INTERNATIONAL MATHEMATICS

Paper 0607/11
Paper 11 (Core)

Key Messages

To succeed in this paper, candidates need to have completed the full Core syllabus, be able to apply formulae, show clearly all necessary working and check their answers for sense and accuracy. Candidates are reminded of the need to read the question carefully, focussing on key words.

General comments

Workings are vital in two-step problems, in particular with algebra and others with little scaffolding such as **Questions 13** and **14**. Showing workings enables candidates to access method marks in case their final answer is wrong. Often the workings were in disjointed parts, scattered over the available space without much thought to logic. Candidates must make sure that they do not make numerical errors especially in questions that are only worth one mark when any good work will not get the mark if the answer is inaccurate. Candidates must take note of the form that is required for answers, for example, in **Question 3(b)**.

The questions that presented least difficulty were **Questions 1**, **3**, **5**, **12(a)** and most parts of **11**. Those that proved to be the most challenging were **Question 4,** on discrete and continuous data, **Question 7**, the equations of asymptotes, **Question 9**, the equation of a line of symmetry and **Question 10**, drawing tangents to a circle. There were few questions omitted as, in general, candidates attempted the vast majority of questions rather than leaving many blank. Those that were occasionally left blank were **Questions 7, 9** and **11(d)**.

Comments on specific questions

Question 1

Candidates did well with this opening question. This was not so much about the order of operations but more about testing arithmetic skills.

Answer: 25

Question 2

In part **(a)**, a few candidates gave the area instead of the required perimeter even though part **(b)** was clearly about area. Some candidates gave the answer as 8, the number of lines on the shape or 3 x 3 x 2 = 18. For part **(b)**, very many of the candidates' diagrams fulfilled the conditions but a few were rotations of shape *A*. Some got the method mark if they showed the area of shape *A*. The vast majority used whole squares but a few used half squares which gained credit. However, this is not good practice; if there is a grid provided it is sensible to unitise the gridlines and keep the shape contained within the given grid. A grid will always be large enough for a correct answer to be shown.

Answers: **(a)** 16

Question 3

Incorrect answers to part **(a)** included –6 or 8. Some candidates found the single fraction in part **(b)** correctly but did not give it in the lowest terms so only gained one out of the two marks.

Answers: **(a)** –8 **(b)** $\frac{3}{5}$

Question 4

The part asking for discrete data was most likely to elicit the incorrect response, **D** (which plant the grapes came from) and was the most challenging question on the paper. Part **(b)** was handled better with **A** and **B** sometimes incorrectly chosen as the continuous data. All candidates chose answers to this question - with a multiple choice question, there is no excuse for leaving the answer line blank.

Answers: **(a) B** **(b) C**

Question 5

For part **(a)**, 6:00 was not an acceptable answer as that is an actual time not a time period as asked for in the question. There was a follow through mark available for the result of the distance divided by their answer to part **(a)**.

Answers: **(a)** 6 **(b)** 7

Question 6

Another multiple choice question which no candidate left blank. The wrong values that were picked most often were $\frac{2}{9}$ or 7. A few candidates tried to evaluate $\sqrt{7}$ as 2 point something but that did not score the mark.

Answer: $\sqrt{7}$

Question 7

This question was not done well by candidates and had one of the highest omission rates. The question did demand a lot from candidates as they had to understand the function drawn, understand asymptotes, find where they were and finally write these as equations. A mark was available for those candidates that indicated where the asymptotes would be on the graph, implied by 1 and –2. Many candidates used 1.5 and –3 (where the lines cut the axes) in their answers.

Answer: $x = 1$ and $y = -2$

Question 8

This question was generally well understood with most candidates scoring at least 2 out of the 4 marks. Candidates were slightly more successful with part **(b)** than part **(a)** which might be because there was a method mark for finding the angle of the required sector where as the method mark for part **(a)** was for the full method. A few candidates gave $\frac{1}{3}$ and $\frac{1}{4}$ as their answers which were the correct fractions of a circle but did not go on to connect these with the context, the total cost of the holiday.

Answers: **(a)** 240 **(b)** 180

Question 9

This was one of the more challenging questions on the paper with some candidates drawing the line of symmetry but, as this was a one mark question, candidates had to go on to give the equation of the line to get the mark. Others were distracted by the domain and gave their answer as the range or a variation of it. Some copied the function in the question as their answer.

Answer: $x = 2$

Question 10

Some candidates only drew one tangent, or two inaccurate tangents. Some drew a line from *P* straight across the circle and then a tangent where the line cut the circumference.

Question 11

The success rate varied throughout this question from only about half the number of candidates having parts **(a)(iii)** and **(d)** correct up to part **(c)**, the best answered question on the whole paper. Most parts should have been familiar to candidates but part **(a)(iii)** was slightly more unusual as candidates had to deal with algebraic fractions. Finally with part **(d)**, it could be seen that candidates find dealing with inequalities one of the more challenging aspect of algebra.

Answers: **(a) (i)** $5x - 17$ **(ii)** $8d^2$ **(iii)** $\frac{x}{6}$ **(b)** $2a(3b - 4a)$ **(c)** 7 **(d)** $x < 5.5$

Question 12

Generally, candidates could plot the four points within acceptable tolerance. A majority knew the scatter graph showed negative correlation but positive, moderate, weak and decrease were seen as answers. Some tried to describe the connection between the age and value of the cars. All that is needed to describe correlation is the word positive, negative or no correlation. For part **(c)**, candidates had to plot the mean point and then make sure their line of best fit went through that point.

Answers: **(b)** Negative

Question 13

This question and the one following, did not have scaffolding that led candidates through the calculation and that made the questions more challenging. The question stated that this was a pyramid and asked for the volume, so there was no excuse for candidates to choose the wrong formula from those on page 2 of the paper even if they got no further.

Answer: 100

Question 14

This question was also challenging, as befitting its place in the paper. The question used Pythagoras' Theorem but did not show a right-angled triangle. A few candidates who drew in the diagonal subtracted the squares of the sides instead of adding or made numerical errors. Some did not work out the square root and left their answer as $\sqrt{100}$. Some gave 14 (half perimeter) or 28 as their answer.

Answer: 10

INTERNATIONAL MATHEMATICS

Paper 0607/12
Paper 12 (Core)

Key Messages

To succeed in this paper, candidates need to have completed the full Core syllabus, be able to apply formulae, show clearly all necessary working and check their answers for sense and accuracy. Candidates are reminded of the need to read the question carefully, focussing on key words.

General comments

Workings are vital in two-step problems, in particular with algebra and others with little scaffolding such as **Questions 13** and **14**. Showing workings enables candidates to access method marks in case their final answer is wrong. Often the workings were in disjointed parts, scattered over the available space without much thought to logic. Candidates must make sure that they do not make numerical errors especially in questions that are only worth one mark when any good work will not get the mark if the answer is inaccurate. Candidates must take note of the form that is required for answers, for example, in **Question 3(b)**.

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Answer: 25

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In part **(a)**, a few candidates gave the area instead of the required perimeter even though part **(b)** was clearly about area. Some candidates gave the answer as 8, the number of lines on the shape or 3 x 3 x 2 = 18. For part **(b)**, very many of the candidates' diagrams fulfilled the conditions but a few were rotations of shape *A*. Some got the method mark if they showed the area of shape *A*. The vast majority used whole squares but a few used half squares which gained credit. However, this is not good practice; if there is a grid provided it is sensible to unitise the gridlines and keep the shape contained within the given grid. A grid will always be large enough for a correct answer to be shown.

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Incorrect answers to part **(a)** included –6 or 8. Some candidates found the single fraction in part **(b)** correctly but did not give it in the lowest terms so only gained one out of the two marks.

Answers: **(a)** –8 **(b)** $\frac{3}{5}$

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Answers: **(a) B** **(b) C**

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Another multiple choice question which no candidate left blank. The wrong values that were picked most often were $\frac{2}{9}$ or 7. A few candidates tried to evaluate $\sqrt{7}$ as 2 point something but that did not score the mark.

Answer: $\sqrt{7}$

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Answer: $x = 1$ and $y = –2$

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Answer: 10

INTERNATIONAL MATHEMATICS

Paper 0607/13
Paper 13 (Core)

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Answer: 100

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This question was also challenging, as befitting its place in the paper. The question used Pythagoras' Theorem but did not show a right-angled triangle. A few candidates who drew in the diagonal subtracted the squares of the sides instead of adding or made numerical errors. Some did not work out the square root and left their answer as $\sqrt{100}$. Some gave 14 (half perimeter) or 28 as their answer.

Answer: 10

INTERNATIONAL MATHEMATICS

Paper 0607/21
Paper 21 (Extended)

Key message

Candidates need to show all of their working. Incorrect answers without working cannot be given credit, whereas partial credit can be awarded if a correct method is shown.

Candidates must be aware of mathematics in everyday life. e.g. know the number of seconds in an hour.

Candidates must know that for an answer to be in standard form, the 'number digits' must be between 1 and 10.

General comments

Candidates were reasonably well prepared for the paper and demonstrated very good algebraic skills.

Many candidates lost marks through careless numerical slips, particularly with negative numbers and simple arithmetic operations.

Candidates should make all of their working clear and not merely write a collection of numbers scattered over the page.

Candidates should always leave their answers in their simplest form. Many candidates lost marks through incorrect simplification of a correct answer.

Comments on specific questions

Question 1

Nearly all candidates answered this question correctly. Some candidates simply subtracted the numerator and the denominator.

Answer: $\frac{1}{4}$

Question 2

This question showed a lack of knowledge of basic facts concerning everyday maths. Many candidates converted time using 360 seconds in an hour. A significant number of candidates who were successful in the time conversion were unable to use the correct distance conversion.

Answer: 43.2

Question 3

(a) Nearly all candidates answered this part correctly.

(b) This part proved to be demanding. Many candidates started the question correctly but did not convert their final answer into standard form.

Answer: **(a)** 4.8×10^{-5} **(b)** 1.2×10^{16}

Question 4

This question proved to be too demanding for all but the best of candidates. Many candidates were unable to relate 17 to the 5% and proceeded to reduce $17 by 5%.

Answer: 340

Question 5

Although there were many correct answers, a significant number of candidates simplified the question correctly to give $5\sqrt{3} - 3\sqrt{3}$, but were then unable to complete the question.

Answer: $2\sqrt{3}$

Question 6

(a) This part was well answered.

(b) This part also was well answered. The common mistake occurred when candidates initially divided by *a*, but did not divide the '*u*' term.

Answer: **(a)** 2 **(b)** $\frac{v-u}{t}$

Question 7

There were many correct answers to this question. There were, however, a significant number of careless numerical mistakes following a correct squaring of the two values.

Answer: 8

Question 8

Many candidates struggled with the vertical scale of the diagram.

(a) There were many correct answers.

(b) Nearly all candidates scored at least one mark for this part by drawing a vertical line at 20. However, an answer of 38 was seen as frequently as the correct answer.

Answer: **(a)** 13 **(b)** 36

Question 9

(a) This part was well answered. The most common incorrect answer being 0.08.

