INTERNATIONAL MATHEMATICS

Paper 0607/01
Paper 1 (Core)

General comments

Most candidates were quite well prepared for this paper. The majority of candidates were able to demonstrate an understanding of some elements of the subject and it was rare to see a paper where a reasonable attempt had not been made to at least some of the questions. Working was usually shown for those questions for which it was appropriate and the standard of presentation was good. Time did not appear to be a factor as the majority completed the paper with most candidates attempting the final question.

Comments on specific questions

Question 1

(a) Although many candidates answered correctly, a number of candidates found the highest common factor and so gave an answer of 3.

(b) This was answered quite well with most candidates calculating both 5^2 and 2^3 correctly. A few candidates gave 5 – 2 as an incorrect first step.

Answers: **(a)** 18 **(b)** 17

Question 2

(a) This part was answered well, with some candidates being able to write down the correct answers without any working, whilst others correctly wrote down $250 $\div$ 5 as the first step.

(b) This was also answered well by most candidates who generally gave 200 g for one person as the first step.

Answers: **(a)** Samir 100 Josef 150 **(b)** 1600

Question 3

(a) Candidates would benefit from more practice on this section of the syllabus. Only a few candidates gave the correct answer with many unable to give an appropriate method to find the gradient. A small number of candidates who did know the correct formula then substituted the *x* coordinates in the numerator and the *y* coordinates in the denominator.

(b) There were only a few completely correct answers to this part. Candidates need to know the method for calculating the coordinates of the midpoint. Candidates could have used a sketch to obtain the answer to this part as well as part **(a)**.

Answers: **(a)** 2 **(b)** (3, 5)

Question 4

Most candidates answered this question correctly either by giving the number of equal sectors as $360 \div 60 = 6$ or by finding the fraction of the circle as $60 \div 360$.

Answer: 100 cm^2

Question 5

Candidates would benefit from more practice on this topic as this was found to be one of the most difficult questions on the paper.

(a) Some candidates gave the correct answer but many did not appreciate that, in this case, the total number of candidates could be obtained from the highest number on the cumulative frequency axis.

(b) Some candidates gave the lower quartile to earn one mark but did not go on to find the upper quartile and so did not give the interquartile range.

Answers: **(a)** 120 **(b)** 10

Question 6

(a) This part was answered well and any errors were caused by not aligning the dots carefully enough and therefore having 6 dots, for example, in the top row.
.
(b) This was also answered well even by those candidates who did not have the correct number of dots in part **(a)**.

(c) Many candidates omitted this part.

Answers: **(a)** Correct diagram **(b)** 1, 4, 9, 16 **(c)** n^2 or $n \times n$

Question 7

Candidates often made a good attempt at the algebra and earned at least two marks on this question. Most used the elimination method and generally were able to rearrange one of the equations and also to use a suitable multiplier to equate the coefficients of either x or y. The addition or subtraction of the equations caused difficulty for some, with a sign error being common. A few used substitution and usually made a correct start but sign errors were also made with this method.

Answers: $x = 3$, $y = -2$

Question 8

(a) Many candidates correctly identified angle *ADE* as 70° but then did not use the isosceles triangle *ADE* correctly, so it was quite common to see angle *AED* given as 70°.

(b) Candidates needed to appreciate that triangle *OPQ* is isosceles and that the angle between the tangent and the radius is 90°. A few candidates gave z as 20° possibly from assuming that it is 'alternate' to angle *OQP*.

Answers: **(a)** 55° **(b)** 140°, 70°

Question 9

(a) A good attempt was made at this part by many candidates. When multiplying out brackets, care needs to be taken with negative signs, as $-10y$ was seen quite frequently.

(b) Many candidates also made a good attempt at this part although it was common to see an expression that was only partially factorised i.e. a common factor of x or 3 used.

(c) Some candidates identified a suitable common denominator of 15 and although one or two incorrectly gave $\frac{2x-x}{15}$, some went on to give the correct answer.

Answers: **(a)** $x + 7y$ **(b)** $3x(x + 3y^2)$ **(c)** $\frac{7x}{15}$

Question 10

(a) This was answered quite well. Some assumed that the back face was a square and thus wrote down an expression such as 5 x 4 x 4^2.

(b) Candidates were often unable to identify the faces with equal areas. A few assumed that all the faces were equal and gave 5 x 4 x 6, for example.

Answers: **(a)** 100 **(b)** 130

Question 11

(a) This was answered very well, with most candidates plotting both points correctly.

(b) Although quite a number of candidates added up the scores for Test 2 and gave a total, some were unable to carry out the division by 8 correctly and gave an answer of 32 or 32.4 for example.

(c) This was done quite well by candidates who attempted to plot the point, either using the correct coordinates, or from their Test 2 coordinate obtained in part **(b)**.

(d) Candidates needed to appreciate that the line of best fit should pass through the mean coordinate. Some drew their line through the origin, which was not correct on this occasion.

Answers: **(a)** Both points plotted correctly **(b)** 32.5 **(c)** Correct point **(d)** Correct ruled line passing trough mean point.

INTERNATIONAL MATHEMATICS

Paper 0607/02
Paper 2 (Extended)

General comments

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

Bearings, graphs of common functions and the surface area of a cuboid were areas of the syllabus that candidates appeared to find problematic.

Comments on specific questions

Question 1

(a) Candidates demonstrated excellent skills at manipulating surds. Occasionally a candidate understood the need to express 75 as a product of its factors but did not appreciate the need for one of those factors to be a square number and hence faltered at $\sqrt{5\times15}$.

(b) Candidates demonstrated an excellent knowledge of the meaning of $\log_{10} 1000$. A few candidates recognised that $1000 = 10^3$ but did not go on to deduce that the value of the log was 3.

Answer: **(a)** $5\sqrt{3}$ **(b)** 3

Question 2

Candidates were skilled at extracting a common factor from each pair of terms and many went on to give a fully correct answer. A wrong first step involved sign errors of the type $2a(c + 3) – 5b(c – 3)$. Candidates could focus more on ensuring that the brackets contain identical expressions so that progress to full factorisation can be made. Candidates should be aware of the difference in the meaning of $2a – 5b(c + 3)$ and $(2a – 5b)(c + 3)$.

