more experience with set notation.

(iii) Most candidates understood that a number of elements was required and recognised the correct subset. A number of candidates indicated a need for more experience with set notation.

(b) (i) The Venn diagram was usually correctly completed. The only error seen quite often was to put 24, 24 and 13 in the outside subsets instead of subtracting what was already in those sets.

(ii) The total number in the universal set was usually correctly answered, following through with the values in the Venn diagram.

Answers: **(a)(i)** 12 **(ii)** 5 **(iii)** 10 **(b)(ii)** 40

Question 9

(a) The volume of the cylinder was almost always correctly found. A few candidates left the answer as a multiple of, π and this was accepted but in a context question such as this a decimal answer is more appropriate.

(b) The total surface area of the inside of the open cylinder was also very well answered. A few candidates doubled the area of the circle.

(c) This part to find the height of water in the cylinder, given the volume, was found to be a more discriminating question. Many candidates answered the question well and the method of dividing the volume by the cross-sectional area was probably the most popular. The alternative method of using the ratio of the heights being equal to the ratio of the volumes was equally successful and seen quite frequently. The final answer had to be in centimetres correct to the nearest millimetre and was found to be challenging. Many candidates gave their correct answers to other accuracies and gained 2 of the 3 marks. Several candidates gave answers in millimetres and appeared to need more experience with this type of accuracy.

(d) This reverse of similar volumes question was the most difficult part in **Question 9**. The stronger candidates quickly found the linear ratio of $\frac{1}{2}$ and went on to find the radius correctly. Many candidates omitted this part and a large number used the volume of 150. Those who did use the volume of 150 often used the height of the original cylinder whilst some were rather fortunate in using $\frac{1}{2}$ of the height of the original cylinder.

Answers: **(a)** 2410 cm^3 **(b)** 804 cm^2 **(c)** 2.5 cm **(d)** 4 cm

Question 10

(a) This question asking for the inter-quartile range from a list of data was found to be more demanding than anticipated, with many candidates applying incorrect methods. There was the safe option of using the graphics calculator although this would have been rather time consuming. The list contained 30 values (an even number) and so the accepted method was to find the middle values of the first and second lists of 15 values, which were 18 and 47, leading to the answer of 29. If candidates used 47.5 – 18.5 this was considered to be wrong working and gained no marks.

(b) This was more successfully answered with many candidates scoring full marks. As expected, there was greater success with the frequencies than with the frequency densities, although many candidates used the given frequency density as a guide in calculating the others.

(c) The histogram was well drawn by the majority of candidates and the asking for frequency densities in part **(b)** appeared to make this part much more accessible. A number of candidates lost the mark for the widths of the bars because they started at 0, instead of 9.5. This challenging topic was well answered.

Answers: **(a)** 29 **(b)** 4, 5, 10, 5, 6 and 1, 0.5, 0.5, 0.3

Question 11

(a) Almost all candidates answered this simple probability question correctly.

(b) This combined probability question was generally well answered. The only error seen to any extent was to treat the problem as a “with replacement” situation, using the same denominator of 4 instead of the second one being 3.

(c) The same comments as part **(b)** also apply to this part.

(d) Similar comments as part **(b)** also apply to this part. The product of the four fractions was often very well set out with the third and fourth being $\frac{2}{2}$ and $\frac{1}{1}$, demonstrating a full understanding of the situation. A few candidates had $\frac{1}{2}$ instead of $\frac{2}{2}$ and this spoiled an otherwise correct method.

Answers: **(a)** $\frac{1}{4}$ **(b)** $\frac{1}{6}$ **(c)** $\frac{1}{4}$ **(d)** $\frac{1}{12}$

Question 12

(a) Almost all candidates drew the correct quadrilateral from the given co-ordinates.

(b)(i) The reflection in the *y*-axis was usually correctly drawn. A number of candidates reflected the object in the *x*-axis, indicating a lack of experience with the equations of the axes.

(ii) The translation was almost always correctly drawn. A few candidates reversed the *x* and *y* components.

(iii) The enlargement with a fractional scale factor was also very well answered. A few errors were seen with the plotting of one of the points and these candidates did not realise that the fact that the image was not similar to the object was an indication of an error. A few candidates used a scale factor of 1.5, even though it took part of the image off the given grid.

Question 13

(a) Many candidates obtained a correct expression for the area of the sector in terms of x and π. A few did not replace r by 10 and only earned the single mark for $\frac{x}{360}$.

