CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/01

Paper 1 (Core)

General comments

This non-calculator paper was the second paper of the syllabus that candidates have taken and most were well prepared. As last year almost all candidates were able to demonstrate an understanding of some elements of the subject and it was rare to see a paper where a reasonable attempt had not been made of at least some of the questions. Working was usually shown for questions for which it was appropriate and the standard of presentation was very good. The standard of carrying out calculations without the aid of a calculator was very good with not many errors seen.

Particular Centres had difficulty with certain topics: for example, stem and leaf diagrams is one topic that seemed to have not been covered by some Centres. Reading information from a Venn diagram was another topic that candidates from some Centres could not answer well.

Time did not appear to be a factor as the majority completed the paper.

Comments on specific questions

Question 1

Part (a) This part was answered very well. The majority of candidates either wrote down $2 \times 2 \times 2$ and then gave the correct answer, or simply wrote down the correct answer.

Part (b) This was not answered well as many candidates were unable to recall that any number raised to the power of zero is equal to 1. It was very common to see an answer of 2 and less frequently an answer of 0.

Answers: **(a)** 8 **(b)** 1

Question 2

Most candidates evaluated the numerator and denominator correctly to reach $\frac{12}{32}$, with just the very occasional error in calculating 4×8 seen. However, quite a number of candidates made mistakes when attempting to reduce the fraction to its lowest terms.

Answer: $\frac{3}{8}$

Question 3

Candidates found this question difficult, with relatively few giving a completely correct answer. Some candidates attempted to multiply both 2 and 10^5 by 6 and others gave 10^5 as 1 000 000. Those that did write down 10^5 correctly usually gave 1 200 000 but were then not always able to convert this to standard form. Very few candidates used the most efficient method namely $12 \times 10^5 = 1.2 \times 10^6$.

Answer: 1.2×10^6

Question 4

Candidates found this to be one of the most difficult on the paper.

Part (a) The majority of candidates gave the incorrect answer of discrete, presumably not understanding that any number obtained from measuring is always continuous.

Part (b) Most candidates did not show any understanding of what is required for a stem and leaf diagram. Those that did draw a stem and leaf diagram nearly always gave an ordered version without first drawing an unordered diagram. This may have accounted for some of the numbers being omitted which was seen on a number of occasions. In order to obtain full marks it was necessary for candidates to provide a key in order for the diagram to be understood, but very few did so.

Part (c) was done well with most candidates showing that they understood that the range is the lowest value subtracted from the highest. A few candidates, however, gave their answer as 8 – 26.

Answers: **(a)** Continuous

(b)

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

Key e.g. 2|3 means 23

(c) 18

Question 5

Generally candidates did very well on this algebra question with many obtaining full marks.

Part (a) A few candidates gave $15p^6$ and some gave $8p^5$.

Part (b) Some candidates only partially factorised the expression giving either $2(x^2+3xy)$ or $x(2x + 6y)$.

Answers: **(a)** $15p^5$ **(b)** $2x(x + 3y)$

Question 6

This was the most straightforward question on the paper and very nearly all candidates obtained full marks.

Part (a) This was virtually always correct with only a very small number of candidates plotting the *x* – coordinates as *y* – coordinates and vice versa.

Part (b) This was also virtually always correct.

Answers: **(a)** points plotted correctly **(b)** (1, 6)

Question 7

This question was answered well with many candidates obtaining full marks.

Part (a) All three of the expected methods were seen regularly. The most common was the division of the figure into three rectangles using two horizontal lines. Most candidates calculated the areas of the two equal rectangles as 4 x 2 but a few failed to give the dimensions of the third rectangle correctly: for example, giving 6 x 1 rather than 2 x 1. Some candidates used a vertical line leading to two equal rectangles of 3 x 2 and one of 6 x 1. The third method of giving 6 x 4 and then subtracting the area of the rectangle with an area of 3 x 2 was seen occasionally.

Part (b) The majority of candidates understood that the scale factor was 12 and then went on to give either 6 x 12 = 72 or 24 + 24 + 24 = 72.

Answers: **(a)** 18 **(b**) 72

<u>Question 8</u>

The majority of candidates answered **parts (a)** and **(b) (i)** well but found **part (b) (ii)** difficult.

Part (a) Most candidates gave the correct answer. Occasionally an answer of 0.1 or 0.3 was seen.

Part (b) (i) There was a mixed response to this part. A quite common misconception was to write down in the tree diagram the probability for windy and not sailing as 0.1 and for not windy and not sailing as 0.8.

(ii) Not many candidates realised that that the two probabilities need to be multiplied and a common response was 0.4 + 0.8 in spite of the fact that this gave an answer greater than 1.

Answers: **(a)** 0.7 **(b) (i)** 0.7 0.2 0.9 **(ii)** 0.24

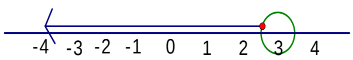
<u>Question 9</u>

This question on inequalities proved to be quite difficult for the majority of the candidates.

Part (a) Most candidates multiplied out the brackets correctly but were unable to complete the part. Answers such as $x = 3$, $x > 3$ and $x < 2$ were seen.

Part (b) Many candidates simply marked a point on the number line that did not necessarily ‘match up’ with their answer to **(a).** Others gave an interval such as a line from 3 to 0. Of those that used their answer from **(a),** some gave the correct line but were not always aware of the notation for indicating that $x = 3$ was not included.

Answers: **(a)** x < 3 **(b)**



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<u>Question 10</u>

Many candidates appeared to be unfamiliar with set theory notation and this was reflected in the answers to **parts (a)**, **(b)** and **(c)**.

Part (a) There were very few correct answers seen, mainly because candidates did not understand that n(*A*) means the number of elements contained in set *A*. Thus it was very common to see $\{1, 2, 3, 6\}$ or $\{3, 6\}$.

Part (b) A variety of incorrect responses were noted, examples of which were $\{1, 2, 3, 4, 6, 8\}$, $\{5, 7, 9\}$ and $\{3, 4, 6, 8.\}$

Part (c) As in **(b)** there were more incorrect answers than correct ones. These included $\{1, 2\}$, $\{1, 2, 5, 7, 9\}$ and $\{3, 4, 6, 8\}$.