(b) There were many correct responses, but a significant number of candidates gave their final answer as $\frac{1}{\left(\frac{1}{2}\right)}$.

(c) This part proved to be more challenging. The most common problem was candidates who worked out 64^2 first and were then unable to find the cube root.

(d) This part was poorly answered. Although candidates are well versed on log rules, it is clear that changing numbers in different bases is not understood to the same level.

Answer: **(a)** 0.008 **(b)** 2 **(c)** 16 **(d)** $\frac{1}{2}$

Question 10

The majority of candidates gained at least one mark, but many candidates did not realise that *ABCD* was a cyclic quadrilateral.

Answer: $x = 50$, $y = 130$

Question 11

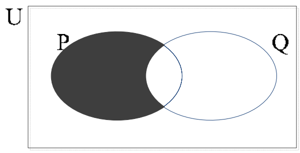
Although some candidates scored full marks, many candidates did not realise that *p* was the gradient of the line.

Answer: $p = \frac{1}{2}$, $q = 2$

Question 12

Both parts of this question were well answered by the majority of candidates.

Answer: **(a)** 4 **(b)**



Question 13

The majority of candidates were able to score some marks although full marks were in the minority. Candidates realised that the question needed both gradient and gradient of a perpendicular line but solutions often had careless use of 'minus' signs.

Answer: $y = -\frac{4}{3}x + 7$

Question 14

Both parts of this question were well answered by the majority of candidates.

Answer: **(a)** $y = \frac{9}{\sqrt{x}}$ **(b)** 1

Question 15

This question proved to be challenging for the majority of candidates, as they were unable to relate the given information to find the amplitude and the period of the function.

Answer: $a = 3$, $b = 2$

INTERNATIONAL MATHEMATICS

Paper 0607/22

Paper 22 (Extended)

Key message

Candidates need to show all of their working. Incorrect answers without working cannot be given credit, whereas partial credit can be awarded if a correct method is shown.

Candidates must know that for an answer to be in standard form, the 'number digits' must be between 1 and 10.

General comments

Candidates were reasonably well prepared for the paper and demonstrated very good algebraic skills.

Many candidates lost marks through careless numerical slips, particularly with negative numbers and simple arithmetic operations.

Candidates should make all of their working clear and not merely write a collection of numbers scattered over the page.

Candidates should always leave their answers in their simplest form.

Comments on specific questions

Question 1

(a) Nearly all candidates answered this part correctly.

(b) Although many candidates had an answer that was equivalent to the correct answer, their final answer was not given in standard form.

Answer: **(a)** 20 **(b)** 1.6×10^{-6}

Question 2

(a) Although there were many correct solutions to this part, a significant number of candidates made careless mistakes with the resulting loss of marks. In addition a number of candidates, on their initial expansion, obtained a quadratic equation.

(b) Many candidates were able to obtain 3.5 as an answer, but then, incorrectly, assumed that the 'other' answer was –3.5. This shows a lack of understanding of the modulus function.

Answer: **(a)** 1.25 **(b)** –2, 3.5

Question 3

There were many excellent solutions to this question. Some candidates incorrectly interpreted the question as y varying as the square of x.

Answer: 50

Question 4

(a) The majority of candidates gave a correct answer here. The common error was to add $\frac{1}{6}$ to $\frac{1}{6}$.

(b) Nearly all candidates answered this part correctly.

(c) Although there were many correct answers to this part, there was a similar proportion of candidates whose final answer was $\frac{3}{36}$. This was due to candidates listing the possible outcomes and not including both 3, 4 and 4, 3 etc.

Answer: **(a)** $\frac{1}{36}$ **(b)** 0 **(c)** $\frac{6}{36}$

Question 5

(a) The majority of candidates answered this part correctly, although there were some careless arithmetic mistakes seen.

(b) Candidates who understood the notation normally went on to score full marks, but some weaker candidates were unaware of the notation. Again, careless mistakes spoilt an otherwise correct solution.

Answer: **(a)** $\begin{pmatrix} -1 \\ -3 \end{pmatrix}$ **(b)** 13

Question 6

(a) This part was well answered. The most common mistake was the inability to take out a 'negative' factor.

(b) This part also was well answered. This demonstrated that candidates had a good understanding of quadratics.

Answer: **(a)** $(4x+y)(2a-b)$ **(b)** $(3x+4)(x-3)$

Question 7

(a) Virtually all candidates scored this mark.

(b) There were many correct answers to this part. The common mistake was candidates omitting to simplify their answer, and leaving their final answer as $\frac{1}{5^2}$.

Answer: **(a)** 1 **(b)** $\frac{1}{25}$

Question 8

The first part of this question proved to be the most challenging, with candidates who did not realise that there was a cyclic quadrilateral. The marks for all subsequent parts could be gained as 'follow through' marks and all of these parts were successful for the majority of candidates.

Answer: **(a)** 72 **(b)** 144 **(c)** 18 **(d)** 18

Question 9

(a) Virtually all candidates realised that this part was testing Pythagoras' Theorem. However, identifying the hypotenuse proved to be challenging. Candidates who made a small sketch, in general, were successful. Some candidates having set up a correct equation made subsequent careless numerical slips and some candidates gave their final answer as $\sqrt{16}$.

(b) Candidates who knew their trigonometrical ratios, in general, gave correct responses, but a significant number of candidates gave their final answer as $\sin^{-1} 0.5$.

Answer: **(a)** 4 **(b)** 30

Question 10

This question was too demanding for many candidates. It was clear that the majority of candidates were unaware of the significance of the vertex of a quadratic graph.

Answer: $h = 2$, $k = -3$

Question 11

Although many candidates scored full marks, many candidates did not calculate the frequency densities with the subsequent resulting loss of marks.

INTERNATIONAL MATHEMATICS

Paper 0607/23
Paper 23 (Extended)

Key message

Candidates need to show all of their working. Incorrect answers without working cannot be given credit, whereas partial credit can be awarded if a correct method is shown.

Candidates must be aware of mathematics in everyday life. e.g. In **Question 8**, the distance between two places is not going to be in excess of 10 million kilometres.

Candidates need to have a better understanding of logs, not simply be able to apply the rules.

General comments

Candidates were reasonably well prepared for the paper and demonstrated very good algebraic skills.

Many candidates lost marks through careless numerical slips, particularly with negative numbers and simple arithmetic operations.

Candidates should make all of their working clear and not merely write a collection of numbers scattered over the page.

Candidates should always leave their answers in their simplest form. However, many candidates lost marks through incorrect simplification of a correct answer.

Comments on specific questions

Question 1

Nearly all candidates answered this question correctly.

Answer: 30

Question 2

Although there were many correct answers, this question showed a lack of understanding of the order of numerical operations by many candidates.

Answer: $5 - (2 + 3) \times 2 = -5$

Question 3

Nearly all candidates answered this question correctly. Where candidates were not awarded the marks, it was normally due to careless arithmetic slips.

Answer: $\begin{pmatrix} 1 \\ -12 \end{pmatrix}$

Question 4

The majority of candidates were successful, again any common mistakes were due to careless arithmetic.

Answer: $\frac{18}{25}$

Question 5

This question proved to be too demanding for all but the best candidates. Nearly all candidates realised that totals needed to be found but they were then unable to complete the question.

Answer: 1

Question 6

There were many correct solutions to this question. However, there were a surprising number of candidates who started the question correctly but left their final answer as $\sqrt{9}$.

Answer: 3

Question 7

There were many correct answers to this question. There were, however, a significant number of careless numerical mistakes following a correct elimination of one variable.

Answer: $u = 7$, $w = -2$

Question 8

This question showed the lack of basic understanding of mathematics in the real world. By far the most popular answer was 10500000 km.

Answer: 105

Question 9

This question proved to be challenging with the correct answer being in the minority.

Answer: – 3

Question 10

(a) Nearly all candidates answered this part correctly.

(b) This part was more demanding. Many candidates realised that the n^{th} term depended on –7, but they were unable to obtain a correct expression.

Answer: **(a)** – 8 **(b)** $-7n + 27$

Question 11

Although many candidates scored full marks, a number of candidates initially tried to square root each term.

Answer: $\sqrt{v^2 - 2as}$

Question 12

This question was well answered by the majority of candidates. The most common mistake was dealing with the negative common factor.

Answer: $(2a-b)(1+x)$

Question 13

Full marks were in the minority for this question. Many candidates simply re-wrote the question and gave their answers to **parts (a)** and **(b)** as $\frac{1}{3^3}$ and $\sqrt[4]{16^3}$ without any further simplification.

Answer: **(a)** $\frac{1}{27}$ **(b)** 8 **(c)** $\frac{\sqrt{3}}{2}$

Question 14

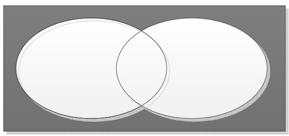
This question was too challenging for the majority of candidates. Candidates appeared to be unfamiliar with indices raised to another power. More work on indices would have benefitted candidates in both this question and in **Question 13**.

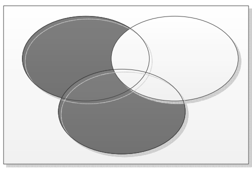
Answer: $2x^2$

Question 15

There were many correct answers to the first part, but less so to the demands of the second expression.

Answer:





Question 16

Candidates who drew a small sketch normally went on to complete the question correctly, although there were many instances of incorrect simplification of correct expressions.

Answer: $y = x - 2$

Question 17

The majority of candidates scored at least one mark by multiplying by a correct expression. Some candidates, however, tried multiplying throughout by $\sqrt{5}+2$.

Answer: $3(\sqrt{5}-2)$

Question 18

(a) This part was well answered.

(b) This part proved to be far more challenging for the majority of candidates, as they were unable to factorise the denominator. Being able to recognise the difference of two squares in an important aspect in factorisation.

Answer: **(a)** $y(3 - y)$ **(b)** $\frac{y}{3+y}$

Question 19

This question proved to be difficult for the majority of candidates, as they were unable to simplify the log expressions, or to have a clear understanding of bases.

Answer: **(a)** $\frac{2}{3}$ **(b)** 1.5

Question 20

Again, this question proved to be challenging for the majority of candidates. As the question was only worth 1 mark, candidates should have realised that there was simple method of solving the expression. Many candidates tried to find an inverse function and then to solve an equation, with very little success.

Answer: 5

INTERNATIONAL MATHEMATICS

Paper 0607/31
Paper 31 (Core)

Key messages

It is important that candidates have studied the full syllabus. Candidates should be reminded to show their working as many marks were lost because it was not written down. Marks were also lost when the candidates did not write their answers correct to 3 significant figures (unless otherwise specified in the question). The candidates must have a graphics calculator and know how to use it.

General Comments

Most candidates attempted all the questions so time was not an issue in this paper. It also appeared as if the questions were at the correct standard for the Core candidates.

If no specific accuracy is asked for in the question, candidates should give their answers exactly or to three significant figures. Giving answers to fewer significant figures will usually result in a loss of marks.

Candidates need to show all their working out. Often answers were given with no working out shown. When working out is shown, and is correct, then partial marks can be awarded if the final answer is incorrect.