(b) Most candidates were successful in finding the expression for the area of the triangle in terms of x and π. Again, a few left r in the expression instead of replacing it by 10.

(c) The candidates who answered parts **(a)** and **(b)** correctly usually found the correct expression for the area of the segment.

(d) This was another "show that" question and as in similar questions earlier in the paper candidates found this to be more challenging. There was a mark for showing that the 150° is found by subtracting the acute angle of 30° from 180° and many candidates missed this out, earning 2 of the 3 marks available. The best method was to use the given area to find the sine of the angle as $\frac{1}{2}$, as this increased the chances of seeing 180 – 30. The candidates who used the 150° to show that the area was 25 cm^2 usually only scored 2 out of 3.

(e) This was generally well answered and the candidates' answers to part **(c)** were followed through in this part. This question was not a context type and so an answer in terms of π was acceptable. The many candidates who had more simplified answers to parts **(a)**, **(b)** and **(c)** were rewarded by finding this part very straightforward.

Answers: **(a)** $\frac{x}{360} \times \pi \times 10^2$ **(b)** $0.5 \times 10 \times 10 \sin x$ **(c)** $\frac{x}{360} \times \pi \times 10^2 - 0.5 \times 10 \times 10 \sin x$ **(e)** 106 cm^2

Question 14

(a) The sketch of a pentagon was usually adequate. The quality or regularity were not looked for when marking the sketch. The purpose of this part was to set up part **(b)**. A number of candidates drew other polygons, the most common error being a hexagon.

(b) There were many different successful methods seen, indicating good problem solving skills. Most candidates used the sketch efficiently and chose appropriate trigonometry for their sketch. As in other questions candidates seemed to prefer general triangle trigonometry to right-angled triangle trigonometry and the sine rule was frequently seen. One quite common error seen was by candidates who drew triangle *ACD* and took the height from *A* to *CD* to be the diameter of the circle.

Answers: **(b)** 3.40 cm

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/43
Paper 43 (Extended)

Key message

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General comments

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Question 8

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(ii) Most candidates understood that a number of elements was required and recognised the correct subset. A number of candidates indicated a need for more experience with set notation.

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Question 9

(a) The volume of the cylinder was almost always correctly found. A few candidates left the answer as a multiple of, π and this was accepted but in a context question such as this a decimal answer is more appropriate.

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Answers: **(a)** 2410 cm^3 **(b)** 804 cm^2 **(c)** 2.5 cm **(d)** 4 cm

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(a) Almost all candidates answered this simple probability question correctly.

(b) This combined probability question was generally well answered. The only error seen to any extent was to treat the problem as a "with replacement" situation, using the same denominator of 4 instead of the second one being 3.

(c) The same comments as part **(b)** also apply to this part.

(d) Similar comments as part **(b)** also apply to this part. The product of the four fractions was often very well set out with the third and fourth being $\frac{2}{2}$ and $\frac{1}{1}$, demonstrating a full understanding of the situation. A few candidates had $\frac{1}{2}$ instead of $\frac{2}{2}$ and this spoiled an otherwise correct method.

Answers: **(a)** $\frac{1}{4}$ **(b)** $\frac{1}{6}$ **(c)** $\frac{1}{4}$ **(d)** $\frac{1}{12}$

Question 12

(a) Almost all candidates drew the correct quadrilateral from the given co-ordinates.

(b) (i) The reflection in the *y*-axis was usually correctly drawn. A number of candidates reflected the object in the *x*-axis, indicating a lack of experience with the equations of the axes.

(ii) The translation was almost always correctly drawn. A few candidates reversed the *x* and *y* components.

(iii) The enlargement with a fractional scale factor was also very well answered. A few errors were seen with the plotting of one of the points and these candidates did not realise that the fact that the image was not similar to the object was an indication of an error. A few candidates used a scale factor of 1.5, even though it took part of the image off the given grid.

Question 13

(a) Many candidates obtained a correct expression for the area of the sector in terms of x and π. A few did not replace r by 10 and only earned the single mark for $\frac{x}{360}$.

(b) Most candidates were successful in finding the expression for the area of the triangle in terms of x and π. Again, a few left r in the expression instead of replacing it by 10.

(c) The candidates who answered parts **(a)** and **(b)** correctly usually found the correct expression for the area of the segment.