Part (d) This part was answered quite well even though the majority did not have the correct answer for **(a)**. Candidates generally understood that the number of elements in set *A* was required for the numerator thus emphasising that the errors seen in **(a)** were due to a lack of understanding of the notation.

Answers: **(a)** 4 **(b)** $\{1, 2\}$ **(c)** $\{5, 7, 9\}$ **(d)** $\frac{4}{9}$

Question 11

Part (a) This was answered very well with virtually all candidates appreciating that the common difference was 3 and therefore able to write down the next term of the sequence.

Part (b) Many candidates found this part difficult. A good number realised that the *n*th term of the sequence contained $3n$ but only a few were able to give a completely correct answer.

Part (c) There were two strategies used by candidates attempting this part. The first involved putting their expression for the *n*th term in **part (ii)** equal to 296 and then showing that the solution was not an integer. By far the most common error, however, was to divide 296 by 3. The second strategy was to try to list the terms close to 296 and some candidates used their own method to avoid having to write down all the terms. This normally involved using $3n - 5$ with $n = 100$, for example. Those that did try to list all the terms up to 296 invariably made an error.

Answers: **(a)** 13 **(b)** $3n - 5$ **(c)** Conclusion that 296 is not a term with a valid explanation.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/02

Paper 2 (Extended)

General comments

Candidates appeared to have been well prepared for this examination. All questions were accessible to the vast majority of candidates. The period of a function and the length of a vector were once again areas of the syllabus that candidates appeared to find problematic, along with the stretch transformation.

Marks obtained by candidates ranged from single figures up to full marks with the majority gaining more than half marks.

Clear working was shown on most papers with candidates writing in pen. Method marks could be awarded for correct working seen even when the answer was incorrect.

Time did not appear to be a factor as most candidates completed the paper.

Comments on specific questions

Question 1

This question was answered very well with most candidates scoring full marks. Occasional incorrect answers seen were 36×10^3, 3.6×10^3 and 3.6×10^{-4}.

Answer: 3.6×10^4

Question 2

Part (a)(i) was well answered. Incorrect answers seen were 0 and 3. **Part (a)(ii)** was also answered well although some candidates failed to evaluate $\sqrt{36}$ and some misinterpreted $36^{\frac{1}{2}}$ as $36 \div 2$. **Part (b)** was well answered. An incorrect answer seen was $x = 8$. Some candidates failed to recognise that the index rules should be used and evaluated $2^8 \div 2$ to get 128 but often then failed to convert back to index form. Some candidates stated 2^7 as their answer.

Answers: **(a)(i)** 1 **(ii)** 6 **(b)** 7

Question 3

This question proved difficult for many candidates. Most reached but did not progress beyond $3y(x^2 - 4y^2)$, failing to recognise the difference of two squares.

Answer: $3y(x + 2y)(x - 2y)$

Question 4

Most candidates successfully identified a as the amplitude, 4. The value of b proved to be more difficult. Common errors included 90°, 180° and occasionally answers a and b were reversed.

Answers: $a = 4$ $b = 2$

Question 5

Most candidates scored full marks on this question. Those that made errors in **part (a)** could often be awarded marks in **part (b)** when they used their factorised expression from **part (a)** to solve the equation. Errors seen in **part (a)** included $2(x – 3)(x + 2)$ and $(2x + 3)(x – 2)$. Many candidates started again in **(b)** and chose to use the quadratic formula.

Answers: **(a)** $(2x – 3)(x + 2)$ **(b)** $x = 3/2$ or $x = –2$

Question 6

Part (a) of this question was well answered with the majority of candidates successfully showing $\log 2^3 + \log 3^2$ in their working and subsequently reaching the correct solution. Some candidates incorrectly stated $k = \log 72$ and a minority thought that $k = 17$. There were a surprising number of numerical errors such as $2^3 = 6$ and $3^2 = 6$. **Part (b)** proved to be problematic for many candidates. The most usual answers were log5, log20 and 5.

Answers: **(a)** 72 **(b)** 2

Question 7

Part (a) was well answered with most candidates understanding that $2\begin{pmatrix}5\\2\end{pmatrix} - \frac{1}{2}\begin{pmatrix}-4\\2\end{pmatrix}$ was required. Many, however, found the combination of multiplication, subtraction and negative numbers too complicated. $\begin{pmatrix}8\\1\end{pmatrix}$ and $\begin{pmatrix}8\\3\end{pmatrix}$ were common incorrect answers. **Part (b)** proved difficult for many candidates. Most did not understand that they were required to find the length of vector **q**. Some candidates tried to find the length of a line segment joining points (5, 1) and (-4, 2). Many candidates left **(b)** blank. The application of Pythagoras' Theorem and the use of surd form were good by those candidates who understood the notation |**q**|.

Answers: **(a)** $\begin{pmatrix}12\\1\end{pmatrix}$ **(b)** $\sqrt{20}$ or $2\sqrt{5}$

Question 8

Part (a) of this question was well answered with many candidates showing correct manipulation of surds. Errors seen from a minority of candidates included $\sqrt{22}$ and confusion between $5\sqrt{2}$ and $2\sqrt{5}$. Some candidates faltered having reached $3\sqrt{8} – 5\sqrt{2}$. Candidates found **(b)** more of a challenge. Although many appeared to understand what 'rationalise' meant, confusion was caused by trying to multiply numerator and denominator by $2 – \sqrt{3}$ or just $\sqrt{3}$.

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

Question 9

Part (a) was very well attempted although the rotation was often stated as 'clockwise'. **Part (b)** was problematic. Many candidates drew enlargements. Stretches with the x axis invariant were common. The best that was usually seen was a horizontal translation of the correct answer, most commonly from using $x = 2$ as the invariant line.

Answers: **(a)** rotation of 90° anticlockwise, centre (0, 0) **(b)** vertices at (4,0) (4,3) (8,3) (8,2) (6,2) (6,1) (8,1) (8,0)

Question 10

Parts (a) and **(c)** were very well answered. In **part (b)** many candidates failed to spot the cyclic quadrilateral and offered a wide variety of wrong answers.