Answer: $(2a – 5b)(c + 3)$

Question 3

Two very successful approaches to this question were seen. The most efficient began with $\frac{a-1}{6-2}=\frac{3}{2}$ and candidates were able to manipulate the equation to evaluate a. The second approach began with evaluating c in $y = mx + c$ from $1=\frac{3}{2}\times2+c$ and then substituting $(6, a)$ into $y=\frac{3}{2}x-2$. Candidates who attempted this approach sometimes lost their way after evaluating c and were unable to link this to the second stage to evaluate a. Only a small minority of candidates inverted the gradient to **K** x'/y' Many candidates successfully used a simple sketch either to obtain their value of a or to verify it.

Answer: $a = 7$

Question 4

(a) (i) Candidates understood how to find the median.

(ii) Candidates who found the UQ and the LQ used the values successfully to find the IQR. Candidates need to understand that, from a graph, it is acceptable in a sample of 200 plants, to look for the UQ at the 150th value and the LQ at the 50th value. Attempts to use methods more appropriate to lists of data led to confusion and rarely to more accurate answers.

(b) Candidates understood how to find the number of plants with heights greater than 50 cm and most were able to convert this to a percentage. Occasionally the percentage of plants with heights of 50 or less was calculated instead.

Answers: **(a) (i)** 45 **(ii)** 25 **(b)** 34 to 36 inclusive.

Question 5

Candidates who used a simple sketch showing a cuboid with sides labelled x, x and y were very successful at both parts of this question. Part **(a)** was generally done well but this was followed by common wrong answers of $6xy$ and $6x^2$ in part **(b).** Some candidates interchanged the methods for finding volume and surface area.

Answers: **(a)** $x^2 y$ **(b)** $4xy + 2x^2$

Question 6

(a) Bearings did not seem to be fully understood. Many sketches showed a bearing of 210^o of *B* from *A* instead of *A* from *B* or did not label *A* and *B* at all. Some angles of 210^o were measured anti-clockwise from North whilst others were measured starting from East or West. Some candidates who indicated 210^o starting from North in a clockwise direction showed 210^o as an acute angle or gave *BA* a direction between West and North.

(b) Candidates with accurate sketches in part (**a**) or with *A* and *B* reversed usually successfully used trigonometry in part (**b**) to find a horizontal distance. A good knowledge of sin30^o = ½ was demonstrated. Candidates should note that scale drawing is not an acceptable alternative method to calculation.

Answers: **(b)** 25

Question 7

Candidates successfully set up $2\begin{pmatrix}3\\-2\end{pmatrix}+k\begin{pmatrix}-2\\5\end{pmatrix}=\begin{pmatrix}-2\\16\end{pmatrix}$ and many then considered the equations $6 - 2k = -2$ or $-4 + 5k = 16$ separately to establish that $k = 4$. Some candidates attempted to work with column vectors throughout, incorrectly showing divisions such as $\begin{pmatrix}-8\\20\end{pmatrix}\div\begin{pmatrix}-2\\5\end{pmatrix}=\begin{pmatrix}4\\4\end{pmatrix}$ and stating $k = \begin{pmatrix}4\\4\end{pmatrix}$ as their final answer.

Answer: 4

Question 8

(a) Candidates showed excellent understanding of g(2).

(b) Many candidates understood the operation g(f(x)) and scored full marks here. Of the incorrect answers seen, g(x) x f(x) = $(3x^2+ 1)(2x - 1)$ was common and more rarely f(g(x)) = $2(3x^2 + 1) - 1$.

(c) Many candidates understood how to find the inverse function either by using a flow chart or rearranging $x = 2y - 1$. A common error was $f^{-1}(x) = \frac{1}{2x-1}$.

Answers: **(a)** 13 **(b)** $3(2x-1)^2 + 1$ **(c)** $\frac{x+1}{2}$

Question 9

Candidates who recalled that $\textit{frequency density} = \frac{\textit{frequency}}{\textit{group width}}$ usually went on to score full marks on this question using bars of correct widths and heights. Some candidates did not understand the relationship between frequency and area in a histogram and showed bars of correct widths but with heights of 2, 1, 1, 3 and 3.

Answer: Histogram with bars of heights 2, 1, 0.5, 6, 2.

Question 10

(a) Candidates understood how to complete the tree diagram correctly.

(b) Many fully correct methods were seen, often leading to the correct answer. Candidates need to take care with mental multiplication of decimals; 0.8 x 0.9 = 7.2 and 0.2 x 0.5 = 0.01 were not uncommon. Candidates should always be aware that a probability cannot be greater than 1. Errors such as 0.8 + 0.9 and 0.2 + 0.5 were seen.

Answers: **(a)** 0.2, 0.1, 0.5 and 0.5 placed correctly on the tree diagram. **(b)** 0.82

Question 11

Candidates who set up simultaneous equations using any two of the pairs (–1, 0), (3, 0), (1, –8) or (2, –6) showed competence in solving the equations to achieve the correct solutions. Many candidates did not understand how to use the intercepts with the x-axis and simply gave the values $a = -1$ and $b = 3$. A minority of candidates successfully used the approach $a(x+1)(x-3)$ followed by $-6 = a \times 1 \times -3$ to evaluate a.

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

Question 12

Candidates did not appear to have committed the general shapes of common graphs to memory. The most successful candidates in this question showed some evidence of having given k a nominal value (often 2) and calculating some sets of co-ordinates for each of the equations given. Many candidates recognised that the first graph was a modulus function but then chose equation **B** instead of **D**.

Answers: **D**, **E**, **A**

INTERNATIONAL MATHEMATICS

Paper 0607/03

Paper 3 (Core)

General comments

This was the first November sitting for this new syllabus. It is pleasing to report that the overall performances were quite successful, although a few candidates found the paper to be challenging.