(d) This was another "show that" question and as in similar questions earlier in the paper candidates found this to be more challenging. There was a mark for showing that the 150° is found by subtracting the acute angle of 30° from 180° and many candidates missed this out, earning 2 of the 3 marks available. The best method was to use the given area to find the sine of the angle as $\frac{1}{2}$, as this increased the chances of seeing 180 – 30. The candidates who used the 150° to show that the area was 25 cm^2 usually only scored 2 out of 3.

(e) This was generally well answered and the candidates' answers to part **(c)** were followed through in this part. This question was not a context type and so an answer in terms of π was acceptable. The many candidates who had more simplified answers to parts **(a)**, **(b)** and **(c)** were rewarded by finding this part very straightforward.

Answers: **(a)** $\frac{x}{360} \times \pi \times 10^2$ **(b)** $0.5 \times 10 \times 10 \sin x$ **(c)** $\frac{x}{360} \times \pi \times 10^2 - 0.5 \times 10 \times 10 \sin x$ **(e)** 106 cm^2

Question 14

(a) The sketch of a pentagon was usually adequate. The quality or regularity were not looked for when marking the sketch. The purpose of this part was to set up part **(b)**. A number of candidates drew other polygons, the most common error being a hexagon.

(b) There were many different successful methods seen, indicating good problem solving skills. Most candidates used the sketch efficiently and chose appropriate trigonometry for their sketch. As in other questions candidates seemed to prefer general triangle trigonometry to right-angled triangle trigonometry and the sine rule was frequently seen. One quite common error seen was by candidates who drew triangle *ACD* and took the height from *A* to *CD* to be the diameter of the circle.

Answers: **(b)** 3.40 cm

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/05

Paper 5 (Core)

General comments

Many candidates were able to demonstrate very good skills in investigation and understood the pattern that developed. The vast majority were successful in the first four questions. Overall there were a large number of excellent responses to the investigation and most candidates were able to gain the mark which was awarded for communication.

Comments on specific questions

Question 1

This question introduced addition triples and nearly all the candidates found the full set required. A few candidates either did not restrict themselves to the integers 1 to 7. Occasionally a candidate repeated triples or used repeated numbers within triples.

Question 2

Candidates had to find addition triples for different sets of integers. After random ordering in **Question 1** many candidates started to develop a system to ensure that all the triples had been found. A communication mark was possible for a system listing all 12 triples in the last part. A large number of candidates were rewarded for their approach.

Question 3

Most candidates gained full marks in this question where a table showing the number of addition triples had to be completed. Those who had made errors in **Question 2** were often able to recover the pattern here. The majority of candidates successfully extended the table, the common method being to notice that, starting at 1, one added on the numbers 1, 2, 2, 3, 3, 4, 4, etc. to give the number of addition triples.

Question 4

Nearly all candidates were able to copy the relevant answers from **Question 3** and so complete and extend the sequence of squares for the number of triples.

Question 5

This question (and subsequent ones) differentiated between candidates. The majority used a method of table extension to reach the answer. If this method was shown clearly a communication mark was awarded. Several candidates wrote an answer without any explanation and so lost the communication mark.

Answer: 21

Question 6

(a) Many candidates were successful in this question which required more general reasoning. They showed knowledge of the fact that 225 was a possible number for addition triples because it was a perfect square. Some went further and deduced that 31 integers would give 225 triples.

(b) Candidates who had understood part **(a)** were often able to gain credit for part **(b)**. To gain full credit the Examiners looked for mathematical language that was correct: usually this was seen from candidates who took the square root and observed that it was not an integer which was described in various ways – not exact, not a decimal, not a whole number.

Question 7

(a) There were relatively few correct responses to this question. Some candidates persevered with extending the table but then often missed an entry somewhere. The most successful method was to notice that half of 99 gave 49.5 and so 49^2 was calculated. It was possible to gain a communication mark for showing a correct process but many found this difficult to describe correctly. Some candidates, though, impressed the Examiners by using a formula.

Answer: 2401

(b) Candidates had to find how the answer in part **(a)** could be used to find the number of triples for 100 integers, a straightforward method being to add 49 to answer in part **(a)**. Other able candidates used the fact that 101 integers produced $50^2 = 2500$ triples and then subtracted 50.

Answer: 2450

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/06

Paper 6 (Extended)

General comments

This paper comprises two parts (an investigation and a modelling task) which are weighted equally. This year there was a significant difference in how well candidates performed on each of these tasks. Possibly candidates concentrated most of their efforts on the investigation to the detriment of the modelling. It may be that time management needs more consideration from candidates and they are advised to spend 45 minutes on each task.