Answers: **(a)** 35° **(b)** 125° **(c)** 15°

Question 11

Part (a) of this question was well answered. The vast majority of candidates used the *y* intercept correctly and most were also successful in finding the gradient. Some candidates had a gradient of 2 and a few failed to write an equation, simply writing $-2x+4$ instead. **In part (b)** the mid-point was almost always correct but many candidates were unable to use the gradient of a perpendicular line. Some of those that did know the correct gradient then faltered and did not substitute their values from the mid-point to find the complete equation.

Answers: **(a)** $y = -2x + 4$ **(b)** $y = \frac{1}{2} x + 3/2$

Question 12

This question was very well answered with many candidates scoring full marks. Some candidates only got as far as $y \propto x^2$ or $y = kx^2$ and thought they had answered the question. A few ignored the scales and wrote $y = x^2$. Some candidates used $ky = x^2$ and then evaluated k, which was an acceptable though less conventional method.

Answers: $y = \frac{1}{4} x^2$

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/03

Paper 3 (Core)

GENERAL COMMENTS

This was the first full sitting of this examination, following the pilot papers taken in May 2009.

The paper was found to be challenging in places, but some questions were also seen to be quite straightforward. The scores were well spread out suggesting that the paper successfully discriminated throughout the ability range.

Questions found to be difficult were the reverse fraction calculation, interpreting graphs, linear equations, speed-time, arc and chord length, bearings and angles in a circle. Topics found to be easy were ratio, direct fraction calculation, numerical substitution into algebraic expression, description of transformations and co-ordinates. More details on these questions will be found in the comments below.

Candidates did not use their graphics calculators to their full potential. This is an essential part of the syllabus and needs a considerable amount of teaching time.

Almost all candidates were able to finish in the allotted time and any blank spaces were an indication of inability to do a question as opposed to being unable to finish.

The working space proved to be more than sufficient for almost all candidates. It is strongly recommended that extra paper is only given out if absolutely necessary. If a candidate does use extra paper then the script should be annotated accordingly. Extra paper can sometimes lead to an absence of working on the script as only answers tend to be copied onto the script; this can sometimes lead to difficulties for Examiners to find the working.

In trigonometry questions it is important that candidates realise that they must be in degree mode. Sometimes when graphics calculators are re-set before an examination they default to radian mode.

Most candidates worked to a good level of accuracy and generally carried out the instructions in the rubric on the front page of the examination paper. There were a few who did not use the value of π on their calculator and, in some cases ended up with answers outside an acceptable range.

COMMENTS ON INDIVIDUAL QUESTIONS

Question 1

(a) A division of an amount in a given ratio was successfully carried out by almost all but the weakest candidates.

(b) **Part (i)** was the calculation of a fraction of a given quantity and was found to be straightforward. However the reverse fraction calculation in part **(ii)** proved to be beyond the majority of the candidates. Many calculated $\frac{9}{11}$ of \$80.

(c) This compound interest question was generally done well. A small number of candidates carried out a simple interest calculation. The instruction about giving the answer to 2 decimal places was often overlooked.

Answers: **(b)(i)** \$35 **(ii)** \$55 **(c)** \$67.42

Question 2

(a) The simple substitution of –1 into a linear expression was almost always successfully done in part **(i)**. The changing of the formula in part **(ii)** proved to be beyond many candidates. Some omitted the question and others made sign errors or order of operation errors. Part **(iii)** was quite well done and many went back to the original formula and solved the resulting equation whilst others successfully followed through from part **(ii)**.

(b) This simultaneous equations question was not done very well. Very few candidates took advantage of both equations being *y* =. The two equations were made equal to each other in a few cases but a graphical solution was never seen.

Equations were re-organised or re-arranged to try to use the elimination method and there were a great many errors seen in the working, such as $2x + y = 3, y - x = 9$. Candidates seemed to want to eliminate *x* and then $y = 18 - 2x$ occurred frequently.

It is hoped that a question such as this could be seen as one which can be done on the graphics calculator.

Answers: **(a)(i)** – 5 **(ii)** $\frac{y+3}{2}$ **(iii)** 4.5 **(b)** $x = 4$, $y = 5$

Question 3

(a) **(i)** The description of the reflection was usually correct.

(ii) This was not always seen as a rotation and even when this was correct, quite a number of candidates did not indicate that the 90° was clockwise.

In both parts, some candidates used co-ordinates only to try to describe the transformations, showing very limited knowledge of this part of the syllabus.

(b) There were many correct enlargements drawn but a surprising number of incorrect vertices, apart from the origin.

Answers: **(a)(i)** reflection, $x = -1$ **(ii)** rotation, centre (0, 0), 90° clockwise

Question 4

(a) There were many accurate pie charts scoring full marks. There also were some drawn with the angles too small leaving part of the pie chart which did not represent anything. Some candidates omitted this part and this may have been due to not having a protractor.

(b) (i) The mode was usually correct and it was pleasing to see that most candidates gave the value and not the frequency.

(ii) The calculation of the mean was quite well done but a frequent answer was 2.5, which was the six values divided by 6.

(iii) The range was not well done and many candidates appeared to make a guess, such as 0 to 5, indicating a lack of familiarity with this part of the syllabus.

The two quartiles in parts **(iv)** and **(v)** were rarely correct,.

Part **(b)** was set as a question that could be largely done on the graphics calculator and this is why each part was only given 1 mark. Parts **(iii), (iv)** and **(v)** could have been read directly from a display if the correct statistics function had been used.

(c) All three parts were quite well done although there were answers where the actual numbers of goals were seen instead of the frequencies, for example $\frac{6}{20}$ for part **(ii)**. In part **(iii)** some candidates interpreted more than one goal to be one goal or more.

Answers: **(a)** angles of 72°, 162°, 54° **(b)(i)** 1 **(ii)** 1.5 **(iii)** 5 **(iv)** 1 **(v)** 2 **(c)(i)** $\frac{9}{20}$ **(ii)** 0 **(iii)** $\frac{7}{20}$

Question 5

There was an improvement in the graph sketching compared to last year but there are still many candidates who find interpreting from their sketches to be difficult.

(a) The two sketches were generally well done.

(b) Very few candidates appeared to have any idea of asymptotes.

(c) (i) Only a small number of candidates achieved both marks by correct use of the intersection function on the graphics calculator and by giving answers to 4 decimal places.