Candidates should bring the correct equipment to the examination. Many appeared not to have a ruler with them to draw a straight line. It also appeared as if some candidates did not have a graphics calculator.

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Parts **(a)** and **(b)** were better attempted than part **(c)**.

(a) Most candidates managed to write down the correct factors of 18.

(b) (i) Nearly all candidates found the correct answer.

(ii) Most candidates managed to find the cube of 6.7 but some truncated the answer.

(iii) Although many candidates found the correct answer there were some who did not. The most common errors were to forget to use the fraction button or not to put brackets around the numbers in the numerator.

(c) (i) This part was generally well answered although some candidates did not round correctly.

(ii) Not all candidates knew what significant figures were.

(iii) Although there were many correct answers here, it appears that not all candidates knew how to write a number to the nearest 10. Some wrote 810.000.

(iv) Similar mistakes were made as those made in part **(iii)**.

Answers: **(a)** 2, 3, 6, 9 **(b)(i)** 26 **(ii)** 300.763 **(iii)** 12.8 **(c)(i)** 807.54 **(ii)** 807.5 **(iii)** 810 **(iv)** 800

Question 2

A good number of candidates managed to find all four angles correctly. A common mistake was to write angles *a* and *b* as 44 and c as 48. However, many received follow through marks for part **(d)**.

Answers: a = 48, b = 44, c = 44, d = 88

Question 3

(a) Many candidates managed to find the number of pieces of candy that Wali received. Some of those who were unsuccessful managed to pick up 1 mark for adding the ratios together correctly.

(b) Fewer candidates managed to work this percentage profit out correctly. Many just divided 4500 by 5300. There were also very few method marks awarded in this part.

Answers: **(a)** 36 **(b)** 17.8

Question 4

(a) (i) Many candidates managed to find the area of the patio correctly. Some mixed up the area and perimeter.

(ii) Again, this part was well attempted. However, some candidates only added two sides instead of all four.

(b) There were not many correct answers seen for the length and width of a grey tile.

(c) Many candidates managed to find the correct number of tiles. It would have been easy for them just to count the number of tiles on the diagram and probably many of them did just that. A common answer was white = 64 and grey = 128.

(d) Many candidates picked up the follow through marks for this part about the cost of the tiles.

Answers: **(a)(i)** 19.2 **(ii)** 18.4 **(b)** 0.5, 0.4 **(c)** 64, 64 **(d)** 147.20

Question 5

(a) (i) Although there were many correct answers seen, it appeared as if many candidates were not sure of the terminology in this question. Some wrote down the mean here.

(ii) This was reasonably well done. Some candidates again wrote down the mean instead of the mode.

(iii) This was reasonably well done. Some candidates did not put the numbers in order before finding the middle one. Some did not realise that they had to add the two middle numbers together and divide by 2.

(iv) Many candidates managed to find the mean correctly.

(b) All but a handful of candidates drew the bar chart correctly.

Answers: **(a)(i)** 5 **(ii)** 23 **(iii)** 23.5 **(iv)** 23.6

Question 6

(a) Nearly all candidates found the total number correctly.

(b) Most candidates correctly doubled their answer for part **(a)** – but a few halved it instead.

(c) Many candidates forgot that there were 2 sandwiches and gave $2.10 for the answer.

(d) Many candidates managed to find the profit correctly but some gave the profit for all the lunches.

Answers: **(a)** 150 **(b)** 300 **(c)** 0.65 **(d)** 0.75

Question 7

(a) There were a few different incorrect answers given for the cost of the journey. A good many candidates did manage to write the correct answer.

(b) Most candidates either gave the correct answer, or were awarded follow through marks.

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Answers: **(a)** $F + 2M$ **(b)** 15 **(c)** 9

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(a) Although there were many correct Venn diagrams, there were candidates who either omitted this or filled in wrong numbers.

(b)(i) This was well attempted although some candidates mixed up intersection and union.

(ii) Again, this part was well attempted.

(iii) This part was not as well done. Some candidates gave the values for the complement of *A* as their answer.

(c)(i, ii) Many candidates managed to find these probabilities correctly although a few included 4 in part **(ii)**.

(iii) The majority of candidates appeared unfamiliar with triangle numbers. Some drew triangular dots and gave an answer of $\frac{3}{10}$. However, they missed out 1 and so did not get the correct answer.

Answers: **(b)(i)** 1, 3, 7 **(ii)** 2, 10 **(iii)** 4, 9 **(c)(i)** $\frac{5}{10}$ **(ii)** $\frac{3}{10}$ **(iii)** $\frac{4}{10}$

Question 9

(a) Most candidates managed to write down the next two term of the sequence.

(b) Very few candidates managed to find the correct expression for the sum to *n* terms. Many just wrote $n – 3$. Some managed to gain a method mark by finding the second set of differences.

Answers: **(a)** 33, 46 **(b)** $n^{-2} - 3$

Question 10

(a) Many candidates managed to complete the tree diagram correctly.

(b) There were also many correct answers for this part. If the tree diagram was not correct then some managed to pick up follow through marks here.

(c) This part was not very well attempted. Some just added the two values for “not late” from the tree diagram.

Answers: **(b)** $\frac{4}{100}$ **(c)** $\frac{71}{75}$

Question 11

(a) Many candidates reflected *P* in the *y*-axis instead of the line $x = 1$. A few candidates reflected it in the line $y = 1$.

(b) This part was quite well attempted. Some candidates reversed the numbers in the translation.

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(e) Only a minority of candidates managed to find the equation of the line. Extending the line on their diagram would have given them the *y*-intercept.

Answers: **(b)** (5, 0) **(c)** 8.49 **(d)** –1 **(e)** $y = -x + 5$

Question 13

(a) Very few candidates found this angle correctly. Many just wrote 90.

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(c) Some candidates gained follow through marks here but not many correct answers were seen.

(d) Again, only very few correct answers seen. 36 was a common answer.

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(a) A good many candidates managed to draw a cubic curve but some were not very accurate.

(b)(i) Those who drew a good graph and were experienced in the use of a graphics calculator managed to find these points correctly.

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Answers: **(b)** (–4, 0), (1, 0), (5, 0) **(c)** (0, 10) **(d)** (3.27, –14.3)

INTERNATIONAL MATHEMATICS

Paper 0607/32
Paper 32 (Core)

Key messages

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INTERNATIONAL MATHEMATICS

Paper 0607/33
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Answers: **(b)** (–4, 0), (1, 0), (5, 0) **(c)** (0, 10) **(d)** (3.27, –14.3)

INTERNATIONAL MATHEMATICS

Paper 0607/41
Paper 41 (Extended)

Key message

Full coverage of the syllabus is essential.

Extensive use of the graphics calculator is expected. However, functions available on the calculator which are not included in the list in the syllabus will not earn method marks.

Many marks are awarded for method and candidates are reminded that correct answers without working do not necessarily earn full marks. It is the responsibility of the candidate to communicate.

General comments

The standard of work was generally high with most candidates demonstrating good syllabus coverage, good methods and suitable accuracy. All candidates appeared to finish comfortably in the 2 hours 15 minutes.

The use of the graphics calculator continues to improve, especially in questions involving graphs. More candidates used the calculator widely and this was particularly noticeable in **Question 10(d)** where a sketch of $\log(x + 1)$ was often seen. This approach was more successful than the use of laws of logarithms. There were candidates who did not use the statistics function to calculate a mean and did a lot of work for only 2 marks. There was also a small number of candidates who appeared to have little experience of using the graphics calculator when it is hoped that it is seen as a useful teaching and learning tool to be used throughout the course.

Topics which met with success were ratio, percentages, transformations, graph sketching and equations, trigonometry, statistics, probability and a problem leading to simultaneous equations. Questions involving transformation of a function, inequalities, inverse of a function and its graph, range of a function, similar areas, mensuration and a problem leading to an equation containing algebraic fractions were found to be more challenging.

Candidates do need to experience different situations within what might be routine topics in order to develop problem solving skills and ability to choose appropriate strategies. This paper contained a few marks which did discriminate between candidates who could think about a situation and others who could only apply routine methods.

Comments on specific questions

Question 1

(a) The simplification of a ratio was almost always correct.

(b) (i) The calculation of \$24 as a percentage of \$80 was very well answered.

(ii) The calculation of the compound interest was often answered correctly. A number of candidates gave the amount instead of the interest, overlooking the emboldened word in the question.

(c) This question involved exponential reduction and many candidates answered both parts correctly. A few candidates overlooked the exponential aspect of the problem. In part **(ii)**, trial and improvement was seen more often than the use of logarithms.

Answers: **(a)** 16 : 15 **(b)(i)** 30% **(ii)** \$24.30 **(c)(i)** \$48 **(ii)** 13

Question 2

(a) (i) The multiplication of column vectors by scalars and the addition of column vectors were both successfully answered.

(ii) The magnitude of a vector notation proved to be much more challenging although there were many correct answers. Some candidates gave a column vector for their answer and others found the difference of the moduli instead of the modulus of the difference.

(b) The translation vector for the transformation of f(x) onto f(x + 2) was found to be very challenging. The components were often reversed and a negative sign was often omitted.

(c) The drawing and descriptions of three transformations were very well answered, especially the rotation and reflection.

In part **(i)** there were some difficulties in using the correct centre of rotation and a few candidates drew the rotation in the wrong direction.

The stretch in part **(iii)** was much more discriminating, although there were many fully correct descriptions.

Answers: **(a)(i)** $\begin{pmatrix} 46 \\ 30 \end{pmatrix}$ **(ii)** 13 **(b)** $u = -2$, $v = 0$ **(c)(ii)** reflection in line $x = -1$ **(iii)** stretch, factor 4, x-axis invariant

Question 3

(a) The sketch of f(x) was very well answered.

(b) The inequality proved to be much more challenging with many candidates attempting to use the equation instead of the sketch. This algebraic method invariably led to only one of the limits of the inequality as a result of multiplying by a variable.

(c) Candidates usually find an inverse function question quite accessible. This particular question involved more steps and proved to be much more discriminating with only the stronger candidates being fully successful.

(d) Candidates with correct answers to part **(c)** were successful in sketching the graph of the inverse.

(e) The description of the graph of a function on to the graph of its inverse proved to be challenging, even for those candidates who had a correct sketch. A few candidates had an incorrect inverse but had knowledge about the graphs of functions and their inverses.

Answers: **(b)** $0 < x < 2$ **(c)** $\dfrac{2}{1-x}$ **(e)** reflection in line $y = x$.

Question 4

(a) This straightforward similar triangle question was answered correctly by most candidates. Candidates did have to choose an appropriate given side and a few chose incorrectly.

(b) This part also involved choosing appropriate sides in order to calculate the length of a side of similar triangles. This was more challenging as the equal angles were from angles in the same segment and more candidates found this difficult.

(c) This involved similar areas and proved to be much more discriminating. Areas were given and so a square root was needed. Many candidates did succeed whilst many others thought that the ratio of areas was equal to the ratio of sides. A few squared the ratio of the areas.

Answers: **(a)** 6.75 cm **(b)** 3 cm **(c)** 8.49

Question 5

(a) This right-angled triangle question was usually answered correctly, with most candidates using the cosine ratio. A surprising number used the sine formula, although usually with success.