There appeared to be adequate working space throughout the paper and all candidates had sufficient time to complete the examination. The work was usually clear and well set out. The front cover of the paper is quite clear about the need to show relevant working and candidates do have a responsibility to show how they arrived at their answers. In some cases an effort was made to check answers to see if the method had been correct. In others, some evidence was needed when final answers were incorrect. In any event, candidates may earn method marks when an answer is incorrect.

The responses to the questions involving the use of graphics calculators were extremely varied. Some Centres had clearly prepared their candidates thoroughly. Others would benefit from more work using this important tool. The syllabus contains a list of requirements for the graphics calculator. Many candidates only used it for curve sketching, and did not use the statistics capabilities of the calculator in **Question 9**. Centres should be advised that one mark answers are an indication that a calculator is expected to be used, especially when, for example, there is only one mark for the mean.

Weaker areas were the questions on transformations of graphs of functions, asymptotes and set notation.

Comments on specific questions

Question 1

(a) Many candidates scored full marks, but a common error was 2.76×10^3. A few candidates either did not recognise the words "standard form" or were unable to attempt this part.

(b) This was generally well answered with most candidates demonstrating how to calculate a fraction of a given quantity.

(c) (i) This was usually correct. Some candidates misread the question and found 4% of 276 000 rather than increasing it by 4%.

(ii) Many candidates found this part difficult. More work on rounding numbers to, for example, the nearest ten thousand would be beneficial.

Answers: **(a)** 2.76×10^5 **(b)** 135 930 **(c) (i)** 287 040 **(ii)** 290 000

Question 2

(a) This part on stem-and-leaf diagrams was omitted by a number of candidates. More care was needed when completing the lists by some of those who knew the topic. Very few were able to interpret the diagram to find the median.

(b) The bar graph was generally well done, often without making use of part **(a)**. The column for 30 was occasionally omitted, probably because of the 0 in the 30 row.

(c) Most candidates were successful in this straightforward percentage calculation, although a few found 2 as a percentage of 29.

Answers: **(a)(i)** 7, 5, 5, 9, 6, 9 and 9, 5, 3, 1 **(ii)** 5, 5, 6, 7, 8, 9, 9 and 1, 1, 3, 4, 4, 5, 5, 5, 5, 5, 9, 9 and 0 **(iii)** 23.5 **(b)** columns for 23, 24, 25, 29 and 30 with heights of 1, 2, 5, 2 and 1 **(c)** 10%

Question 3

(a) Most candidates were able to draw a translation, a reflection and a rotation. There were also many who made errors with the specific requirements of each transformation, thus gaining only one mark out of two in such parts. The rotation proved to be the weakest of the three transformations with errors in the centre of rotation.

(b) The enlargement was usually recognised and the correct scale factor was frequently given. Candidates should remember that the centre of enlargement must be given, as this was often either omitted or incorrect.

Answers: **(a)** Correct translation, reflection and rotation. **(b)** enlargement, scale factor 3, centre (– 8, 6)

Question 4

(a) Most candidates gave a correct arrival time after adding 19 minutes to a starting time.

(b)(i) This calculation of speed was generally well done. Candidates would benefit from more work on converting between units, as the conversion into km/h in part **(ii)** was rarely correct.

(c) The multiplication of 850 m by 10 was recognised by many candidates. Some candidates only multiplied by 5. The conversion into kilometres was usually correct.

Candidates should be encouraged to check what information they have been given in a question, since some carried out a lengthy calculation of multiplying the speed by the time to obtain the 850 m, which had been given.

Answers: **(a)** 08 10 **(b) (i)** 44.7 m/min **(ii)** 2.68 km/h **(c)** 8.5 m

Question 5

(a) There were some good sketches of the two parabolas. Other candidates did not attempt this part. The use of a graphics calculator is an important aspect of this syllabus and this question is typical of what should be a straightforward sketching task.

(b) Candidates found the transformations of graphs of functions a challenging topic. It was hoped that sketching the two curves would make the translation more visual as opposed to a piece of theory.

(c) This part was intended to test the theory on transformations of graphs of functions i.e. $f(x) + c$. Few candidates knew what to do. One mark out of two for $f(x) + 3$ was sometimes gained.

Answers: **(b)** translation $\begin{pmatrix}1\\0\end{pmatrix}$ **(c)** $x^2 + 3$

Question 6

(a) Many candidates drew the correct line accurately after plotting several points. Candidates perhaps, erroneously, felt that the need for an accurate graph made the use of a graphics calculator irrelevant. Some candidates were unable to draw this line and ended up drawing a line connecting the point *R* to the origin. Those who had a correct line found the labelling of *P* and *Q* quite easy.

(b) Most candidates who had part **(a)** correct were able to plot *R* and complete the triangle.

(c) Candidates found this part, to find an angle using trigonometry, much more difficult, even given the instruction to use trigonometry. Some candidates lost the final mark by overlooking the requirement of one decimal place. A few thought it necessary to calculate the length of *PQ* when tangent was available using the vertical and horizontal distances.

Answers: **(c)** 26.6˚

Question 7

This geometry question of many parts met with mixed success and the majority of candidates were able to earn some marks.

(a) The name "pentagon" was usually seen.

(b) Most candidates correctly used a parallel line property, although a few thought the angle in question was allied to angle *EAB* as opposed to corresponding to it.

(c) Most candidates knew the sum of the angles of a pentagon but full marks were given for simply stating 540˚.

(d) This part was found a little more challenging since it required answers from parts **(b)** and **(c)**. Follow through marks were given where possible.

(e) (i) The majority of candidates extended the two lines correctly to meet at *F*, although some thought *F* had to be inside the polygon.

(ii) A range of answers was seen here, including parallelogram and rectangle when the quadrilateral clearly had only one pair of parallel sides.

(iii) This part depended on part **(d)** and candidates still had to use angles on a straight line and in a triangle. The successful answers usually came from a correct part **(d)** although a follow through was possible.

(iv) Those candidates who had been successful in part **(iii)** usually went on to a correct "equilateral" here and some of those who did not have 60˚ in part **(iii)** did realise that "isosceles" was the answer and this was allowed.