Answers to 2 or 3 decimal places were frequent as were answers which were close to the correct 4 decimal place answers, which may have been found using a trace function. Candidates should be familiar with the graphics calculator requirements.

(ii) A small minority of candidates connected this part to the x - co-ordinates of part **(i)**.

(d) Correct or even partially correct answers were rarely seen. There were a few attempts at describing how the graph may have moved but "translation" was only seen a very small number of times.

Answers: **(b)** $x = 0$, $y = 0$ **(c)(i)** (– 0.7454, – 2.4142), (1.3415, 0.4142) **(ii)** –0.7454 and 1.3415 **(d)** translation $\begin{pmatrix} 0 \\ -2 \end{pmatrix}$

Question 6

(a) The required co-ordinates were almost always correct.

(b) This was generally well done, with only a few candidates not recognising that Pythagoras was required.

(c) There was much less success here with many candidates not demonstrating any understanding of gradient, while others had $\frac{run}{rise}$. There were few correct answers to part **(i)** and even fewer to part **(ii)**, although a follow through was allowed. The few candidates who wrote down an equation almost always had a c value which was not zero.

Answers: **(a)** (10, 3) **(b)** 10 **(c)(i)** $\frac{6}{8}$ **(ii)** $y = \frac{6}{8}x$

Question 7

This question demonstrated how candidates have great difficulty in changing between hours and minutes and decimal values in hours. There were very few fully correct answers.

(a) In part **(i)**, there were many correct answers to this time question but also many errors, particularly the answer of 12 h 8 min.

(ii) This was rarely correct. Most candidates attempted to divide distance by time and gained one mark for this. However, the majority of candidates did not change their answer to part **(i)** into a decimal in hours. So, the working commonly seen was 1150 ÷ 11.52.

(b) A similar problem in the lack of conversion of units occurred in this part. Most candidates divided 1150 by 95 which gave 12.105. This was then taken as 12 h 10 min and the very common answer was therefore 18 minutes.

Answers: **(a)(i)** 11h 52 min **(ii)** 96.9 km/h **(b)** 14 min

Question 8

This question asked for an arc length and a chord length. Several candidates mixed up these two parts.

(a) In addition to the above error, some candidates lacked knowledge of the arc being a fraction of the circumference,.

(b) There was some success with this part, although a common error was to treat the triangle *OAB* as being right-angled. Some who correctly found *AM* or *BM* rounded this value before multiplying by 2 for *AB*. This strategy runs the risk of losing the accuracy mark.

(c) This easy addition of the answers to parts **(a)** and **(b)** was done by many candidates but vocabulary was a problem for some as they omitted this part.

Answers: **(a)** 7.82 cm **(b)** 7.51 cm **(c)** 15.3 cm

Question 9

(a) Some candidates did not work out the angles at *A* but other problems appeared to be due to a lack of understanding of bearings.

(b) This was the most successful part of this question, with many correct answers. A common error was to have the reciprocal of the correct tangent ratio.

(c) There were very few correct answers to this second bearing question and again the impression was that the understanding of bearings was more of a problem than the angles to be found at *B*.

Answers: **(a)** 050° **(b)** 54.8° **(c)** 085°

Question 10

A small number of candidates overlooked the formulae given on page 2 of this examination paper, resulting in strange formulae appearing for the surface area and the volume of a sphere.

(a) This calculation using a given formula was generally well done.

(b) As in part **(a)**, the correct formula was usually successfully applied.

(c) In part **(i)** most candidates successfully multiplied their answer to part **(b)** by the given density but the conversion from grams into kilograms in part **(ii)** caused more problems, such as dividing by 100 or by multiplying by 1000.

(d) The volume from part **(b)** was usually used but it was often divided by 6 or 3 and sometimes by 4. Some candidates realised that a root would be needed but took the square root. The question was also often omitted.

A few of the stronger candidates obtained the correct cube root.

Answers: **(a)** 804 cm^2 **(b)** 2140 cm^3 **(c)(i)** 16 800 or 16 900 g **(ii)** 16.8 or 16.9 kg
(c) 12.9 cm

Question 11

(a) (i) This angle in a semi-circle was usually recognised.

(ii) The use of the angle between a tangent and radius as well as a right-angled triangle was generally well done, although a number of candidates took triangle *APB* to be isosceles.

(iii) The isosceles right-angled triangle was usually recognised. A few candidates took triangle *BAQ* to have the same angles as triangle *APB*, giving an answer of 38° or 52°.

(b) This was rarely correct. Statement such as “the angles are not equal” or the lines will meet” were not sufficient. Answers such as “angles in the same segment” and “angle $PBA \neq$ angle BAQ” were the type of answer being looked for.

Answers: **(a)(i)** 90° **(ii)** 38° **(iii)** 45°

Question 12

(a) This was generally well done, although a number of candidates calculated 19% of 120.

(b) The phrase “at least” caused a problem to some candidates who had an incorrect numerator in their fraction to be simplified.

(c) The estimate of the mean using mid-values caused many problems and a correct answer was not seen very often. This part was often omitted.

(d) (i) The missing values from the cumulative frequency table were usually correctly calculated.

(ii) The cumulative frequency curve was generally well done but was occasionally not attempted.

(iii) Most candidates who had succeeded in part **(ii)** obtained the correct median. Some gave an answer of 20, which should have been clearly not possible from the values in the table, whilst others gave an answer of 22, which was from misreading the scale.

Answers: **(a)** 15.8% **(b)** $\frac{8}{15}$ **(c)** 20.2 cm **(d)(i)** 56, 103 **(iii)** 21 cm < answer $\leq$ 21.5 cm

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/04

Paper 4 (Extended)

GENERAL COMMENTS

This was the first full sitting of this examination, following the pilot papers last May.

It is pleasing to report that the paper was found to be accessible to almost all of the candidature and there were many high scoring scripts. The scores were well spread out suggesting that the paper successfully discriminated throughout the ability range. Some questions were seen to be straightforward and there were also some challenging questions or part questions.

Questions found to be challenging were on histograms, domain and range of functions, part of a trigonometry problem requiring two general triangle calculations, surface area of a prism requiring a Pythagoras calculation, probability of combined events and the *n*th term of a geometric sequence. Areas found to be easy were percentages, Venn diagrams, mean from a continuous distribution, proportion, regular sine and cosine rules, probability tree diagram and numerical values in sequences. More details on these questions will be found in the comments below.