(b) This part required the use of the cosine rule to calculate an angle and it was very well answered. A few candidates treated the triangle as being right-angled and a few others found one of the other angles in the triangle.

(c) The area of a quadrilateral was to be found by adding the areas of two triangles. This was generally well answered and even those who had incorrect answers to parts **(a)** and **(b)** showed correct working in this part and earned method marks. The efficient way was to use $\frac{1}{2}ab\sin C$ in both triangles. A few candidates used longer methods involving more trigonometry and $\frac{1}{2}\text{base}\times\text{height}$. These methods are fine and can earn full marks although carry the risk of losing accuracy during the lengthy calculation.

Answers: **(a)** 9.83 cm **(b)** 59.2° **(c)** 85.3 cm^2

Question 6

(a) Most candidates correctly answered this calculation of a mean, although many showed a full method rather than using the facility on the graphics calculator. The allocation of only 2 marks should have been an indication that not much working was expected.

(b) The completion of the histogram was generally well done, showing that candidates continue to improve in this topic. Almost all candidates gave correct column widths. A number of candidates drew columns with heights which were a fraction of the correct ones, perhaps not expecting such large frequency densities.

Answers: **(a)** 1.31 kg

Question 7

(a) (i) The mass of the cuboid was usually found correctly. A small number of candidates found the correct volume and then divided by the mass of 1 cm^3.

(ii) The cost of painting the surface of the cuboid proved to be much more challenging. Many candidates did not find the total surface area, often finding the total of only three rectangles. Most candidates did change cents into dollars correctly.

(b) The number of cubes that could be cut from a cuboid was found to be more challenging than anticipated. The problem would have been more challenging if there was not an exact fit of the cubes since many candidates used a volume approach. Of those candidates who found how many cubes would fit along each side of the cuboid, many correctly multiplied, while a few added the three numbers. A few candidates divided the volume of the cuboid by the length of the side of the cube.

(c) (i) This part involved finding how many spheres could be made from the volume of a cuboid and met with more success. A few errors were seen with the formula for the volume of a sphere even though the formula is on page 2 of the examination paper. A number of candidates rounded up to the nearest integer, giving an impossible answer and making the next two parts impossible too, although there was still the chance of a method mark in part **(iii)**.

(ii) Finding the volume of metal remaining proved to be a very discriminating part of this question and correct accurate answers were not frequently seen. Some candidates simply gave the decimal part of their answer to part **(i)**, others used the volume of one sphere and many others gave inaccurate answers.

(iii) Many candidates found this part more accessible and showed the method for finding the radius of a sphere from a given volume. The errors in the formula were repeated by those who did not use the correct formula in part **(i)**.

(d) This was one of the most challenging questions on the paper. The masses of two shapes were to be compared. Very few candidates left π as π and others found the mass of 1 cm^3 difficult to deal with. Another common error was that $(2r)^3$ became $2r^3$.

Answers: **(a)(i)** 2512 g **(ii)** \$34.56 **(b)** 48 **(c)(i)** 67 **(ii)** 12.8 cm^3 **(iii)** 1.45 cm **(d)** $\frac{3}{8}$

Question 8

(a) Many excellent sketches were seen.

(b) Most candidates demonstrated their awareness that the *x*-coordinate of the point of intersection was the solution of the given equation. In this part and in later parts a number of candidates used less than 3 significant figure accuracy, perhaps thinking that a sketch could not give this level of accuracy. It is important that candidates realise that the graphics calculator will give the necessary accuracy when using the correct functions.

(c) This intersection with the *x*-axis was correctly answered by most candidates. A number of candidates solved the algebra equation rather than use their graph and on this occasion this approach was just as successful.

(d) (i) The minimum point was usually correctly stated. The problem mentioned in part **(b)** was often seen in this part.

(ii) The range of a function is often found to be a demanding topic and this proved to be no exception. Many candidates did attempt to use the *y*-coordinate of the minimum point but not always with the correct inequality sign. Many candidates also overlooked the upper value of the domain and so lost the upper value of the range.

(e) This question was set up to be a small investigation into a function not likely to be known by candidates. The structure helped many candidates and overall the question was well answered. It is likely that many candidates will have found that g(0) gave an error message but used the answers to part **(i)** together with the sketch to find the value that g(*x*) approached as *x* approached zero.

(i) This part simply required three numerical values of g(*x*) for given values of *x*. Most candidates found this part more accessible while a few others did not attempt the question as it was a more unusual situation.

(ii) The three answers to part **(i)** were leading to the limiting value in this part. Many candidates proved their ability to interpret this and gave the correct answer.

Answers: **(b)** 1.28 **(c)** 1.73 **(d)(i)** (0.368, 0.692) **(ii)** $0.692 \leqslant y \leqslant 4$ **(e)(i)** 0.794, 0.955, 0.993 **(ii)** 1

Question 9

(a) This involved the rolling of two dice and both parts were extremely well answered either by the product of probabilities or by using a space diagram.

(i) This was a single product and almost all candidates were successful.

(ii) Most candidates succeeded in finding the correct sum of two correct products and others found that a good space diagram led immediately to the answer.

(b) This part involved only one die and a product of four probabilities. It was a much more challenging question but was well answered by many candidates.

(c) This part also involved one die with a given probability and candidates were required to work out how many times the die was rolled. This required good problem solving skills to appreciate the situation and many candidates found the question difficult. Incorrect strategies were seen as well as many omissions. It was a good discriminating final part of the question.

Answers: **(a)(i)** $\frac{1}{12}$ **(ii)** $\frac{5}{36}$ **(b)** $\frac{8}{81}$ **(c)** 6

Question 10

(a) The evaluation of a compound function was generally well done.

(b) The simplifying of g(f(x)) was also well done. Almost all candidates gave the correct first step of $2x+3-1$. A surprising number went on to give an answer of $2x - 2$ and a few others gave an answer of $-2x - 3$.

(c) This part was more of a challenge of adding two algebraic fractions with linear denominators rather than testing an understanding of functions. Good manipulative skills were frequently seen and incorrect cancelling was rarely seen. The only frequent error was the careless simplification of $x-1+2x+3$ to $3x - 2$.

(d) This was a high grade test involving a logarithmic function. Most successful answers came from candidates who sketched log(x + 1) from the graphics calculator. Candidates who used laws of logarithms rarely used the equivalence between $y = \log_b x$ and $x = b^y$. $\log(x + 1) = \log x + \log 1$ was a common error.

(e) This was another challenging part and many candidates did not recognise the efficient approach of taking the square root immediately and that this would lead to the exact answers. Many candidates chose the strategy of expanding the brackets and then used the formula or the graphics calculator to solve the quadratic equation. This led to correct answers being in decimal form, earning 2 of the 3 marks.

Answers: **(a)** 5 **(b)** $2x + 2$ **(c)** $\frac{3x+2}{(2x+3)(x-1)}$ **(d)** -0.9 **(e)** $1+\sqrt{5},\ 1-\sqrt{5}$

Question 11

(a) This worded problem leading to simultaneous linear equations was very well done. The values of \$1.57 and \$2.96 were not straightforward but candidates coped really well and there was little confusion between dollars and cents. A few candidates scored 5 out of the 6 marks as a result of not finding the final total cost of 3 cakes and 2 drinks.

(b) This second worded problem was much more demanding as it led to an equation containing algebraic fractions. The stronger candidates demonstrated good algebraic skills, obtained the correct quadratic equation and then solved it by a variety of methods. The answer was a simple integer and this led to many candidates reaching the answer by trial and improvement. As there was no need to obtain the quadratic equation candidates could have used the graphics calculator with the original equation and simply drawn a sketch indicating where they found the answer. This approach was rarely seen. Quite a few correct answers were reached from clearly incorrect working and such cases could not be rewarded unless some verification of the answer was seen.

Answers: **(a)** \$2.79 **(b)** \$3

INTERNATIONAL MATHEMATICS

Paper 0607/42
Paper 42 (Extended)

Key Messages

To succeed in this paper, candidates should:

- have completed full syllabus coverage
- give answers to the appropriate degree of accuracy
- show clear working
- be familiar with the required functions of the graphics calculator

General Comments

Many candidates performed well in this paper. Almost all the candidates presented neat solutions and they all appeared to have sufficient time to complete the paper. Candidates performed well in general in the questions on logarithms, statistics and probability, and the curve sketching was good on the whole. More challenging were topics in algebra, particularly when combined with percentages or with harder inequalities. The question on mensuration, in particular, was one where premature approximation led to a loss of accuracy even when the method was completely correct. More candidates gave final answers correctly rounded to 3 significant figures, but there are still those who truncate answers or give less accurate values.

Comments on Specific Questions

Question 1

(a) Many candidates followed the instruction to correct the numbers to 1 significant figure, but only after doing some preliminary work such as squaring 1.91 or finding the square root of 9.12. In particular, a significant number wrote $\frac{10}{5}+\frac{16+4}{3}$ with a final answer of $8\frac{2}{3}$. The ideal solution would have been $\frac{\sqrt[3]{1000}}{5}+\frac{20+2^2}{\sqrt{9}} = \frac{10}{5}+\frac{24}{3} = 2+8 = 10$.

(b) Many answers here made a fairly vague reference to most numbers being rounded up. However, a significant number of candidates correctly wrote that all the numbers in the numerators had been rounded up while all those in the denominators had been rounded down.

(c) This answer was generally correct, although a small number gave the answer to 2 significant figures or truncated it to 8.54.

Answers: **(a)** 10 **(c)** 8.55

Question 2

(a) (i) Most candidates successfully used the properties of logarithms to evaluate the exact answer. There were a few who mistakenly wrote that $\log a - \log b = \frac{\log a}{\log b}$ instead of $\log\frac{a}{b}$.

(ii) While the more able candidates found the value of *x* without difficulty, sometimes supporting their answers with a sketch, nearly everyone could state that sin *x* was equal to $-\frac{1}{2}$, and either give the out of range answer of –30° or the incorrect answer of 30°.

(b) Nearly all candidates started their solution to this part correctly, by squaring both sides of the formula, and then clearing fractions. However, a large number were unable to continue successfully, with many solutions still containing *x.*

Answers: **(a)(i)** 40.5 **(ii)** 210, 330 **(b)** $\dfrac{1}{1-a^2}$

Question 3

(a) (i, ii) Nearly all candidates gave the correct answers to these two parts, with any errors usually resulting from a value entered wrongly into their calculators.

(b) (i) There were many correct equations, usually with sufficient accuracy.

(ii) While many evaluated the history mark correctly using their equation, there were some who misunderstood the question and substituted 51 for *y* instead of for *x.*

Answers: **(a)(i)** 57.2 **(ii)** 56.8 **(b)(i)** $y = 0.54[0]x + 25.9$ **(ii)** 53

Question 4

(a) (i) The most common wrong answer here was to say that the reflection was in the y-axis.

(ii) A few candidates omitted to use the term rotation in this part, which cost them both marks, while some lost one mark for omitting either the angle or the centre of rotation.

(b) Most candidates used the space on the paper wisely to help them work out the answer to this part and many gave the correct transformation. Only a small number neglected to heed the instruction that a **single** transformation was required.