Answers: **(a)** pentagon **(b)** 108˚ **(c)** 540˚ **(d)** 120˚ **(e) (ii)** trapezium **(iii)** 60˚ **(iv)** equilateral.

Question 8

Many candidates had difficulty with set notation, and more familiarity with this would be beneficial, as parts of this question were written to test notation as well as the understanding of sets.

(a) (i) Most candidates correctly listed the elements of the set *P*.

(ii) Very few candidates gave the complement of *P* as their answer and gave incorrect combinations of *Q* and U.

(iii) This intersection set was more successful.

(iv) Very few candidates appeared to be familiar with the n notation and answers were usually elements of the sets and rarely numerical.

(b) The region $P \cap Q'$ was rarely correctly shaded and this part was often omitted.

(c) The two straightforward probability parts were much more successful than the questions involving sets.

(d) It is pleasing to report that many candidates succeeded in this type of "conditional probability" from the Venn diagram.

(e) Expectation proved to be more challenging with several candidates giving a probability as an answer. Another error seen was interpreting the question as one particular member of *P* and using $\frac{1}{7}$ instead of $\frac{3}{7}$.

Answers: **(a) (i)** *a*, *e*, *f* **(ii)** *P′* **(iii)** *e*, *f* **(iv)** 6 **(c) (i)** $\frac{1}{7}$ **(ii)** 0 **(d)** $\frac{1}{3}$ **(e)** 30

Question 9

Centres are reminded that certain statistical functions on the graphics calculator are a syllabus requirement. In part **(b)** the mean and median could have easily been found using the calculator.

(a) The fraction was often correct. A common error was making the value of 22, and not its frequency, as the numerator.

(b) (i) The range was usually correctly stated, with the common error of lowest value to highest value seen a few times.

(ii) One mark for the mean from a frequency table should have signalled the use of the graphics calculator. Many candidates carried out the full calculation, often correctly to their credit. This was a lot to do for only one mark.

(iii) The median was also available from the graphics calculator but this facility was rarely used. There was little success for those who used the table to find the middle value.

(iv) A surprising number of candidates failed to recognise the mode.

(c) This angle on a pie chart was generally well calculated.

Answers: **(a)** $\frac{1}{5}$ **(b) (i)** 6 **(ii)** 22.07 or 22.1 **(iii)** 22.5 **(iv)** 23 **(c)** 111.6 or 112

Question 10

(a) Candidates found this conversion using square kilometres, square metres and hectares very difficult. Follow through from any answer in this part was rewarded in part **(b)(ii)**.

(b) (i) The simplest method of subtracting the area of a triangle from the area of a rectangle was often overlooked. Several candidates thought the area of the rectangle was the required area, even though the question carried 3 marks.

(ii) Any answer from part **(a)** was followed through as was the answer to part **(b)(i)**. However further conversion errors often appeared such as factors of ten or dividing by the answer to part **(a)**.

(c) (i) The stronger candidates realised that a Pythagoras calculation was required to find one side of the pentagon and these candidates usually went on to obtain a fully correct perimeter. Some thought the full rectangle was the perimeter whilst others gave the four more obvious lengths, omitting the side *CD*. As in part **(b)(i)**, candidates should be guided by the number of marks being given.

(ii) The cost was usually calculated correctly and a full follow through was available from part **(i)**.

Answers: **(a)** 100 **(b) (i)** 0.9 km^2 **(ii)** 90 ha **(c) (i)** 3.8 km **(ii)** $1710

Question 11

This question revealed problems with the use of a graphics calculator in several respects, as will be described by the comments below.

(a) There were few rectangular hyperbolae seen. Candidates need to remember to use brackets where necessary to ensure that they enter the correct equation into the calculator; several straight lines suggested $\frac{x}{x} - 2$ was used rather than using brackets around the $x - 2$. Part **(b)** did not seem to act as a prompt that two asymptotes could well suggest a hyperbola.

(b) Candidates were unable to find the asymptotes correctly. Asymptotes may be challenging but they are part of the core syllabus and the graphics calculator is a useful tool in demonstrating such lines.

(c) The only answers offered were descriptions of the domain. Again, this is a difficult topic but it can be made more visual and accessible with the use of a calculator.

(d) (i) The straight line was often correctly drawn and was the first mark gained by many candidates.

(ii) A small number of candidates obtained the *x*-co-ordinates of the points of intersection from the graphics calculator but several resorted to algebra, which is beyond the core syllabus.

Answers: **(a)** $x = 2$, $y = 1$ **(c)** $y \in R$, $y \neq 1$ **(d) (ii)** 0, 4

INTERNATIONAL MATHEMATICS

Paper 0607/04
Paper 4 (Extended)

General comments

This was the first November sitting of this examination. The paper was found to be accessible to most candidates and there was a reasonable number of high scoring scripts. The scores were well spread out suggesting that the paper successfully discriminated throughout the ability range.

The topics which were found to be the most difficult were a quadratic equation problem, domain and transformation of trigonometrical functions, circle properties and similar triangles.

Candidates performed well on the questions on sets and Venn diagrams, percentage decrease, standard form, solving a quadratic equation, graphs of straight line equations, formulating and solving a linear equation, transformations and scatter diagrams.

The graphics calculator was rarely used to its full potential and most candidates had problems with the graph sketching and interpreting question (**Question 14**). It is important that candidates are made aware of this important part of the course, and they would benefit from more practice using a graphics calculator.

The working space proved to be more than sufficient for almost all candidates. Additional paper should only be given out if a candidate requires more working space. If a candidate does use extra paper then the script should be annotated accordingly.

Most candidates proved to be very accurate with their working, either by keeping values in their calculator or working with 4 or more significant figures. There are some situations where an exact surd or exact multiple of π will be a perfectly acceptable answer, as well as the usual correct to 3 significant figures. However there were some common accuracy errors which will be dealt with in the comments on individual questions. The mark schemes, whenever possible, do not penalise a lack of accuracy or poor rounding very heavily but a few candidates seem to think that working with 3 significant figures through a multi-step question will give 3 figure accuracy at the end. This includes the use of 3.14 for π.