A large number of excellent responses to the investigation were seen and many candidates gained the maximum marks for communication. A more careful reading of the questions would have improved the quality of response of a few candidates. For instance the condition for a distinct number triple was not always applied.

A smaller number gave very fine answers to the modelling question and most candidates took the time to communicate their understanding with explanations of trigonometry, geometry and algebra. Some candidates though attempted the modelling task without using a graphics calculator, which made the later questions almost impossible to answer correctly.

Some candidates used extra sheets of paper, which in most cases were unnecessary: candidates can use the size of the working space to estimate how much working is expected. When space was insufficient it was often the case that the candidate had missed the key point of the question.

There were unfortunately still a few candidates who made very little of this paper and for whom Paper 5 would have been more appropriate.

Comments on specific questions

Section A: Addition Triples

The large number of correct responses to the questions showed that the majority of candidates can tackle an investigation with confidence. A large number of candidates achieved a perfect score. The level of communication was generally of a high standard and most made a commendable effort in explaining the mathematical processes to gain credit. Some candidates, though, still need to appreciate the necessity for communication in this paper.

Question 1

This question introduced addition triples and nearly all the candidates found the full set.

Question 2

Candidates had to find addition triples for different sets of integers. As the question progressed many candidates developed a system to ensure that all triples had been found and show how a pattern was developing. A communication mark was possible for a systematic approach to the last part and most candidates were rewarded for their approach.

Question 3

The large majority of candidates successfully extended the table, the common method being to notice that, starting at 1, one adds on the numbers 1, 2, 2, 3, 3, 4, 4, etc. to find the number of addition triples. Those with errors in **Question 2** were usually able to recover and still find the pattern here.

Question 4

The intention of this question was to allow candidates to focus on the number of addition triples when there were an odd number of integers.

Question 5

This was a key question for the rest of the investigation. Candidates who could not identify the operations were unlikely to succeed in proceeding further with this task. Some candidates only identified the relationship between consecutive numbers of triples. It was possible to gain another communication mark in this question by showing clearly and correctly how the operations were applied. However the mark could not be awarded if a candidate ran statements together as in $7–1 = \frac{6}{2} = 3^2 = 9$.

Candidates who used the quadratic regression tool on their calculator were unable to relate it to the required operations and so gained no credit.

Answer: Divide by 2 and square or Square and divide by 4

Question 6

(a) Those who correctly found the operations in **Question 5** usually had little difficulty with this question. Those who had difficulty expressing their operations in the previous question sometimes recovered here to find the correct answer. The Examiners rewarded good communication when candidates stated correctly the steps used to produce the answer.

Answer: 2500

(b) This question required candidates to reverse the operations in **Question 5** and many gained a communication mark by giving a clear description of applying these inverse operations. Some in fact set up an equation and solved it in clear stages to gain this mark. A common error was to calculate the answer for 11449 integers, assuming that part **(b)** was a repetition of part **(a)**.

Answer: 215

(c) Different forms of the expression for the number of addition triples were numerous and these were all given credit. Nearly all the candidates took care to write their algebra with correct brackets. Some candidates made use of the quadratic regression tool on the graphics calculator in which case the communication marks in parts **(a)** and **(b)** were usually not awarded. For instance, a simple statement that a calculator had been used to solve $0.25n^2 – 0.5n + 0.25 = 11449$ was insufficient. It is worth noting that use of a quadratic regression tool is not in the syllabus and so questions, such as this and **Question 5**, often prove disadvantageous to the candidate who used the tool.

Answer: $\left(\frac{n-1}{2}\right)^2$

Question 7

(a) Most of the correct answers showed the use of an addition onto the answer found when there were 99 integers in the list. A communication mark was possible here but this was more difficult to obtain since the method arriving at the answer was more complex.

Answer: 2450

(b) Only the most able candidates were able to score marks here. There were no clear operations to reverse and, although related to previous questions, candidates had to use a variety of steps to find the answer.

Answer: 74

(c) The formula sought could be expressed in any correct form, of which numerous examples were seen. Most of the successful candidates made use of the idea of adding on from a square number or subtracting $\frac{1}{4}$ from the previous formula. Some were able to go further and found a simplified answer.

In spite of this being the final and probably most challenging question in the investigation there were a good number of correct answers.