Answers: **(a)(i)** reflection *x*-axis **(ii)** rotation 90° about origin **(b)** reflection $y = -x$

Question 5

Candidates were all able to find the next term in both parts of the question, while finding the *n*th term proved more challenging to some.

(a) A large number of candidates found the *n*th term, usually, but not always, in the simplest form.

(b) A geometric sequence proved harder for more candidates, with some leaving the *n*th term answer space blank. A number lost marks for writing what could have been intended as the correct answer incorrectly, such as $1024 \times \dfrac{1^{n-1}}{2}$ instead of $1024 \times \left(\dfrac{1}{2}\right)^{n-1}$. The very neat answer of 2^{11-n} was frequently seen.

Answers: **(a)** -8, $34 - 7n$ **(b)** 32, $2048 \times \left(\dfrac{1}{2}\right)^n$

Question 6

In **part (d)** the better candidates annotated their graph to indicate the various points at which they were taking their readings.

(a) Candidates who gave a wrong answer as a result of keying in a wrong number in the calculator could gain a part-mark if they indicated sufficiently clearly that they were using the mid-values in their calculation.

(b) Nearly all the candidates were able to complete the table.

(c) Many candidates plotted the points correctly and drew a suitable cumulative frequency curve.

(d) (i) While there were many correct answers to this part, some candidates gave an answer of 50 or an answer of something over 400, from reading off the cumulative frequency at the mark of 50.

(ii) In this part also, many correct answers were given but a number of candidates, after correctly working out that the essential frequencies were 600 and 200, subtracted these to get 400 and read off the mark at the median again.

(iii) The best solutions to this part showed clearly that 15% of 800 was 120 and that the required mark would be found at a cumulative frequency of 680.

Answers: **(a)** 49.3 **(b)** 146, 286, 446, 588, 700 **(d)(i)** 46 to 49 **(ii)** 26 to 30 **(iii)** 74 to 77

Question 7

(a) (i) Nearly all candidates sketched a curve of the approximately correct shape, and the better sketches were neatly drawn with the asymptotes also marked.

(ii) Although there were many correct equations, there were also a variety of incorrect ones, and a number of answers were just numbers rather than equations.

(iii) There were a large number of correct co-ordinates, with the values correctly given to 3 or more decimal places or as fractions.

(b) Very few candidates appeared to use their sketch to help them obtain the answers here or to realise the significance of the value of x for which the denominator was zero. There were attempts at rearranging the inequality to form a quadratic expression which frequently led to the answer $-1 < x < 5.5$.

Answers: **(a)(ii)** $x = 1.5$, $y = 3$ **(iii)** (0, –3.67), (–1.83, 0) **(c)** $1.5 < x < 5.5$ and $x < -1$

Question 8

This question was answered well by many, with almost the only errors being in the conversion of time in hours and minutes to a decimal number of hours.

(a) Nearly all obtained the correct answer of 80.

(b) Nearly all increased their speed from **part (a)** correctly by 5% and divided 300 by this new speed.

(c) The two main sources of error in this part were using only 300 km instead of 600, and working in stages with premature approximation in the process.

Answers: **(a)** 80 **(b)** 21 19 to 21 20 **(c)** 107

Question 9

The numerical parts of this question were answered well but many candidates found **part (c)** difficult.

(a) Only a few stated that the new price was $100.

(b) Similarly, a few found the answer to be $1000.

(c) There were some very neat solutions using $10000 \times \left(1+\frac{x}{100}\right)\left(1-\frac{x}{100}\right)$ and simplifying. A number of solutions were seen where candidates wrote x % instead of $\frac{x}{100}$ but these could not gain credit as they could not be simplified further. Longer solutions where the candidate worked out first the increased and then the decreased price were sometimes successful but it was easy to make errors in the process.

Answers: **(a)** 99 **(b)** 960 **(c)** $10000 - x^2$

Question 10

In **parts (a)(ii)** and **(iii)**, some candidates did not gain all the marks available by not considering the number of different ways that the selection could be made.

(a) (i) This answer was usually correct.

(ii) Answers of $\frac{30}{336}$ were common, and occasionally $\frac{60}{336}$.

(iii) The best solutions found the probability of choosing three blue balls and subtracting this and the answer to **part (a)(i)** from 1. However, many candidates preferred to consider the longer method and this frequently led to errors.

(b) For most, the product of their answer to **part (a)(i)** and 1680 gained them full marks.

Answers: **(a)(i)** $\frac{6}{336}$ **(ii)** $\frac{90}{336}$ **(iii)** $\frac{270}{336}$ **(b)** 30

Question 11

(a) Many candidates found the co-ordinates by solving the simultaneous equations and a number by using their calculators and sketching the result. However it is not enough to use the calculator and state "using GDC"; a sketch or some working must be shown.

(b) A large majority of candidates were able to write down the co-ordinates of the midpoint.

(c) Although most of the better candidates had no difficulty in finding the equation of the line, there were many who made a number of errors – among them dividing the difference in the x co-ordinates by the difference in the y co-ordinates, instead of the other way round, to find the gradient. Finding the value of the constant was also made more complicated by trying to use the co-ordinates of the midpoint of the line BM rather than those of B or M.

(d) In this final part of the question, many weaker candidates were unsure of what was required. Substituting the co-ordinates of the point D gained the candidates a method mark. Some lost marks for careless errors following a correct substitution into the correct equation

Answers: **(a)** (3, 2) **(b)** (3.5, 5) **(c)** $y = 6x - 16$ **(d)** 5

Question 12

When given a diagram, such as in this question, a number of candidates too often make unjustified assumptions about the dimensions. The length of *AF* was assumed by many candidates to be either 12 cm or 15 cm.

(a) Using the cosine formula, the correct answer was frequently obtained, although when using their calculators in stages, many candidates omitted to take into account that cos130 has a negative value.

(b) Many candidates did not score full marks in this part. In order to show that the angle is 34.7 correct to 3 significant figures, it is necessary for candidates to write down a more accurate value first. Thus those who used the sine formula correctly but did not write a value such as 34.715 or 34.72 earned only method marks.

(c) Candidates had two lengths to calculate in order to find the perimeter, and they therefore needed to realise that angle *FAB* was also 34.7, or to work out angle *ABF*. Using trigonometry in the right-angled triangle, they were then able to find the lengths of *AB* and *AF*. Many did this successfully but some lost accuracy by rounding values during their working instead of using the calculator memory function.

(d) The area of the quadrilateral was made up of three parts. Most candidates gained a mark for the rectangle area and many used a correct method for the complete answer, even if the lengths they were using were wrong. A few forgot to use the correct formula for the area of a scalene triangle.

Answers: **(a)** 30.4 **(b)** 34.71 to 34.73 **(c)** 116 **(d)** 414

Question 13

(a) (i) Most candidates drew a reasonable sketch of the graph.

(ii) Some answers given were only accurate to 2 significant figures. A number of candidates did not read the question sufficiently carefully and gave the co-ordinates of the required point, rather than only the *x* co-ordinate.

(iii) This part of the question was not well answered. Candidates appear confused between the terms range and domain, with many writing down an inequality involving *x* instead of f(*x*). The answer required covered all values of *x* but credit was given to candidates who gave an accurate range for f(*x*) in the domain specified in the question.

(b) A large number of candidates answered this part well, obtaining their answer from the calculator. A few answers were given to 2 significant figures or were truncated to 1.73, which did not earn the mark. Weaker candidates showed some working, but could not continue correctly after $\frac{100}{2^x} = 30$.

(c) This was another part of the question where even the better candidates did not always earn full marks. The term "translation" was required; words such as "shift" or "move" are not acceptable to define a transformation. Vector notation is the clearest way of describing a translation, although in this case other unambiguous descriptions were accepted.

Answers: **(a)(ii)** 3.32 **(iii)** f(*x*) > –10 **(b)** 1.74 **(c)** translation $\begin{pmatrix} 0 \\ -10 \end{pmatrix}$

Question 14

(a) Most candidates were able to write down the correct fraction.

(b) Although, again, most candidates could write down the required fraction, there were more errors here. This included those candidates who wrote +3 after the numerator and denominator of their answer in **part (a)** but did not think it necessary to simplify this.

(c) (i) A few candidates started incorrectly here by writing down the fractions $P - Q$ instead of $Q - P$, but most were able to write a correct first equation. The most common errors which followed involved careless expansion of brackets and sign errors, but many candidates did establish the given equation.

(ii) The majority of candidates solved the equation correctly.

(iii) Many candidates were able to write down the original fraction P, but too often they attempted to add a second answer from the negative value in the previous part. This was acceptable as long as they remembered the definition of the fraction P, which was that the numerator was 3 less than the denominator. Thus an answer of $\frac{-11}{-8}$ was acceptable but if this was simplified to $\frac{11}{8}$, it no longer satisfied the criteria and so lost the mark.

Answers: **(a)** $\frac{x-3}{x}$ **(b)** $\frac{x}{x+3}$ **(c)(ii)** -8, 5 **(iii)** $\frac{2}{5}$

Question 15

In both parts here, a number alone did not gain any credit. When solving inequalities the variable and inequality signs must also be written down for a complete answer.

(a) Candidates who sketched a curve in this part were more able to realise that the answer consisted of two inequalities. There were many answers of $x > \frac{4}{3}$ but $x < 0.5$ was rarely seen. In a number of scripts the inequality sign was reversed at some point in the working.

(b) This inequality was more straightforward and there were more correct solutions with many candidates showing confidence in their use of logarithms.

Answers: **(a)** $x < 0.5$ and $x > \frac{4}{3}$ **(b)** $x > 33.2$

INTERNATIONAL MATHEMATICS

Paper 0607/43

Paper 43 (Extended)

Key Messages

Candidates should be reminded to include sufficient working in order to gain method marks if their final answer is incorrect.

The general instruction is that answers should be given correct to three significant figures unless the answer is exact or the questions states otherwise. Money answers should be to the nearest cent, again, unless the question says otherwise. This means that candidates may lose marks if answers are given to a lesser degree of accuracy.

Candidates should be familiar with the expected uses of the graphics calculator. This is both for graphical questions and statistical questions.

Candidates should use the mark value indicated in the question as an indicator of how much work is required for a question.

General Comments

The paper proved accessible to most of the candidates with omission rates very low. Just a few parts of some questions proved very difficult for all but the very best candidates and these did have higher omission rates. Marks across a substantial range were seen and the work from the best candidates was very impressive indeed. Although very low marks were rare, there remain a few candidates at the lower end of the scale where an entry at core level would have been a much more rewarding experience.

Whilst most candidates displayed knowledge of the use of a graphics calculator for curve sketching, familiarity with statistical functions was not so apparent.

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

Time did not appear to be a problem for candidates as almost all finished the paper.

Comments on Specific Questions

Question 1

All parts of this question were done well. Some candidates thought that *BC* was 17 cm and also some assumed that angle *ADC* was 90°. In part **(b)** candidates were equally successful whether they used $\frac{1}{2}bc\sin A$ or $\frac{1}{2}\times\text{base}\times\text{height}$. It was common in part **(c)** for candidates to find *AB* and then use the cosine rule on triangle *ABD* with a 90° angle.