The "show that" and "explain why" questions posed some difficulties and candidates are encouraged to practice these more and realise that they have more to do than when a question asks for an answer. In a "show that" question, the answer is given, so the credit is for steps clearly arriving at the answer and not for the answer itself. The candidate should read these questions carefully and decide on exactly what is required. The "explain why" questions are looking for straightforward reasons.

Most candidates displayed all the necessary working in a clear way thus gaining full marks for correctly worked out answers or at least method marks for correct working. There could be questions on this paper where an answer alone may not score full marks as indicated on the front cover of the examination paper.

Quite a number of candidates worked in radians in trigonometry, almost certainly by accident. It was not always possible to recognise this and so this slip may have been expensive, depending on how much working was seen. This may have been due to re-setting calculators before the examination. If this procedure is carried out then candidates need to be clearly advised to set their calculators back into degrees.

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

Comments on specific questions

Question 1

(a) The average speed was usually calculated correctly and it was pleasing to see most candidates changing 5 h 21 min into 5.35 hours or 321 minutes.

As the speed was given and candidates were asked to show that it was 63.55 km/h, correct to 2 decimal places there was a requirement to show an answer more accurate than this.

(b) (i) The reduction by 15% was usually correctly calculated.

(ii) Most candidates succeeded in dividing the distance by the new speed in part **(i)** but many rounded this to 2 decimal places and when converting to minutes, to the nearest minute, this led to an inaccurate answer. Another frequent error was giving the journey time as the final answer and not the arrival time.

Answers: **(a)** 63.551… km/h **(b)** **(i)** 54.0 km/h **(ii)** 19 18

Question 2

(a) (i) This indices calculation was successfully done by most candidates.

(ii) The conversion of part **(i)** into standard form was also well done. Many candidates also rounded their answer to part **(i)** but this was accepted for the mark.

(b) This power and root calculation was found to be more searching but many candidates scored full marks for a correct calculation and then conversion into standard form. As this was a reciprocal expression, some candidates left their final answer as a reciprocal after only calculating the denominator.

(c) Many candidates realised that this involved finding a fifth root and did this successfully to an appropriate accuracy.

(d) The better candidates gave a correct expression in terms of logarithms and this led to a correct value of the power. Many candidates calculated a root, believing that this question was the same type as part **(c)**. This part was also frequently omitted.

Answers: **(a) (i)** 93 312 **(ii)** 9.3312×10^4 **(b)** 9.69×10^{-3} **(c)** 4.57 **(d)** 4.72

Question 3

(a) Almost all candidates used the formula to solve this quadratic equation, usually successfully. Answers were occasionally given to a different level of accuracy to the required 2 decimal places in the question.

A sketch of the graph was rarely seen and this endorses comments about the awareness of the use of the graphics calculator.

Correct answers without working only scored 2 of the 3 marks. A sketch of the graph would have been totally acceptable for the working.

(b) This inequality followed the equation in part **(i)** and would have been much easier had a graphical approach been used. The stronger candidates managed to use their answers from part **(i)** regardless of which method they had used.

Answers: **(a)** – 3.24, 1.24 **(b)** $-3.24 \le x \le 1.24$

Question 4

(a) The three straight lines were usually correctly sketched with many candidates clearly recognising the form of each without the need to obtain values or use the graphics calculator. The line $y = 2x$ was occasionally sketched with a gradient of about 0.5.

(b) The region was often correctly indicated although a number of candidates thought it had to be the region enclosed only by the three lines drawn and overlooked the inequality $x \geq 0$.

Question 5

(a) This question was set for the use of the graphics calculator in statistics and three of the five answers were directly available using this tool. The evidence was that candidates rarely took this approach as working was usually seen for the calculation of the mean. The fact that each part only carried one mark should have been an indication that a calculator could be used.

(i) This was often omitted or given as 1 to 6, instead of the difference of 5.

(ii) Most candidates gained this mark for the mode.

(iii) Many candidates obtained the median correctly but there were those who ignored the given frequencies.

(iv) The mean was usually correct but, as stated earlier, a lot of work was done for only one mark.

(v) The upper quartile was found to be a discriminating question and again many candidates ignored the frequencies.

(b) To find the number of successes given the probability was found to be quite challenging. A common error was to give the frequency rather than the actual event (number of passengers).

(c) (i) This straightforward calculation of a probability was well done.

(ii) The expected value was also often correctly calculated.

Answers: **(a) (i)** 5 **(ii)** 2 **(iii)** 3 **(iv)** 2.875 **(v)** 4 **(b)** 2 **(c)** **(i)** $\frac{1}{8}$ **(ii)** 45

Question 6

(a) This worded problem leading to a linear equation was very well answered. The few candidates who did not set up an equation and used trial and improvement were generally unsuccessful.

(b) (i) This worded problem requiring algebraic fractions leading to a given quadratic equation was found to be more demanding although there were some excellent solutions with every line correctly carried out and shown.

(ii) The factorising of $4y^2 - 4y - 15$ also proved to be challenging and the correct factors were not frequently seen.

(iii) The candidates who succeeded in part **(ii)** usually carried on to interpret the value of y as the cost of 1 kg of peas.

Answers: **(a)** 1.15 **(b)(ii)** $(2y - 5)(2y + 3)$ **(iii)** $2.50

Question 7

(a) The set of real numbers was rarely seen. The common answer was a domain from the candidate's screen and the question was often omitted.

(b) The amplitude was often correctly given but the period was less frequently given. The period was often given as 4, the coefficient of x rather than 360 divided by this coefficient. Other frequent answers were 3sin and $4x$, indicating that the candidates did know the topic to a certain extent.

(c) This part of the syllabus is quite clear but a number of candidates seemed to only be able to attempt it with the help of the graphs. This should not have been a problem with the availability of the graphics calculator.

(i) The stretch factor was often correct together with the invariant line. Enlargement was a common error.