Answer: $\left(\frac{n-2}{2}\right)^2 + \left(\frac{n-2}{2}\right)$

Section B: Regiomontanus' Statue

There were some very impressive responses to the modelling question. It is important though, to note that some candidates experienced difficulty when applying expressions or surd fractions, rather than decimals, to a given equation (the Sine Rule). Some candidates tried to use information later in the paper to gain earlier marks. This produced little reward since then key steps in the process were missing. In particular the words *Show that* in a question indicate that a full explanation is necessary.

Question 1

(a) (i) Nearly all candidates showed the use of Pythagoras to find the required length.

(ii) This question required the identification of $\frac{\text{opposite}}{\text{hypotenuse}}$ for the sine. Several candidates unnecessarily wrote sine in front of the fraction required.

Answer: $\frac{3}{\sqrt{13}}$

(b) Again, nearly all candidates showed the use of Pythagoras to find the required length.

(c) This question reads *Show that…* and so candidates must be aware that full reasoning is required and a short-cut will not gain credit. Candidates were expected to substitute their values from parts **(a)** and **(b)** into the Sine Rule which was given in the question. Many candidates did not substitute the value of the sine and continued to confusingly write sin before fractions within their algebra. Some found the angle that gave a sine of $\frac{3}{\sqrt{3}}$ and then took the sine of that, thereby using an approximate decimal. In fact many preferred to proceed using an argument based on decimals. Since this was a modelling task allowance was made for this approach provided the candidate maintained a high degree of accuracy.

There were many efforts seen in which candidates inappropriately used the Sine Rule in the right-angled triangles.

Question 2

The successful candidates repeated what they had done in **Question 1** and also gained credit for clear communication of Pythagoras and the Sine Rule. The main error was to assume that the sine would remain unchanged and that one could therefore copy the result, with little change, from the previous question. Those who redrew the diagram, rather than enter numbers onto the one given on the page, were less likely to make this error. Those candidates who looked ahead to the next question and used the formula there did not receive credit.

Answer: $\frac{1}{\sqrt{10}}$

Question 3

The method of **Question 1** was repeated here using algebraic terms, so candidates that had assimilated this method in **Questions 1** and **2** were usually successful. As in **Question 1(c)**, the instruction *Show that* emphasises that full reasons must be supplied. In this respect it was necessary to identify why $\sqrt{x^2+1}$ or $\sqrt{x^2+4}$ appear on the denominator by relating them to the correct line segments. There were some candidates who replaced the variable *x* by a number and so were unable to derive a general result. In this question, more accuracy in the algebraic writing of Pythagoras would have improved the mark for some candidates.

Question 4

(a) Candidates who had difficulty with **Question 3** were able to recover here by using the function given. Most candidates took care in typing the function correctly into their calculator and many fine sketches were seen. Some candidates tried to answer this question without using a graphics calculator, which is essential for this paper. Those who joined calculated points often had graphs that did not curve consistently.

In sketching a curve from a graphics calculator candidates do need to take care to represent correctly the essential features of what they see. In this respect candidates were expected to see that, after the maximum, the graph did not in fact have a minimum. Candidates are advised to consider the relationship between the context and the graph when modelling. Here the context implies that the angle (and hence its sine) cannot increase as the viewer walks further and further away. Similarly, from the context, candidates should realise that the graph must start at the origin since, at 0 metres from the statue, the angle of view must be 0°.

(b) Only those candidates using a graphics calculator could answer this question accurately enough and a reasonable degree of accuracy was required for the answer.

Answer: 1.41

(c) There were several answers of 0.33 or 33°, neither fitting well with the original context. Candidates who wrote this had forgotten that the vertical scale on the calculator was for the sine and not the angle.

Answer: 19.5°

Question 5

(a) There were only a few good answers to this question. It required candidates to amend the model of **Question 3** when the height of the statue was *h* metres. Without having a correct process in **Question 3** candidates could not proceed far in this question and only the most able candidates were able to apply the Sine Rule correctly to amend the model. A common error was in not realising that the opposite side to angle *A* in triangle *ABC* was now *h* and not 1 as previously. Several candidates gained partial credit for finding the correct denominator.

Answer: $\frac{xh}{\sqrt{x^2+1}\sqrt{x^2+(h+1)^2}}$

(b) (i), (ii) The few candidates who were able to find the new maximum point on the graph when $h = 2$ usually wrote down the new values for the distance and the angle but then made no comment on the *change* in them as the question required.

Answers: **(i)** 10.5° **(ii)** 0.3 m