Answers: **(a)** 9.84 **(b)** 83.6 **(c)** 11.4

Question 2

Part **(a)** was done well, although finding 60 as a percentage of 1601 was fairly common, as was reaching 127.3% and omitting to subtract 100. Although finding 90% of 216 was fairly common in part **(b)**, a large majority were able to carry out the reverse percentage correctly. More candidates found difficulty with part **(c)** but many were successful. In part **(c)(ii)** the two methods of using logs and trial and improvement were equally successful.

Answers: **(a)** 27.3% **(b)** $240 **(c)(i)** 1190 **(ii)** 26 years

Question 3

In part **(a)(i)** the most common errors were to state the interval as $50 < v \le 60$ or to give a single value rather than an interval. Although part **(a)(ii)** was well done by most candidates there was evidence that many used long methods rather than using the statistical functions on their graphics calculator. Better candidates calculated the frequency densities in **(a)(iii)** well, although a few made errors on the final interval. Weaker candidates did not seem to know the method required. In part **(b)** it was very common for candidates to lose marks due to giving the equation to an insufficient degree of accuracy. This was particularly so with the coefficient of *r*. A fair proportion of the candidates seemed unfamiliar with this use of the graphics calculator.

Answers: **(a)(i)** $60 < v \le 70$ **(ii)** 65.9 **(iii)** 0.1, 2.5, 4.6, 8.2, 0.4 **(b)** $t = -0.286r + 35.4$

Question 4

Many candidates found part **(a)** quite testing. It was common to see symmetry for part of the diagram rather than for the whole 16 squares. Part **(b)(i)** was extremely well done. Stronger candidates did part **(b)(ii)** well but many candidates used the length scale factor rather than the area scale factor.

Answers: **(b)(i)** 7 cm **(ii)** 20 cm^2

Question 5

In part **(a)(i)** most candidates recognised the enlargement but were less successful with the centre and/or the scale factor; –2 was a very common wrong answer for the scale factor. Again, in part **(ii)**, enlargement was almost always correct and, since it was a positive integer, candidates were more successful with the scale factor. Better candidates did part **(b)(i)** well but a large number of candidates drew the mirror line from (0, 0) to (10, 8) instead of (8, 8). Part **(b)(ii)** was more often correct. In part **(c)** most candidates were able to gain part marks for drawing an object and at least one of the transformations, but fully correct answers were much less common.

Answers: **(a)(i)** Enlargement scale factor $\frac{1}{2}$ centre (0, 8) **(ii)** Enlargement scale factor 2 centre (0, 8)
(c) reflection in *x*-axis.

Question 6

There was some impressive work on this quite demanding mensuration question. Part **(a)** was extremely well done although occasionally a sphere formula was used instead of a cone formula. Many candidates did part **(b)(i)** well. Again, occasionally, wrong formulae were used but a variety of correct methods were seen. Many candidates did not realise that, in order to show that the answer was 2749 correct to the nearest cubic centimetre, it was necessary to show a more accurate answer first. A common wrong answer to part **(b)(ii)** was to simply change the answer to part **(i)** to litres. The mark value of 3 should have indicated that there was more to do. Better candidates did it well although some forgot to change the answer to litres.

Answers: **(a)** 6280 cm^3 **(b)(ii)** 1.96 litres

Question 7

Part **(a)** was well done by most of the candidates and even those who found it difficult often gained at least one of the method marks. Weaker candidates sometimes simply worked out (3 + 4) ÷ 2. Part **(b)** proved more difficult. Even the candidates who used the right basic method often struggled with the change of units and the simplification.

Answers: **(a)** 3.56 km/h **(b)** $\frac{5x-4}{5}$

Question 8

In part **(a)**, most candidates knew the basic method but many errors occurred. These included incorrect multiplying out of brackets, sign errors in isolating terms and the inability to go from $-3x < 21$ to $x > -7$. Most were able to show their solution on a number line, although some did not appreciate the method of distinguishing between > and ≥ .

In part **(b)**, most candidates simplified the given equation to a three-term quadratic equation and then solved that either using the formula method or their graphics calculator. Errors were often made, however, in the simplification or giving the answer to the required degree of accuracy. The coefficient of x^2 being 2 meant that very few attempts at completing the square were successful. Fewer candidates went straight to the graphics calculator from the original equation but many of them were successful and showed adequate sketches.

In part **(c)** many tried a log solution but this was not possible in this case. Those using a graphics calculator were usually successful but some did not realise that it was necessary to show the sketches to obtain full marks. Although better candidates did part **(c)(ii)** well, omission rates were fairly high on this part. Some merely used ± their answer to part **(i)**.

In part **(d)**, most candidates knew the method required but the subtract sign led to many sign errors. Also a number of candidates thought they could simplify further having reached the correct answer.

Answers: **(a)(i)** $x > -7$ **(b)** 1.39, – 5.39 **(c)(i)** 4.36 **(ii)** 4.36, 5.76 **(d)** $\frac{x^2-x+2}{(x-1)(x+1)}$

Question 9

Part **(a)** was done quite well by most candidates and most obtained at least one of the marks. In part **(b)**, most were able to obtain the total angle in a 10-sided polygon. However, only the best could go on and complete the question. Many divided the total angle by 10. In all three parts of **(c)**, high and middle ability candidates gained most of the marks. Some method marks were obtained from correctly marked angles on the diagram. Weaker candidates often made incorrect assumptions about right angles and parallel lines.

Answers: **(a)** 127° **(b)** 162° **(c)(i)** 65° **(ii)** 70° **(iii)** 85°

Question 10

Parts **(a)** and **(b)** were done extremely well. In part **(c)** almost all candidates obtained the $\frac{7}{30}$ and $\frac{12}{13}$ but only the very best candidates were able to obtain the $\frac{8}{17}$ and $\frac{9}{17}$.

Question 11

Part **(a)** was extremely well done. In part **(b)** many candidates clearly did not know what was meant by the range of the function. Even those who did, usually gave an inequality rather than two discrete values. Part **(c)** also proved difficult for all but the best candidates. Those who were successful usually substituted $(x – 2)$ for x but then expanded and re-factorised rather than immediately using the difference of two squares factorisation. In part **(d)** most knew the basic methods but the completion in part **(i)** and the inverse of the exponential function in part **(ii)** defeated many.

In part **(e)** many of the stronger candidates recognised that the transformation was a stretch but many could not complete the description.

Answers: **(a)** 8 **(b)** 1, 2 **(c)** 2, –6 **(d)(i)** $\frac{2-x}{x}$ **(ii)** $\log_2 x$ **(e)** Stretch factor 2 with x-axis invariant

Question 12

Almost all candidates drew acceptable sketches of the two curves on part **(a)**. In part **(b)(i)** most obtained the asymptote $x = – 2$ but fewer obtained $y = 0$. In part **(b)(ii)**, only the better candidates were successful. As the last question on the paper, part **(c)** was meant to be testing and so it proved, with a fairly high omission rate. That said, the very best candidates did it well

Answers: **(b)(i)** $x = – 2$, $y = 0$ **(ii)** $y = –5$ **(c)** $x > 2.90$

INTERNATIONAL MATHEMATICS

Paper 0607/51
Paper 5 (Core)

Key Messages

Any questions with the instruction *Show that* require candidates to show their full working, including straightforward steps.

A general algebraic result cannot be shown to be true by testing numerical values.

General Comments

Most candidates showed very good skills in using the Pythagoras' Theorem upon which this investigation was based.

Good communication is expected in this paper and so writing down answers is often insufficient to gain credit for communication. Even when filling in a table there is an expectation that candidates will give clear indications about the origin of their answers. This might be showing how a cell has been calculated or highlighting the pattern in the table.

Comments on Specific Questions

Question 1

(a) Most candidates answered correctly, with a few choosing other prime numbers from the list.

Answer: 13 17

(b) Nearly all those who answered part **(a)** correctly were successful here. Occasionally indices other than 2 were seen.

Answer: $13^2 = 2^2 + 3^2$
$17^2 = 1^2 + 4^2$

(c) Nearly all the candidates answered this question correctly.

Answer: $1^2 + 10^2$

Question 2

(a) Candidates were expected to give the squares of the numbers 7, 24 and 25 and indicate that $49 + 576$ was equal to 625. Most were successful, often using the layout given in the example, although several omitted necessary steps, for instance writing $7^2 + 24^2 = 625$ directly. In this paper candidates should remember to communicate their working fully and precisely.

(b) Many correct responses were seen. Nearly all candidates identified that the number in the last column was always one more than that in the middle column. Most used sequences to complete the other columns, with a few, howeve,r writing 17 for the last number in the first column. By using patterns in the table, candidates who were unsuccessful with the earlier questions could recover.

Answer:

		41
		61
	84	85
15	112	

(c) The majority of candidates correctly identified the pattern that the square of the number in the first column was the sum of the numbers in the other two columns. Several reiterated Pythagoras' Theorem and so had not identified this pattern. By giving an example of what they stated, candidates could be rewarded for good communication.

(d) Candidates who had not noticed the pattern had more difficulty with this question. Most candidates gave 420 for the second number. To find the other number, the most popular method was evaluating $\sqrt{421^2 - 420^2}$ rather than the easier $\sqrt{420+421}$. Credit for communication was given to those candidates who showed how to use the pattern.

Answer: 29 420

Question 3

(a) (i) While most candidates found 15 and 17, there were several who evaluated $2\sqrt{16}$ incorrectly.

Answer: 8 15 17

(ii) Those candidates who omitted steps in the working in **Question 2(a)** often did so again here, so the same comments apply.

(b) In this question, candidates could complete the table by using the given formulae, or the sequence of numbers in each column, or Pythagoras, or any combination of these. There was a good opportunity here for candidates to show their chosen method for completing the table, but only a few candidates made use of this opportunity.

Answer:

	35	
20		101
	143	

(c) The more able candidates noticed correctly that, in a row, the square of the smallest number was always twice the sum of the other two numbers. Several candidates wrote half instead of twice. As in **Question 2(c)** many repeated Pythagoras' Theorem and so had not answered the question.

(d) Only the best candidates were successful here, even though many were able to write statements such as $\left(2\sqrt{x}\right)^2 = 2\left(x-1+x+1\right)$. To gain the marks, candidates should have taken a further step, either writing the left side of this statement as 4*x* or noting that $x-1+x+1=2x$.

The majority of candidates interpreted the question as requiring the substitution of numerical values, which suggests that the significance of the word *algebraically* was not understood.

INTERNATIONAL MATHEMATICS

Paper 0607/52

Paper 5 (Core)

Key Messages

Any questions with the instruction *Show that* require candidates to show their full working, including straightforward steps.

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General Comments

Most candidates showed very good skills in using the Pythagoras' Theorem upon which this investigation was based.

Good communication is expected in this paper and so writing down answers is often insufficient to gain credit for communication. Even when filling in a table there is an expectation that candidates will give clear indications about the origin of their answers. This might be showing how a cell has been calculated or highlighting the pattern in the table.