Almost all candidates were able to finish in the allotted time and blank spaces were an indication of inability to do a question as opposed to being unable to finish.

The working space proved to be more than sufficient for almost all candidates. It is strongly recommended that extra paper is only given out when absolutely necessary. If a candidate does use extra paper then the script should be annotated accordingly. Some candidates were under the impression that they should use extra paper. This led, in some cases, to an absence of working on the script as only answers were copied onto the script, often leading to difficulties for Examiners to find the working.

Most candidates proved to be very accurate with their working, either by keeping values in their calculator or working with 4 or more significant figures. There are some situations where an exact surd or exact multiple of π will be a perfectly acceptable answer, as well as the usual correct to 3 significant figures. However there were some common accuracy errors which will be dealt with in the comments on individual questions. The mark schemes, whenever possible, do not penalise accuracy and rounding very heavily but a few candidates seem to think that working with 3 significant figures through a multi-step question will give 3 figure accuracy at the end.

The "show that" question posed some difficulty and candidates are encouraged to practise these more. If an answer is given, then the credit is for steps clearly arriving at the answer and not for the answer itself. The candidate should read these questions carefully to know exactly what is required.

Quite a number of candidates worked in radians in trigonometry, almost certainly by accident. This may have been due to re-setting calculators before the examination. Candidates should be advised to set their calculators back into degrees.

It is encouraging to report on the good work of so many candidates who demonstrated skills, knowledge and the ability to interpret as well as the potential to go further in this subject. The overall impression was that of a positive experience for the candidates in a new examination.

COMMENTS ON INDIVIDUAL QUESTIONS

Question 1

(a) This was a straightforward money calculation which almost all candidates answered correctly.

(b) This percentage question was usually correctly answered although quite a number of candidates used the final amount for the denominator and not the original amount.

(c) A few more problems were seen in this reverse percentage question with a common error being the calculation of 88% of \$0.84 instead of dividing \$0.84 by 1.12.

(d) The better candidates coped well with this “compound interest” type of question. The most common strategy was to repeat multiplications by 1.06 and this usually reached the correct answer of 5. However, some candidates rounded or truncated too much in their working and this occasionally led to an answer of 6. The more direct method using logarithms was rarely seen. Quite a number of candidates found 6% of \$0.75 and then divided \$0.25 by this amount not realising that this was not a “simple interest” situation.

Answers: **(a)** \$7.60 **(b)** 3.33% **(c)** \$0.75 **(d)** 5

Question 2

(a) Most candidates were able to expand the brackets and simplify, showing all the terms. A few missed out either the x terms or the x^2 terms and thus lost the marks in this “show that” question.

(b) There were a variety of methods seen, although few used the sketch of the graph not touching the x-axis, which was the easiest approach and the easiest result to explain.

The most popular method was to try to solve the equation and come across a negative discriminant. A common error seen here was the square of –1 being –1. Many candidates obtained a negative discriminant but failed to explain why this led to the equation not having any solutions. A few candidates did only look at the discriminant and these candidates were more likely to give an explanation.

Completion of the square was rarely seen when $(x-\frac{1}{2})^2$ could have been quickly seen to be negative.

Weaker candidates tried to explain by somehow contriving to factorise and some stated that there were no solutions because the expression did not factorise.

(c) (i) and **(ii).** involving substitution of numbers into a function. were very well done.

(iii) This was an inverse of a linear function which caused the weaker candidates some difficulty. Most candidates used the change of subject approach and nearly always swapped the x and y at some stage. However there were sign slips in the working or the more serious error of giving the reciprocal function.

(iv) The straightforward method of $x = \mathrm{f}(3)$ being equivalent to the question was often missed and some who did see this method slipped up with $3^3 = 9$. Many found $\mathrm{f}^{-1}(3)$.

It was disappointing to see the absence of $y = \mathrm{f}(x)$ being equivalent to $x = \mathrm{f}^{-1}(y)$, the most fundamental way of looking at what an inverse function is.

Answers: **(c)(i)** 9 **(ii)** 0 **(iii)** $\sqrt[3]{x-1}$ **(iv)** 28

Question 3

(a) The three lists of the elements of the sets were usually correct, although set *A* occasionally included elements which were not in the universal set.

(b) Most candidates were able to put the numbers into the correct parts of the Venn diagram. The element not in any of the three sets was often overlooked, in spite of the question stating that there were 12 elements. A few candidates put the same element in more than one region.

(c) There were problems seen through a lack of knowledge of set notation and these five statements were frequently incorrect.

Answers: **(a)** {3, 6, 9, 12}, {1, 2, 3, 5, 6, 10}, {6, 7, 8, 9, 10, 11}
(c) (i) {3, 6} **(ii)** {3, 6, 7, 8, 9, 10, 11, 12} **(iii)** {3, 6, 10} **(iv)** {4, 7, 8, 9, 11, 12} **(v)** 11

Question 4

(a) This question was set to be done on a graphics calculator. 3 marks were available and so if candidates did show some correct mid-values they earned a mark and if they showed use of $\Sigma fx \div \Sigma f$ then another mark was available. However careful inputting of data should lead to a correct answer directly from the calculator. To err on the side of caution candidates may be advised to write down the value of Σfx, just in case of miscopying the answer. The question asked for an answer correct to the nearest gram and so answers such as 1005.25 scored 2 out of the 3 marks.

Quite a number of candidates found the mean of the six mid-values, completely ignoring the frequencies.

(b) **(i)** This was often well done but a frequent error was in dividing the class width by the frequency, leading to very small values in relation to the grid. There were a few other errors which gave answers above 10 and would therefore not fit the given grid.

(ii) This saw some excellent histograms from very well prepared candidates. The most common error seen was the use of 6 equal interval widths.

Answers: **(a)** 1005 **(b)(i)** 0.4, 1, 10, 4, 0.8, 0.4

Question 5

There were many excellent responses to this question but also in some cases candidates appeared to be unfamiliar with this topic.

(a) The sketch of the graph was generally good with some improvement on last year. Most candidates were able to sketch the correct shape in the correct place. This suggests a good understanding of how to set the calculator up for a sketch. However, this part was often the only part where marks were achieved and candidates were much less able to obtain information from their calculator.