(ii) Many candidates were able to describe that there was a slide to the left of 60 but many did not use the word translation, even though the word was in the next question.

Answers: **(a)** $\mathbb{R}$ **(b)** 3, 90 **(c)** **(i)** stretch, factor 2, x-axis invariant **(ii)** translation $\begin{pmatrix} -60 \\ 0 \end{pmatrix}$

Question 8

(a) (i) The translation was usually correctly drawn.

(ii) The reflection was also often correctly drawn. Errors included reflecting the image in part **(i)** or reflecting the object in an axis.

(b) The enlargement was usually correctly described, although the centre was occasionally omitted.

(c) The inverse vector was often correct but many candidates thought that this was the complete answer when the word translation was also required.

Answers: **(b)** enlargement, factor 2, centre (4, 0) **(c)** translation $\begin{pmatrix} 6 \\ -3 \end{pmatrix}$

Question 9

(a) The list of prime numbers less than 20 was usually correctly completed. Candidates occasionally omitted 2.

(b) The Venn diagram was also often correctly completed and extra values not in the universal set were ignored. Elements repeated in different parts could not be condoned.

(c) and (d) The stronger candidates were comfortable with set notation but there were frequent omissions to these two parts.

(e) Although this part was also about set notation, there was more success with the shading of a region in the Venn diagram.

Answers: **(a)** {2, 3, 5, 7, 11, 13, 17, 19} **(c)** {3, 11, 17, 19} **(d)** 3

Question 10

(a) (i) This "explain why" two triangles are similar question was found to be very challenging. Candidates often gave correct pairs but without reasons. The fact about all pairs of angles being equal was also often overlooked. More experience of this type of question would benefit candidates.

(ii) The area factor was correctly used by many candidates. Others were successful by finding the height of the smaller triangle and using the ratio of the sides to find the required height. The common error was to use the ratio of the lengths instead of squaring it.

(b) This question was a mixture of circle geometry and right-angled triangle trigonometry. Many candidates coped with this and used correct circle properties in parts **(i)** and **(ii)** and were then able to switch to trigonometry.

(i) Angles subtended by the same arc was usually correctly used to find an angle.

(ii) Opposite angles of a cyclic quadrilateral was the straightforward property expected to be used and many candidates used this route correctly. Others used a more complicated method by finding several other angles on the diagram. There were some unexpected errors such as thinking that there were some alternate angles or presuming an angle of a cyclic quadrilateral to be 90°.

(iii) The correct use of trigonometry in a right-angled triangle was seen frequently. Some candidates used the sine rule but were still successful.

(iv) This one mark question proved to be a discriminator with many candidates not realising that *QR* must be a diameter of the circle in question.

Answers: **(a) (ii)** 18 cm^2 **(b) (i)** 50° **(ii)** 98° **(iii)** 5.14 cm **(c)** 4 cm

Question 11

(a) The scatter diagram was almost always correctly completed.

(b) The correlation was usually correctly given as negative.

(c) (i) Most candidates did apply the graphics calculator to obtain the line of regression and they were usually correct. A few candidates found an equation of their line on the diagram.

(ii) Correct interpretations of the line of regression were usually seen and even those with their own equation did give a correct reading. It is also pleasing to report that most candidates gave their answers as integers.

Answers: **(b)** negative **(c) (i)** $y = -0.565x + 58.5$ **(ii)** 30 or 31

Question 12

This question on the sine rule and the ambiguous case was found to be rather unusual, although there were some excellent solutions.

(a) The sine rule was usually applied correctly and a correct sine was seen. Many candidates went on to find the angle but this was condoned. Answers were required to 4 decimal places and this was often overlooked.

(b) (i) The two possible positions were usually correctly drawn on the line in the diagram.

(ii) There were many correct answers for the two possible angles, although only one was often seen.

(iii) Candidate who had the two answers in part **(ii)** usually used angles in a triangle to calculate this angle correctly. If they did not have the two angles, they were unable to do this part.

Answers: **(a)** 0.8333 **(b) (ii)** 56.4, 123.6 **(iii)** 67.1 or 67.2

Question 13

(a) The area of the semicircle was usually correctly calculated.

(b) Most candidates multiplied part **(a)** by a length although the length being given in metres was often overlooked.

(c) (i) The angle subtended at the centre was often correctly calculated by using either the isosceles triangle or the sine or cosine rule. A surprising number of candidates thought that the chord *AB* was 50 cm.

(ii) Both methods for calculating the area of the triangle were seen and often with success.

(iii) The area of a sector was also often correctly evaluated.

(iv) Most candidates realised that this area was the difference between the sector in part **(iii)** and the triangle in part **(ii)**. There were some lengthy solutions even though this part only offered one mark.

(v) Most candidates demonstrated that the volume of a prism is area multiplied by length but many had problems with the length being given in metres and the answer was required to be in litres.

Many candidates were able to gain several follow through marks after an early mistake. The ranges given in the answers were to accommodate different but reasonable rounding of the various parts.

Answers: **(a)** 982 **(b)** 295 000 **(c)** **(i)** 106.3 **(ii)** 299.9 to 300.4 **(iii)** 577.8 to 580 **(iv)** 277 to 280.1 **(v)** 83.1 to 84.03

Question 14

There were some excellent solutions but many candidates were unable to produce a sketch, indicating a lack of experience in the use of the graphics calculator.

(a) The sketches seen were good, usually scoring full marks. It is pleasing to state that most candidates who managed a sketch did appear to have a correct set of axes on their calculator.

(b) The local maximum point was usually correctly stated and the accuracy suggested that the maximum point function on the calculator had been used.

(c) The range of the function was less successfully answered, with many candidates not realising the need to find the *y*-co-ordinate of the minimum point.

(d) This was another interpretation from a sketch found to be difficult. There were several correct answers but this part was frequently omitted.

(e) Many correct answers appeared here without any working, suggesting that a solving facility on the calculator had been used, often after multiplying the equation out into a polynomial. The expected addition of a straight line to the diagram was rarely seen.