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(d) Candidates who had not noticed the pattern had more difficulty with this question. Most candidates gave 420 for the second number. To find the other number, the most popular method was evaluating $\sqrt{421^2 - 420^2}$ rather than the easier $\sqrt{420 + 421}$. Credit for communication was given to those candidates who showed how to use the pattern.

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INTERNATIONAL MATHEMATICS

Paper 0607/53

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The majority of candidates interpreted the question as requiring the substitution of numerical values, which suggests that the significance of the word *algebraically* was not understood.

INTERNATIONAL MATHEMATICS

Paper 0607/61

Paper 61 (Extended)

Key Messages

To do well on this paper candidates needed to show their methods clearly, writing down every step.

In ***Section A*** the candidates were required to follow a new idea rather than use Pythagoras' Theorem throughout.

In ***Section B*** those candidates who could substitute correctly and solve simultaneous equations efficiently scored the higher marks.

General Comments

The Investigation and Modelling sections should each be read as one whole project and not as a series of unlinked questions. The candidates who did best were those who carried forward an idea or solution from one question, using it to solve others.

Comments on Specific Questions

Section A Investigation

Question 1

(a) Most candidates understood 'one more than a multiple of 4' and answered this question correctly.

Answer: 13, 17

(b) Again, candidates understood 'the sum of two square numbers' and answered this question correctly. The order of the two squared numbers did not matter, which meant that most of those with part **(a)** correct also got part **(b)** correct.

Answer: $13 = 2^2 + 3^2$, $17 = 1^2 + 4^2$

(c) Some candidates managed to recover from a mistake in part **(b)** and so most answered this part correctly.

Answer: $1^2 + 10^2$

Question 2

(a) If a fault was made here it was either to jump a step which was needed because this question was a 'show that', or to write the mathematically incorrect statement that $49 + 576 = \sqrt{625}$.

Answer: $49 + 576 = 625$

(b) This table was marked by column with follow through for the third column based on patterns or Pythagoras used. There did not appear to be a consistent mistake here but just that some candidates did not recognise either of those two methods.

Answer:

		41
		61
	84	85
15	112	

(c) The answers to this question marked a big divide between those who understood the lead-in from the previous questions and those who used Pythagoras' Theorem, recognising it as something that they knew. Almost half the candidates, using Pythagoras, wrote about the difference between the squares of the other two numbers.

(d) (i) The correct answers were obtained by the majority of candidates although many used only the connection of subtracting 1 from 421 to obtain the second number; they then used the difference between the squares of 421 and 420 (Pythagoras) to find the 29, as opposed to adding 420 + 421.

Answer: 29, 420

(ii) Apart from trialling numbers, the only way to find these answers was to reverse the pattern method by squaring 29 and dividing by 2. Consequently only half the candidates who answered part **(i)** correctly also answered this part correctly.

Answer: 5100, 5101

Question 3

(a) Some candidates made this more difficult for themselves by subtracting the $(x-y)^2$ and the $(m-n)^2$ from each side and then having to cope with negatives outside brackets. Overlooking small errors, however, many candidates were able to simplify to $4xy$ and $4mn$ and achieved at least one mark.

(b) The majority of candidates found at least one set of equal sums of squares numbers. For the penultimate question in an investigation this was well answered and showed that the candidates had read the question carefully.

Answer: $13^2 + 4^2 = 11^2 + 8^2$
$8^2 + 1^2 = 4^2 + 7^2$
$13^2 + 1^2 = 11^2 + 7^2$

(c) A number of candidates did not follow the pattern through here and looked for two primes that added to make 9, with a difference of 5. The primes of 2 and 7 give a value of 14, which only has one other pair of factors, 1 and 14.

Answer: 13^2 , 15^2

Communication

The communication seen on this paper was quite good. Candidates should be encouraged to give examples to support their statements such as in the communication for **Question 2(c)**.

Section B Modelling

Question 1

(a) Few candidates understood the continuity of the data and gave an answer that indicated this as a reason. More work on the meaning and understanding of graphs would be useful.

(b) Many more candidates, however, could interpret the gradient decreasing as the rate of growth decreased. Many did not answer the question about the 'rate of increase in the number of fish'. Candidates should remember to read the questions very carefully.

Question 2

(a) (i) (ii) Unsimplified answers such as $a(1)^3 + b(1)$ were common but not acceptable because 1^3 was sometimes simplified to 3. Candidates should be encouraged to simplify equations once substitutions have been made and to use their calculators to check, even simple arithmetic such as 1^3 and 5^3.

Answer: **(i)** $a + b = 18$ **(ii)** $125a + 5b = 78$

(b) Candidates should be encouraged to look for the simplest way to solve simultaneous equations. Multiplying part **(i)** by 5 or using part **(i)** as a substitution in part **(ii)** gave answers for a and b very quickly. Many candidates either did nothing or made it too complicated, often with mistakes, the most common being to finish with a positive value for a.

Answer: $y = –0.1x^3 + 18.1x$

Question 3

(a) (i) (ii) Again, unsimplified answers such as $a + b\cos(0)$ were not accepted. Candidates should be encouraged to check answers to avoid such common mistakes as $\cos(0) = −1$ and $\cos(180) = 1$.

Answer: **(i)** $a + b = 10$ **(ii)** $a – b = 100$

(b) Adding the equations in part **(i)** and part **(ii)** gave exceptionally quick answers to a and b. Candidates need to practise the recognition of easy routes to solve simultaneous equations.

Answer: $y = 55 – 45 \cos(18x)°$

Question 4

(a) As a general rule substitution should be practised. Candidates should also know the rules of indices particularly for an index of 0. A very common answer was $k = 10$ coming from $2^0 = 0$ in both the numerator and the denominator.

Answer: 9

(b) Accuracy was judged in two different ways both needing substitution for x and k, which was not always done. Some candidates judged it inaccurate because it was not exactly 78 whilst others felt that 78.048… was close enough for accuracy.

Question 5

(a) Given that scales were already on the axes for these graphs more candidates should have been able to translate what they saw on their calculators to the paper. The main inaccuracies to be watched for, were: graphs for **Question 2** and/or for **Question 4** drawn below the original data graph between the values of $1 \le x \le 6$, the graph for **Question 3** drawn higher than the original data graph and/or the graph for **Question 2** and/or the graph for **Question 4**, between these same values, and/or the graph for **Question 3** having a lower maximum than the graph for **Question 2**. Candidates should also be aware of the boundaries required because the question asked them to draw graphs as far as $x = 15$ and many candidates did not extend their graphs to this value.

(b) A comparison was needed between the logistic model and the other models and the original data. Many candidates determined its accuracy by comparing the logistic model to the other models. Few candidates also compared it to the data situation given at the start of the section – 'After ten years the number of fish stays approximately the same.' It should be remembered that concluding questions are often related to the whole section and not just about that particular question.

Communication

The communication was quite good. Candidates should be encouraged to show how they solve simultaneous equations and not just to write down answers from their calculator. Candidates should also be reminded that all graphs should be labelled.

INTERNATIONAL MATHEMATICS

Paper 0607/62

Paper 62 (Extended)

Key Messages

To do well on this paper, candidates needed to relate their maths to the practical situations particularly when explaining and interpreting answers.

In ***Section A*** the highest marks were achieved by those who identified the difference between polygons and stars.

In ***Section B*** those candidates who showed all their working had several opportunities to gain more marks than those who did not do this.

General Comments

The Investigation and Modelling sections each look at a whole situation with links between the questions that form easier steps for the candidates who use them. In both sections key points were given at the beginning that were useful in answering many, including the last, questions.

Comments on Specific Questions

Section A Investigation

Question 1

(a) A topic well known to all candidates with only a very few not showing the ‘divide by 7’ step that was necessary to earn the mark. Many candidates used the longer route of finding the interior angle first and it was in doing this that some made a mistake.

(b) Again, it would have been helpful to some candidates to know how to find exterior angles without having to find an interior angle first. Incorrect formulas were due to mistakes in the interior angle method.

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

Question 2

(a) This was a very well answered question. Candidates showed here that they read the question and followed the example carefully.

Answer: 102.85…

(b) (i) Again, very well answered showing good understanding of the situation in this investigation.

Answer: 3

(b) (ii) This explanation was about 3 revolutions and 7 angles. Most candidates used ‘points’, ‘sides’ or ‘lines’ instead of ‘angles’ or ‘turns’, which was not good enough for an explanation question.

Answer: 3 revolutions and 7 angles

(b) (iii) Most candidates know what it is necessary to do when they are asked to ‘show’ something and having calculated the value of 205.7 for 4 revolutions they indicated that this is more than 180°. Some candidates omitted to say why it was unsuitable and a very small number misunderstood the question and tried to construct other calculations with answers below 180°.

Answer: $\frac{4 \times 360}{7} > 180$

Question 3

Candidates answered this very well showing that they were following the stages of the investigation and reading the questions carefully.

Answer: $\frac{2 \times 360}{5}$

Question 4

(a) Again this question was very well answered with very few mistakes.

Answer:

		$\frac{2}{5} \times 360$	
	3		
	4	$\frac{4}{9} \times 360$	160
	5	$\frac{5}{11} \times 360$	

(b) Most candidates were able to construct this formula. Those who did not do this correctly need to be made aware of the meaning of the phrase ‘in terms of’. A few candidates were very careless with their writing of the answer and gave answers that looked like $\frac{n}{2n + 1 \times 360}$.

Answer: $\frac{360n}{2n+1}$

(c) Most candidates realised that they needed to equate the formula from part **(b)** to 172.8. Most achieved an answer of n = 12 but some then did not realise that they had only found the number of sides with the number of points still to be calculated. More emphasis should be placed on showing the method for solving equations like this.

Answer: 25

Question 5

(a) Candidates should be encouraged to read the questions very carefully. Another misunderstanding here resulted in many losing one mark. The question asked for the ‘number of complete revolutions that the ant makes to draw each of these stars’. Many candidates wrote down the ‘number of possible 11-pointed stars’ – either 5 (including the polygon) or 4.

Answer: 2, 3, 4, 5

(b) Those candidates who read the question carefully noticed that it asked for an explanation about the calculations for the 15-pointed star and the 3-pointed star, so when the calculations were included in the explanation the candidates were awarded the mark. It was much more difficult to explain this connection without using the calculation, although many tried by using scale factors or multiples.

Answer: $\frac{6}{15} = \frac{2}{5}$

(c) The question asked for 'values of *A* that give a 15-pointed star'. This was the last question so candidates should expect that it would need more thought. Many candidates correctly worked out all the values for *A* with *n* from 2 to 7. Few realised that this meant that there were only three answers because 24°, 72° and 120° (n = 1, 3 and 5) all give regular polygons and 144° (n = 6) gives a 5-pointed star. Some candidates calculated 192° and then some did not identify it as excluded, (being more than 180°).

Answer: 48°, 96°, 168°

Communication

The communication on this investigation was very good. Candidates showed several steps for a substitution and calculation rather than just writing answers as many have done in the past.

Section B Modelling

Question 1

(a) Good substitution into an equation given in words was seen, giving mostly correct answers.

Answer: 80

(b) Candidates showed a good understanding of working backwards. Even when the units were changed to centimetres the correct value was given with the units.