(b) The question asked for equations and yet $<, >, \le, \ge, \ne$ were often seen. Many candidates omitted this part.

(c) This was more successful and often the only other marks in addition to part **(a)**. There were a number of candidates who wrote down a calculator value which was extremely close to 1 or to – 0.25, for example – 0.249999..., without realising that these two values would be exact.

(d) There were very few correct answers here and little connection seen between this part and parts **(b)** and **(c)**. There was sometimes confusion between domain and range.

(e) This was expected to be an easier part compared to part **(d)** but it appeared that very few candidates added $y = 0.5$ to their screen.

In part **(ii)** many candidates appeared to lack knowledge on the absolute value function.

Answers: **(b)** $x = -1, x = 3, y = 0$ **(c)** (1, – 0.25) **(d)** $x \in R, x \neq -1, x \neq 3$ and $y \leq -0.25, y > 0$
(e)(i) 2, **(ii)** 4

Question 6

(a) This proved to be straightforward proportion question which was well answered by most candidates.

(b) Part **(i)** proved that conversion of units frequently leads to errors. Many candidates lost a factor of 10 and several multiplied by both 3600 and 1000 and did not notice how unrealistic their answer was. Another error was to only divide by 60.

Part **(ii)** was allowed a follow through.

Answers: **(a)** 250 km **(b)(i)** 20 m/s **(ii)** 0.225 s

Question 7

(a) This was usually correct although $\frac{5}{x}$ was occasionally seen.

(b) Errors such as $\frac{4}{x+13}$ and $\frac{x}{4}+13$ were seen.

Part **(ii)** used the answers to parts **(a)** and **(b)(i).** Most candidates who had a correct equation were able to solve it correctly.

(c) There were many correct answers but a frequently seen error was (4 + 5) ÷ 2 = 4.5.

Answers: **(a)** $\frac{x}{5}$ **(b)(i)** $\frac{x+13}{4}$ **(ii)** $\frac{x}{5}+\frac{x+13}{4}=46$ **(iii)** 95 **(c)** $4.41

Question 8

(a) This was usually correct but a few candidates chose “None”

(b) Most candidates appeared to do both parts manually rather than use their statistics facilities on their calculators. However, the mean and quartiles from such a list were not too time consuming.

(c) A large number of candidates omitted this part. Of those who answered, there were many correct regression equations, but incorrect rounding of 1.19 and 1.49 was quite frequent.

Answers: **(a)** Positive **(b)(i)** 9.6 mm **(ii)** 11 mm **(c)** $1.20r + 1.50$

Question 9

This question allowed for the full range of ability, with part **(d)** proving the most challenging. Many candidates scored full marks in parts **(a), (b)** and **(c)**.

It was here where the use of radians was seen quite frequently and it must be emphasised that candidates should always check that they are in degree mode.

(a) This was generally well done and the instruction to use the sine rule removed any decision making for the candidate.

(b) A good outcome was seen here as well since there was again an instruction to use the cosine rule. There were, however, a number of candidates who partially ignored the instruction about which triangle to use and others who used the sine rule in the wrong triangle.

(c) The majority of candidates used $\frac{1}{2}ab\sin C$ correctly in two triangles but a few used $\frac{1}{2}$ base × height as though the two triangles were right-angled.

(d) This was a much more challenging part, requiring two general triangle calculations and deciding which triangles could be used. There were some excellent solutions from the stronger candidates and the presentation of their working was exemplary.

A large number of candidates realised that triangle *KAT* or triangle *DAT* was to be used to find *AT* but they could not see how to find the angle to allow them to use the cosine rule. Candidates then made an incorrect assumption that there was a pair of parallel sides in the quadrilateral.

This part was omitted by a large number of candidates.

(e) Most candidates were able to carry out this scale calculation, although there were errors in the number of centimetres in 1 kilometre, often seen as 1 000 000.

Answers: **(a)** 1190 km **(b)** 1200 km **(c)** 569 000 km^2 **(d)** 1490 or 1500 km
(e) 28.2 cm

Question 10

(a) The simple answer of prism was not given by a surprising number of candidates and trapezoid or trapezium were very common errors.

(b) **Part (i)** was generally well done although the two parallel sides were often seen in the expression $\frac{1}{2}(3\times 7)\times 1.5$ quite frequently. Some candidates split the area up into a rectangle and two triangles but took the base of each triangle as 1 cm instead of 0.5 cm.

Part (ii) was usually a correct follow through from **(i)**, although some candidates treated part **(i)** as a volume and only multiplied by the density, overlooking the length.

Part **(iii)** proved to be a good discriminator, since candidates had to realise that the lengths of the sloping edges of the trapezium were needed and Pythagoras was the method for finding these. There were many fully correct solutions.

Errors made included the omission of one or more of the areas, the right-angled triangle having lengths of 1.5 cm and 1 cm, the assumption that the angles in the triangles were 45° and using the length of *BC* as 1.6 cm.

(c) This part was well done with many fully correct answers or follow through answers. Almost all candidates realised that their answer to the division had to be rounded down.

Answers: **(a)** Prism **(b)(i)** 5.25 cm **(ii)** 811 g **(iii)** 91.8 cm^2 **(c)** 24

Question 11

(a) This proved very easy start to the probability question, simply involving a subtraction from 1. Almost all candidates achieved this mark.

(b) Most candidates drew a correct tree diagram, in part **(i)**, with correct probabilities clearly shown. A few left their diagram as ambiguous because of the absence of labels.

There were many correct answers to part **(ii)** but some candidates only gave one of the two products and a few weaker candidates gave $\frac{7}{8} \times \frac{1}{4}$.

Part **(iii)** was found to be more challenging with candidates finding a correct probability for one day; but then for five days, they either multiplied or divided by 5. Multiplying by 5 gave an answer greater than 1 but this did not seem to worry the candidates. Some of those who actually did $\left(\frac{11}{48}\right)^5$ changed the fraction to a decimal and lost the accuracy mark through approximating prematurely.

There was much more success in part **(iv)**, although quite a number of candidates had little idea of expected values.