Answers: **(b)** $(-5.19, 1.24)$ **(c)** $0.161 \le f(x) \le 1.24$ **(d)** $y = 1$ **(e)** -1.62

INTERNATIONAL MATHEMATICS

Paper 0607/05
Paper 5 (Core)

General comments

This paper was based on investigating some of the patterns formed by using the numbers in the Fibonacci sequence. Explanations and leads were given on the question paper and all candidates were able to show that they could follow through from a given example.

The first two questions were completed very successfully and it was pleasing to see how well candidates could comprehend and recognise patterns. Also most candidates gained the communication mark for explaining how they calculated their answers to **Question 1**.

Most candidates had at least some success with the drawing aspect in the first parts of the last question, although some found this more challenging than calculating numerical answers. The skill of using drawing to help in an investigation should not be underestimated.

The last two parts of **Question 3** stretched candidates to generalise the pattern. It was good to see so many worthwhile attempts to the end of this paper.

Comments on specific questions

Question 1

This question was designed to enable the candidates to show their understanding of the basis of the investigation, as explained at the beginning of the paper – how the numbers in the Fibonacci sequence are calculated. Candidates answered this well and also used the opportunity to gain a communication mark for showing their working used to calculate their answers.

Answer:

Term position	14	15
Fibonacci number	377	610

Question 2

This question tested whether candidates could follow a suggested link between certain numbers and their positions in the sequence. Candidates were very successful in spotting the patterns and using the numbers given in the original table and their answers to **Question 1**. They also successfully calculated the sixteenth term for part **(b)(i)**. Part **(c)** was more challenging due to the fact that it was necessary to look at all the work in the previous parts of **Question 2** and not just the answers to part **(b)(ii)**.

Answers:

(a)

Term position	6	9	12
Fibonacci number	8	34	144

(b)(i)

Term position	8	12	16
Fibonacci number	21	144	987

4th term…
4th term …

(ii)

Term position	5	10	15
Fibonacci number	5	55	610

5th term …
5th term …of 5

(c) 6th term

Question 3

This question gave the candidates the opportunity to investigate the Golden Rectangle.

(a) and (b) Most candidates started with the correct sized rectangles and all attempted to then divide these into squares. Many found this to be more challenging than they had perhaps expected and having done their drawings in pen many did not appear to attempt to correct their answers. Most candidates who used pencil tried to amend their drawings and showed that they understood what they were trying to achieve. Credit was given to those attempts that showed some correct squares within each diagram.

Answers:

(a) 5 by 8 rectangle drawn, divided into: one 5 by 5 square
one 3 by 3 square
one 2 by 2 square
and two 1 by 1 squares

(b)
8 by 13 rectangle drawn, divided into: one 8 by 8 square
one 5 by 5 square
one 3 by 3 square
one 2 by 2 square
and two 1 by 1 squares

(c) This part of the question led the candidates to look again at patterns this time using the least number of squares in Golden Rectangles. The table in part **(i)** was successfully completed. In part **(ii)** many candidates did not realise that this was not just the next size of rectangle following on from the table in part **(i)**. Some of these candidates made an attempt at part **(iii)** but did not attempt part **(d)**. The candidates who did spot the connection for part **(ii)** successfully completed part **(iii)** and made an attempt at part **(d)**. The intention of part **(iii)** was to see if candidates had recognised the pattern and could then use it to find a numerical answer.

Answers:

(c)(i)

Size of rectangle	1 by 2	2 by 3	5 by 8	8 by 13
Least number of squares	2	3	5	6

(ii) 8

(iii) 89 144

(d) The intention of this question was to see if candidates could now express the result they had found in part **(c)** in algebraic terms. It was good to see that if the candidates had attempted part **(c)** they were willing to try this and many of these attempts were successful.

Answer: $n - 1$

INTERNATIONAL MATHEMATICS

Paper 0607/06

Paper 6 (Extended)

General comments

This examination paper presented candidates with an investigation task and a modelling task. The ratio of marks for these two sections was approximately 3:2 indicated by the advised time to be spent on each part. The investigation was very well completed by most candidates and although many found the modelling section more challenging most of the answers to this were also very good.

Comments on specific questions

Part A Investigation

This part was based on investigating some of the patterns formed by using the numbers in the Fibonacci sequence. Explanations and leads were given on the question paper and all candidates were able to show that they could follow through from a given example.

Almost all the questions were completed very successfully and it was good to see how well candidates could comprehend and recognise patterns. Most of the candidates gained the communication mark in **Question 1** and many also gained it in the last part of **Question 3**.

Most candidates had success with the drawing aspect in the first parts of the last question, although some found this more challenging than calculating numerical answers. The skill of using drawing to help in an investigation should not be underestimated.

The last part of **Question 3** stretched candidates to generalise a pattern in words. The skills of being able to generalise both algebraically and using words are most important in the conclusion of an investigation.

Question 1

This question was designed to enable the candidates to show their understanding of the basis of the investigation, as explained at the beginning of the paper – how the numbers in the Fibonacci sequence are calculated. Candidates answered this well and also used the opportunity to gain a communication mark for showing their working used to calculate their answers.

Answer:

Term position	14	15
Fibonacci number	377	610

Question 2

This question tested whether candidates could follow a suggested link between certain numbers and their positions in the sequence. Candidates were very successful in spotting the patterns and using the numbers given in the original table and their answers to **Question 1**. They also successfully calculated the sixteenth term for part **(b)(i)**. Part **(c)** was more challenging due to the fact that it was necessary to look at all the work in the previous parts of **Question 2** and not just the answers to part **(b)(ii)**. Most candidates showed that they were able to do this and answered part **(c)** correctly.

Answers:

(a)

Term position	6	9	12
Fibonacci number	8	34	144

(b)(i)

Term position	8	12	16
Fibonacci number	21	144	987

4^{th} term…
4^{th} term …

(ii)

Term position	5	10	15
Fibonacci number	5	55	610

5^{th} term …
5^{th} term …of 5

(c) 6^{th} term

Question 3

This question gave the candidates the opportunity to investigate the Golden Rectangle.