Answer: 1.5

(c) Some candidates forgot to change the metres into centimetres making an answer of h – 100 a common error, but usually the correct formula, in terms of h, was written down.

Answer: $100h - 100$

(d) Candidates need to be able to work with different letters not just the ones usually used. For example, in this case $M = 100h - 100$ had to be linked to $y = mx + c$. It was the candidates who could not equate these two equations who were unable to answer this question correctly. Many candidates were also unable to provide a correct scale for their sketch.

Question 2

(a) Some candidates still need to practise writing down every step, especially for a question that asks them to show something. Others assumed the model and demonstrated that the values of 2 m and 88 kg worked, rather than deriving it from first principles.

(b) Substitution was very well completed and with only one line required for the 'show' this question was very well answered.

(c) Solving this equation having completed the simple substitution was quite easy and again well answered.

Answer: 1.87

Question 3

(a) Many candidates need practice in learning which method to use given certain phrases that reoccur quite regularly. The expected methods here are either to equate the equations of the two models or to draw the graphs on a graphics calculator, but candidates did not realise this and used trial (sometimes with improvement) to find a similar height answer for both models. Many of these reached 1.5 m which was not acceptable as there was a more accurate method. Candidates should also learn to look at their answers for any practical situation very carefully and to discount theoretical answers that do not fit. In this case an adult with a height of 3.06 m is not sensible, so this answer should be omitted.

Answer: 1.485 to 1.49

(b) Many candidates need to learn a method for answering this type of question that was intended as a straightforward interpretation of the model. Those candidates who used a sketch did not always interpret it correctly and rarely mentioned that adults were likely to be between 1.5 m and 2 m in height. Those candidates who used substitution did not always choose valid values for substituting and/or did not refer to their substitutions and answers to explain their choice of model. Some tried to explain why the structure of the model gave larger answers for a BMI.

Answer: Simple ($100h - 100$) and correct conclusion

Question 4

(a) This question was quite well answered. Many candidates, however, need to understand that 'write down' means exactly that and they did not need to rearrange or work with the equations having written them down.

Answer: $78 = k1.84^n$, $50 = k1.54^n$

(b) Candidates still need to practise showing every step of working when answering a 'Show that.' question and many need to learn how to solve simultaneous equations when the unknown is a power. Some candidates tried to rearrange one or both of the equations into different forms. Of those who did divide one equation by the other many just ignored the *k*s and did not show how they divided out to give 1.

Answer: $\dfrac{78}{50} = \dfrac{k1.84^n}{k1.54^n}$

(c) There were several different ways of finding the value of *n*. The only requirement was that the method chosen needed to be written out step by step because this was another 'show that' question.

Answer: $\dfrac{\log 1.56}{\log 1.195}$ or $\log_{1.195} 1.56$

(d) Most candidates correctly substituted leading to a well answered question.

Answer: 17

(e) Those candidates who used their graphics calculator with reasonable scales drew an accurate sketch. Candidates need to practise choosing scales so that the shape of the curve can be seen. Straight lines or curves with vertical sections or a top that curved backwards were not accepted.

Question 5

Again the expected methods were to either sketch the equations of the two models or to equate the two equations, but many candidates used trial to substitute different values and did not achieve the appropriate accuracy.

Answer: 1.67…

Communication

The communication was reasonable for this section with most candidates scoring one of the two available marks. Candidates need to be aware that labelling axes with appropriate scales on a sketch, as in **Questions 3(a)** and **5** is an excellent method of communication; as is showing all stages of working particularly when solving a quadratic equation as in **Question 3a**.

INTERNATIONAL MATHEMATICS

Paper 0607/63
Paper 63 (Extended)

Key Messages

To do well on the whole of this paper, candidates needed to go carefully through all working having read the questions thoroughly.

The candidates who scored well in ***Section A*** were those who knew how to find expressions for sequences where the terms were not consecutive e.g. sequences of odd or even numbered terms.

In ***Section B*** those candidates who substituted carefully and checked that their answers were reasonable were more likely to achieve the better marks.

General Comments

More candidates are working through each section on this paper as a unit of work. There is still room for improvement in looking back at previous answers to make sure they correspond with new calculations and that all the answers make sense.

Comments on Specific Questions

Section A Investigation

Question 1

(a) (i) (ii) (iii) Very well answered questions. Candidates followed through the examples and only very few put the crosses in incorrect places.

(b) Again very well answered. Most candidates worked out the number of cameras in terms of *n*.

Answer: $n + 1$

Question 2

(a) (i) (ii) (iii) This question proved slightly more difficult than **Question 1**. Some candidates did not think carefully enough about the situation and left some squares with some sides not covered by cameras. The main error being having not thought about the statement ‘ … give a clear view for a distance of one side …’.

(b) Also a well answered question. Some candidates used the difference of 2 to give n^2 so more work on very simple sequences is still necessary.

Answer: $2n + 2$

Question 3

Some candidates who were unable to sort out the positions of the cameras for **Questions 2(a)(i)** and **(ii)** found these two diagrams easier to arrange. For those with an incorrect answer there were as many with a lower value as with a higher number of camera; thus not indicating any particular misconception.

Answer: 9, 12

Question 4

(a) Candidates are well prepared in looking for patterns and most of them had no problem in completing all the empty cells in the table.

Answer:

	Number of squares in each row					
	1 square	2 squares	3 squares	4 squares	5 squares	n squares
One row					6	$n + 1$
Three rows	4		8	10	12	$2n + 2$
Five rows		9	12	15	18	$3n + 3$
Seven rows		12	16	20	24	$4n + 4$

(b) Although this is the extended paper most candidates found this step too great. They needed to take a sequence with term numbers 1, 3, 5 and 7 and link these to the coefficients/constants (1, 2, 3 and 4) in the expressions. Much more work on calculating or learning these expressions is necessary.

Answer: $\frac{1}{2}(r+1)n+\frac{1}{2}(r+1)$

(c) Most candidates did not consider all the possibilities. Although this was a follow on from part **(b)** it was also easy to calculate the answers from the n squares column in the table in part **(a)**. Most candidates calculated the 15 squares and 7 squares from one row and three rows. Some calculated 3 squares from seven rows but very few extended the sequence up to 15 rows to obtain 1 square per row.

Answer: 1, 3, 7, 15

Question 5

(a) Again the practical sections of this paper were well answered and this part produced more correct answers than **Questions 2(a)** and **3**.

Answer: 10, 13

(b) Most extended candidates could not find the required expression linking 2, 4, 6 and 8 squares in 2 rows with the minimum of 4, 7, 10 and 13 cameras. More work on finding expressions where 'n' does not run consecutively, like this part and **Question 4(b)**, is very necessary.

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

Question 6

(a) About half the candidates managed to follow the patterns to complete this table correctly. Composing and following on the pattern for the n squares proved quite difficult.

	Number of squares in each row				
	2 squares	4 squares	6 squares	8 squares	n squares
Two rows			10	13	$\frac{3n}{2}+1$
Four rows			17	22	$\frac{5n}{2}+2$
Six rows		17		31	$\frac{7n}{2}+3$
Eight rows		22	31		$\frac{9n}{2}+4$

(b) Almost half the candidates did not attempt this question. As before, finding connections between 2, 4, 6 and 8 rows and coefficients of 3, 5, 7 and 9 or constants of 1, 2, 3 and 4 was too difficult for most.

Answer: $\frac{1}{2}(r+1)n+\frac{1}{2}r$

Communication

The communication mark was usually achieved by the correct drawings in **Questions 3** and **5(a)** and many candidates made very good attempts at showing their method(s) for trying to find an expression, particularly in **Question 2(b)**.

Section B Modelling

Question 1

(a) On the whole, candidates are quite able to plot points accurately and to join them freehand to make a smooth curve.

(b) Incorrect answers only occurred when candidates did not know that they needed to project the curve to $x = 0$. Candidates should learn when it is and is not feasible to estimate from a projected curve/line.

Answer: 80 to 100

Question 2

(a) Much work needs to be done on matching relationships with their graphs. An overwhelming number of candidates chose the linear model to fit the curve they had just drawn. It was more likely to have been the quadratic connection so candidates should be taught to consider the practical implications of the situation in order to find a suitable model: For the quadratic, the extension of the curve into negative x values (days) does not make sense and there is no information to validate a turning point after more days (greater x).

Answer: pq^x

(b) More work needs to be done with candidates on solving equations and simultaneous equations with powers in them. Despite being told which values to use, candidates did not know how to solve these equations. Either by division or using substitution the answers could have been calculated quite easily and far too many candidates appeared not to know either of these methods and tried to resolve the situation by adding or subtracting.

Answer: 1.48

(c) Correctly following through a substitution is also a technique that needs to be practiced by many candidates. Even those with a correct answer for part **(b)** did not all manage to obtain the correct answer for p in this part.

Answer: 77.1

(d) (i) Candidates knew that they had to substitute to calculate the answer here. Many also used the value of 7. Practice on calculations involving indices would be useful. Some candidates did not rewrite the model as requested to do in the question.

Answer: 1099 to 1200

(ii) Again many candidates knew that they needed to substitute here but could not evaluate their model correctly with an index of zero. Others did not realise the value to use was zero or did not replace the x.

Answer: 77

(iii) Marks were awarded for an appropriate comparison of the two answers. The large range allowed in **Question 1(b)** and follow through marks for the values of p and q meant that the correct answer was the one that was relevant to the candidates correctly calculated answers. Many candidates were able to make suitable comments and others should be shown how to make a statement in these cases.

Question 3

(a) This question was well answered. There are still candidates who need practice in giving answers to the required degree of accuracy, such as 3 significant figures.

Answer: 2.23, 2.40, 2.57, 2.72

(b) This was also well answered. Some candidates need to make sure they know how to calculate a mean.

Answer: 3, 2.4

(c) Some candidates should do more work on reading scales. The main loss of marks on this question was for the incorrect plotting of the points mostly through using one small square (2 mm) on the vertical scale as 0.1.

(d) (i) Good knowledge of using $y = mx + c$ was shown here. The projected values were most commonly an extension of the line of best fit.

Answer: 1.89 to 1.95

(ii) Good knowledge that m represents the gradient and of how to find the gradient was shown.

Answer: 0.15 to 0.17

(e) As in **Question 2(d)** some candidates did not write out their model, or substituted incorrectly. Candidates should learn more about using logs to evaluate answers because the most common error was to give the log n value as the answer, without anti-logging.

Answer: 890 to 1390

(f) Again, the substitution of zero was not always made, nor in the correct place. The calculation was then usually correct with the value for log n given as the answer. Candidates need to understand about the working of logs so that they realise they need to antilog this value.

Answer: 79 to 90

Question 4

Candidates should be aware that in order to compare models they should look for similarities and differences and, if possible, compare these to any know data values. The work of this modelling section had drawn them to look at values at the start of the experiment and on the seventh day as well as giving them data from which they might extrapolate answers for day 0 and day 7.

Communication

The communication was reasonable but not as good as in the investigation. Showing two cases of substitution would have earned the mark so candidates should be encouraged to show the substitution not just the answer.