Answers: **(a)** $\frac{1}{6}$ **(b)(ii)** $\frac{37}{48}$ **(iii)** 0.00063 **(c)** 148

Question 12

(a) Most candidates found the next term correctly from a reasonably easily seen pattern. However, the *n*th term proved to be much more difficult and weaker candidates either omitted this part or attempted a quadratic. The stronger candidates realised that there was a power of 2 involved.

(b) As in part **(a)**, the majority of candidates found the next numerical term. The *n*th term for this sequence was a little more accessible via the difference method. A large number of candidates did successfully use the difference method and found *a*, *b* and *c* in the expression $ax^2 + bx + c$. Some of the other candidates were a little more intuitive and spotted the products of two terms which were 2 apart.

Answers: **(a)** 192, 3×2^n **(b)** 24, $n^2 - 2n$

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/05

Paper 5 (Core)

General comments

This examination paper presented candidates with an investigation which relied on being able to work out remainders. Examples were given on the question paper as to how these could be found and practically all candidates showed they were able to follow this method.

Most enjoyed success in the first four questions and it was pleasing to note that they heeded the instruction to provide full reasons. Nearly all candidates were thus awarded a mark for communication, an improvement over last year.

Candidates can be complimented on their ability to recognise and extend patterns. However the later questions were more abstract in content and with these candidates had difficulty. A key component of any investigation will be the ability to generalise and there is a need for candidates to improve their skills in this respect.

The provision of answer spaces on the question paper provided a clearer structure for Examiners to mark and for candidates to follow.

Comments on specific questions

Question 1

This question was designed to give a lead-in to finding remainders. Most, but not all, candidates were able to use the power button on the calculator correctly and it was pleasing to note the care that was taken in explaining how the remainders were found. Credit for communication was awarded here.

Answers: **(a)** 3 **(b)** 7 **(c)** 4 **(d)** 2

Question 2

This question is where candidates could find the pattern on which the investigation was based.

The vast majority tackled this successfully. There was no penalty for those who also filled in the shaded boxes on the question paper. Those candidates may have been troubled however by the answers not fitting the pattern. The question also introduced, in the last row, the continuation of the pattern. Some candidates however left this row blank.

Answer:

Prime	Division	Remainder	Division	Remainder	Division	Remainder
3	$2^2 \div 3$	1				
5	$2^4 \div 5$	1	$3^4 \div 5$	1	$4^4 \div 5$	1
7	$2^6 \div 7$	1	$3^6 \div 7$	1	$4^6 \div 7$	1
11	$2^{10} \div 11$	1	$3^{10} \div 11$	1	$4^{10} \div 11$	1
13	$2^{12} \div 13$	1	$3^{12} \div 13$	1	$4^{12} \div 13$	1

Question 3

This question tested whether candidates had spotted the pattern they had produced in the table. It also introduced numbers where, particularly in part **(a)**, the calculator did not offer a good method of finding the remainder. Candidates were usually very successful in extrapolating from the pattern in the table to find their answers.

Answers: **(a)** 13 1
(b) 17 1

Question 4

(a) This question led candidates through some sophisticated mathematical thinking in order to determine a prime factor of $7^{12} - 1$. It was encouraging to see that most candidates were able to provide the correct answers here by following the pattern of the worked example provided in the question.

Answer: $7^{12} \div 13$ (has a remainder of 1)
$7^{12} - 1$ (will divide by) 13

(b) Here candidates were being tested on whether they had spotted the method of writing down a prime factor. Hence the command "Write down" was given in bold. In spite of this many chose to repeat the method used in part **(a)**. The command "Write down" will always indicate an answer that can and should be found immediately, without any working.

Answer: 17

Question 5

The intention of this question was to see if candidates could generalise a result and express it in algebraic terms. This turned out to be to be quite challenging for some but is an important step to make in many investigations. Several candidates wrote $p - 1 + 1$ indicating the need to increase the power by 1. This gained full credit.

Answer: p

Question 6

This proved to be the most difficult question on the paper and frequently no attempt was made at this question. Of those who did, most took $p = 25$ and several others were clearly unsure about the meaning of $p > 25$. Many did not remember that p had to be prime. Examiners gave part credit to those who at least attempted to work with a prime number larger than 25.

Answer: For example: $3^{28} - 1$ has prime factor of 29

Question 7

While also seen as a difficult question, candidates were more successful here than in **Question 5** or **6**. The fact that the numerical pattern, rather than the more abstract algebraic one, was being tested may have had something to do with it. It was possible to gain credit here without using Fermat's Little Theorem but by simply trying out all the prime numbers of which 23 is in fact the smallest (after 3) that is a factor.

Answer: 23

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/06

Paper 6 (Extended)

General comments

This examination paper presented candidates with an investigation task and a modelling task, carrying equal marks. It was thus expected that candidates would spend an equal amount of time on each task.

The provision of answer spaces on the question paper provided a clear structure for Examiners to mark and for candidates to follow.

Overall the performance of candidates was strong and they appear to have been well-prepared for such tasks by the Centres.

Comments on specific questions

Part A Investigation

The investigation relied on candidates being able to work out remainders. Examples were given on the question paper as to how these could be found and practically all candidates showed they were able to follow this method. Candidates can be complimented on their ability to recognise and extend patterns. The later questions were more abstract in content and with these candidates had more difficulty.

Question 1

This question was designed to give a lead-in to finding remainders. Nearly all candidates were able to use the power button on the calculator correctly and it was pleasing to note the care that was taken in explaining how the remainders were found so that a communication mark could be gained.

Answers: **(a)** 2 **(b)** 8

Question 2

This question is where candidates could find the pattern on which the investigation was based.

The vast majority tackled this successfully. There was no penalty for those who also filled in the shaded boxes on the question paper. However those candidates may have been troubled by the answers not fitting the pattern. The question also introduced, in the last row, the continuation of the pattern. Some candidates however left this row blank.

Answer:

Prime	Division	Remainder	Division	Remainder	Division	Remainder
3	$2^3 \div 3$	2				
5	$2^5 \div 5$	2	$3^5 \div 5$	3	$4^5 \div 5$	4
7	$2^7 \div 7$	2	$3^7 \div 7$	3	$4^7 \div 7$	4
11	$2^{11} \div 11$	2	$3^{11} \div 11$	3	$4^{11} \div 11$	4

Question 3

This question tested whether candidates had spotted the pattern they had produced in the table. It also introduced numbers where the calculator did not offer a suitable method of finding the remainder. Candidates were usually very successful in extrapolating from the pattern in the table to find their answers.