(a) and (b) Most candidates started with the correct sized rectangles and all attempted to then divide these into squares. Many found this to be more challenging than they had perhaps expected and had to try to amend their first attempt at the drawings. Some who had done their drawings using pen, naturally found this difficult. Most candidates did show that they understood what they were trying to achieve. Credit was given to those attempts that showed some correct squares within each diagram.

Answer:

(a) 5 by 8 rectangle drawn, divided into: one 5 by 5 square
one 3 by 3 square
one 2 by 2 square
and two 1 by 1 squares

(b)
8 by 13 rectangle drawn, divided into: one 8 by 8 square
one 5 by 5 square
one 3 by 3 square
one 2 by 2 square
and two 1 by 1 squares

(c) This part of the question led the candidates to look again at patterns this time using the least number of squares in Golden Rectangles. The table in part **(i)** was successfully completed. The candidates who spotted the connection for part **(ii)** successfully completed part **(iii)** and made a very good attempt at part **(d)**. The intention of part **(iii)** was to see if candidates had recognised the pattern and could then use it to find a numerical answer.

Answer:

(c)(i)

Size of rectangle	1 by 2	2 by 3	5 by 8	8 by 13
Least number of squares	2	3	5	6

(ii) 8

(iii) 89 144

(d) The intention of this question was to see if candidates could now express the result they had found in part **(c)** in algebraic terms. It was good to see that so many of these attempts were successful.

Answer: $n - 1$

(e) The final part of the investigation challenged most candidates. Most candidates attempted this question and tried to use words to explain the connection they had found. It was also good to see that although there was no command e.g. "You must show your working" the majority of candidates used the centimetre square grid provided. Some candidates also used their drawings to exemplify their word answer; a very good way to communicate.

Answer:

The least number of squares is:
the same as the term number that comes between the position numbers of the width and the length
OR
the mean of the position numbers of the width and the length
OR
width (smallest) position number plus 1 OR length (largest) position number minus 1

Part B Modelling

The modelling question required the ability to use logs to set up a model connecting the distance from the Sun and the time taken to orbit the Sun for planets in our Solar System. Explanations, data and leads were given on the question paper and all candidates were able to show that they could use logs to base 10.

The first questions were completed very successfully and it was good to see how most of the candidates gained the communication marks for showing their working and not just writing answers.

Most candidates managed the graph work in **Questions 2** and **3**, although just a few found this more difficult than calculating the numerical answers in **Question 1**. **Questions 4** and **5** proved to be more challenging and **Question 6** stretched candidates to test a model. The skills of being able to test a model and comment on this test are most important in the conclusion of a modelling question.

Question 1

This question set up the data for the development of the models. The candidates had to use their calculator to find log values and because some answers were given it enabled the candidates to check this process and to confirm how to give values correct to two significant figures. Most candidates completed this question successfully.

Answer:

8.4	2.8
8.9	3.6
9.2	4.0

Question 2

Almost all candidates correctly used the scales given on the question paper to plot the points and the mean. Most candidates knew that the line of best fit should go through the mean and follow the trend. This question was successfully answered by the majority of candidates.

Answer:

(a) 7 points plotted correctly

(b) Mean (8.6, 3.2) plotted correctly
Line of best fit ruled through mean

Question 3

Again this question was well answered by most of the candidates. Credit was given for an answer following from the candidate's own line of best fit and the answer did not have to be in standard form. It was good to see that the majority of candidates were working in the context of the question and realised that they needed to anti-log their reading from the graph. Almost all candidates also gave answers of the correct magnitude. It was also to their credit that most candidates showed their working out by drawing lines on their graph and writing down their reading. This was a good opportunity for communication.

Answer: 2.8×10^9 / 3.2×10^9

Question 4

This question was more challenging in that it required candidates to have the knowledge of how to find the equation of a straight line and to be able to use their calculator to do this. Candidates who used the mean were mostly successful. Others had less success but again the majority of candidates gained merit for communication by showing their working.

Answer: $m = 1.5$
$c = -9.6$ / -9.7

Question 5

Candidates also found this question more challenging despite being given the model and the necessary data as part of the question. This question required a substitution and then an anti-log. It was at this stage that some candidates started to confuse distance with time and consequently made an incorrect substitution. It was good to see that many candidates attempted to correct mistakes when they had a value for their answer that was obviously of an incorrect magnitude. The main reason for this was the use of values corrected to 2 significant figures because the answers were asked for in this form. Candidates should be aware that accuracy is often lost unless uncorrected values are used in further calculations. Again merit for communication was gained by candidates who showed the working for their calculations.

Answer: 7.6×10^4 / 6.0×10^4

Question 6

This question asked the candidates to work with their model and to test its accuracy. Most of those candidates who had confused time and distance in **Question 5** were unable to complete this successfully. Many found this question difficult although it was good to see that most attempted to complete it.

(a) Some candidates were able to demonstrate their knowledge of the rules of logs by showing the two necessary steps. Others, who obviously knew the rules, need to develop the ability to show this formally.

Answer: $\log T = \log S^m + \log k$
$\log T = \log kS^m$

(b) This part needed the candidates to have correctly read the stem to **Question 6**. Those candidates who worked from the stem that read 'writing *c* as log *k*' had no problems in calculating a value for *k* following on from their value of *c*. The majority of candidates who tried to find a value for *k* without using this information were unsuccessful.

Answer: 2.0×10^{-10} / 2.5×10^{-10}

(c) This part of the question required the candidates to test their model by using the data for Earth which should be familiar to them, and was given in the table in **Question 1**. Those candidates who had used fairly accurate (not corrected to 2 significant figures) values throughout their calculations obtained an answer close to 365 days. Of those who did not, some did state that the inaccuracy of their model was due to the approximate nature of the values they had used. Candidates should realise that the test of a model is only complete when a comment has been made as to the validity of the result.

Answer: $T = \text{their } k \times (1.5 \times 10^8)^{\text{their } m}$
$T \approx 367$ / 459
Comment on accuracy that is appropriate to result of their test