Answers: **(a)** 11 7
(b) 17 8

Question 4

(a) Here candidates were led through some sophisticated mathematical thinking in order to determine a prime factor of $5^{12} - 1$. It was encouraging to see that most candidates were able to provide the correct answers here by following the format of the worked example provided in the question.

Answer: $5^{13} \div 13$ (has a remainder of 5)
($5^{13} - 5$ has a prime factor of) 13
$5(5^{12} - 1)$ 13

(b) In this part candidates had to spot the method of writing down a prime factor. Hence the command "Write down" was given in bold. In spite of this, many chose to repeat the method used in part **(a).** The command "Write down" will always indicate an answer that can and should be found immediately, without any working being shown.

Answer: 17

Question 5

The intention of this question was to see if candidates could generalise a result and express it in algebraic terms. This proved to be quite challenging for some but is an important step in many investigations. Several candidates wrote $p - 1 + 1$ indicating the need to increase the power by 1. This gained full credit.

Answer: p

Question 6

This turned out to be the most difficult question on the paper. A major failing was in writing an expression in which p was a multiple, rather than a factor of a. Many did not remember that p is a prime number in Fermat's Theorem.

Answer: For example: $p = 3$ and $a = 6$ gives $6^2 - 1 = 35$ which does not have a factor of 3

Question 7

It was very pleasing to note that, in spite of the difficulty of this question, many were able to manipulate the indices correctly and so provide some prime factors. The question was deliberately phrased in a more open-ended way though in fact only three further prime factors can be found using this method.

The most common error was to use $7^{24} = (7^4)^{7-1}$ and conclude incorrectly that 7 is factor of $7^{24} - 1$.

Answers: 3, 5 and 13

Part B Modelling

The modelling question required the ability to calculate speeds in the first four questions. There were a significant number of candidates who were unable to do so. These candidates could, in the later questions, apply the given model. Candidates should though be aware that using a model given later is not a substitute for developing the model itself and some candidates lost marks by pre-empting the result.

Overall the marks in the modelling proved a little harder to gain than those in the investigation and it was noticeable that some candidates did not make effective use of their graphics calculators in providing the graphs and solving equations graphically.

There is also a need for candidates to be more comfortable in generalising an arithmetic procedure algebraically and so develop a model.

Question 1

(a) While intended as an easy start, checking that candidates knew how to find the **total** distance, it was surprising to see the many candidates who wrote 10.

Answer: 20

(b) Those who wrote 10 in part **(a)** usually corrected themselves here and this question was tackled successfully by nearly all candidates. No credit was given to those candidates who applied the model which was given later.

Answer: $\frac{20}{1\frac{1}{2}}$ = 13.3

Question 2

As in **Question 1(b)** no credit was given for using the model in this "show that" question.

This question allowed candidates to check that their method of approach yielded the correct answer.

Answer: $\frac{10+5}{1\frac{1}{4}}$ = 12

Question 3

This question allowed a final numerical calculation before generalising to produce a model in **Question 4**.

Candidates successful in **Question 2** usually had no difficulty with this question, which most candidates answered correctly. Most candidates gained credit for communication here in showing clearly how they reached their result.

Some candidates correctly averaged out the speed in 12-minute intervals. This uncommon method had the advantage that it did lead more quickly to the given model in **Question 4**.

Answer: 11.7 km/h

Question 4

(a) In this question candidates had to generalise the arithmetic they had used in the previous three questions.

This was thus a more challenging question and only the more able candidates were successful. Some were distracted by part **(b)** and became confused between hours and minutes in their expressions.

Answer: S = $\frac{10+20\times\frac{x}{60}}{1+\frac{x}{60}}$ or equivalent from their working

(b) Only candidates with a correct answer in part **(a)** could gain credit here.

Answer: Multiply the top and bottom of the fraction in part **(a)** by 60.

Question 5

This was the first question on applying a given model and understanding the context and variables used.

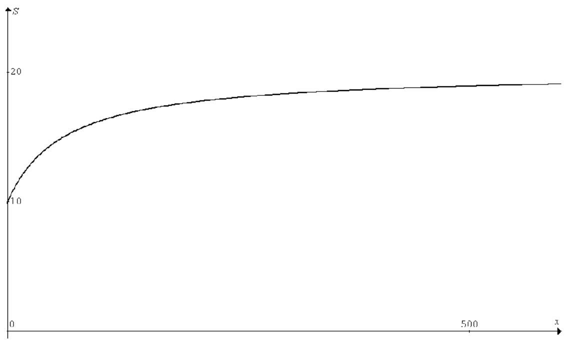
It was pleasing to see most candidates gaining credit here for communicating the method of substitution to obtain the result.

Answer: 11.8 km/h

Question 6

This question required use of the graphics calculator. The word "sketch" indicated that an exact plot was not required and that candidates should therefore copy their diagram from their calculators. Examiners were looking for a smooth graph which started at 10 on the vertical axis and flattened out. (The asymptote itself did not have to be stated or drawn.) Several candidates calculated several points and then joined them up: this was done with varying degrees of success. Some candidates drew graphs which implied a steady increase. Taking graphs from the graphics calculator to help understand the behaviour of a model is an important skill in many modelling exercises.

Answer:



Question 7

The intention here was to allow candidates to use their graphics calculator to find a solution. Credit for communication could be gained by indicating the intersection of the graph of the curve and a horizontal line. A popular method was to solve an equation algebraically for which credit for communication could also be given.

Answer: 26 minutes

Question 8

(a) Many candidates were successful here and realised the answer could be written down by replacing the 20 in the model by *y*.

Answer: $S = \dfrac{600 + yx}{60 + x}$

(b) A further credit for communication was possible for those who explained how the answer was arrived at, in practically all cases by solving an equation algebraically.

Answer: 3

(c) This question tested interpretation of the context of the model. Many did not understand that if Sam stops during Stage 2 then *y* = 0 or confused the overall average speed *S* with the speed at any instant. Several tried unsuccessfully to form a graph without consideration of the model.

Answer: