ADDITIONAL 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 answers for sense and accuracy. Candidates should be reminded of the need to read questions carefully, focussing on key words or instructions.

General comments

Working is vital in two-step problems, such as **Questions 11** and **12**. Showing working enables candidates to access method marks in case their final answer is inaccurate. 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 credit if the answer is wrong, this was noticeable in **Question 11(a)**. Candidates must take note of the form or the units that are required, for example, in **Question 4**.

The questions that presented least difficulty were **Questions 1(a)**, **1(b)**, **2**, **3(a)** and **15(a)(i)**. Those that proved to be the most challenging were **Question 5(b)**, similarity, **Question 9(d)**, number of elements, **Question 11(c)**, the equation of a line and **Question 13**, the equations of asymptotes of a graph. In general, candidates attempted the vast majority of questions. Those that were left blank the most often were **Questions 9(d)** and **13**, questions that have already been mentioned as challenging.

Comments on specific questions

Question 1

Candidates did fairly well with this opening question. As this is a multiple choice question there is no reason for answer lines to be left blank but this occasionally happened with **part (c)**, the cube of 2, as maybe candidates are less familiar with 2^3 expressed in words. Candidates did not seem to be too concerned with the fact that the number 8 was used twice, in **parts (b)** and **(c)**. In **part (a)**, the most common misunderstanding was giving 2 as the answer to the square of 4. In **part (d)**, a slightly more complex question, many gave 2 as it is the lowest factor of the two numbers, a misunderstanding of lowest common multiple. This question was unusual as the LCM of 16 and 32 was actually one of the numbers.

Answers: **(a)** 16 **(b)** 8 **(c)** 8 **(d)** 32

Question 2

Part (a) was very well answered. The few wrong answers involved ignoring the order of operations. For **part (b)**, many candidates did the subtraction before the multiplication.

Answers: **(a)** 20 **(b)** 1

Question 3

Part (a) was the best answer question on the paper. The extremely common misconception for **part (b)** was that many gave, or tried to give, the *n*th term instead of the rule for continuing the sequence. The fact that the answer was required to be given on a line across the page indicates that a description in words it required.

Answers: **(a)** 27 **(b)** Add 5

Question 4

Often candidates are asked to work out only one number to a power but this asked for something slightly different. Candidates needed to know that anything to the power zero is 1, so really all that was needed was for 4^{-2} to be worked out. Some tried to combine the 3 and the 4 and also the powers giving 12^{-2}. Some said 4^{-2} was $\frac{1}{2}$, –8 or –16.

Answer: $\frac{1}{16}$

Question 5

Like **Question 1**, this is a multiple choice question and candidates did leave one or other part blank. Candidates were fairly successful with **part (a)** but A and C were frequently seen as wrong choices along with B and E. **Part (b)** was not done so well with B and D incorrectly given as the answer while others left this blank. This second part was more problem-solving than **part (a)** as candidates were asked something more complex than just using similarity.

Answers: **(a)** A and E **(b)** A or E and C

Question 6

Some candidates drew a six pointed star in the hexagon or only drew the 3 lines from a vertex to the opposite vertex. It was common to see 4 lines, the vertex to vertex lines along with a vertical line but the other two mid-side to mid-side missing.

Question 7

Candidates found that the difficulty level rose as they worked through the question. First, candidates had to understand function notation and that they were required to substitute 2 for *x*. Some did this but then stopped instead of evaluating $\frac{6}{2}$ as 3, which got no marks. The negative sign in the denominator of **part (b)** caused confusion for some. Dealing with a fraction in the denominator of **part (c)** also proved problematic and candidates gave incorrect answers of 3, $6\frac{1}{2}$ or 13.

Answers: **(a)** 3 **(b)** –3 **(c)** 12

Question 8

As in previous sessions, some candidates used incorrect descriptions such as scattered, linear, straight line, random, discrete, diverse, regular, organised data, strong or weak when what is required for questions about correlation is positive, negative or none (or no correlation). Some left one or other of these parts blank.

Answer: Negative, none

Question 9

Most candidates were familiar with at least some of the set notation used in this question. Sometimes it was not possible to tell what was the reasoning behind the answers. Candidates did limit themselves to numbers from the universal set although in some cases a number was repeated. Often for **part (a)** all numbers of the universal set or *B* were given rather than the intersection of *A* and *B*. For **part (b)**, candidates often gave all or some of the elements of *B*. **Part (c)** asked for the union of *B* and *C* but was often answered as the intersection of the two sets. In the last part of this question, candidates were the least successful giving the number of elements in their previous answer and did not see the connection between the last two parts. This part was often left blank.

Answers: **(a)** 2, 6 **(b)** 1, 4 **(c)** 2, 3, 4, 5, 6 **(d)** 5

Question 10

Some candidates picked any value for x that satisfied the inequality rather than giving the smallest value. Some gave –4 or 1 for **part (a)**. For **part (b)**, some candidates gave $x > 8$ as their answer which is the simplification of the inequality but not the answer to the question that was asked.

Answers: **(a)** –2 **(b)** 9

Question 11

For **part (a)**, candidates sometimes answered with 20 (from $6 \times 3 + 7 - 5$) or 125 or –125 (from $6 \times 3 + 7 = 25$, then 25×5 or –5). There were answers given as algebraic expressions such as $18x + 35y$. Those that substituted, occasionally made arithmetic slips or ignored the negative sign giving 53. In **part (b)**, the correct answer was sometimes achieved then spoilt by giving an equation such as, $70x + 50y = 120$ or just 120 alone. Work on the equation of a line is one area of content that candidates often find challenging and candidates did find this the most challenging question on the paper. This time, instead of candidates being asked to find the equation from a diagram, the question asked for a re-arrangement of a given line into a different form, so this is more an algebraic manipulation question. The common wrong answer of $y = 3x + 12$ had two main errors, no negative sign in front of the x and the coefficient of y, 4, had been ignored. Sometimes the constant term had been divided by the 4 but not the x term.

Answers: **(a)** –17 **(b)** $70x + 50y$ **(c)** $y = -\frac{3}{4}x + 3$

Question 12

This was not done particularly well. Many knew that they needed to use sin 50 but for some that was as far as they went. Some left their answer as the method, 20 × 0.766, but did not go on to do the multiplication.

Answer: 15.32

Question 13

Some candidates drew in the asymptotes but then did not write the equations correctly. A few tried to give the equation of the curve itself but more tried to give a pair of co-ordinates on the curve. This was the question that the most candidates did not attempt.

Answer: $x = 1$, $y = 2$

Question 14

A few candidates preformed a translation using the centre as a vector. Most made the triangle larger but not using a consistent scale factor for all points and certainly not in the correct place. Only a few used the correct centre of enlargement.

Question 15

Often questions on circles give a list of words for the candidates to choose from, but here candidates had to produce the words themselves. Candidates were far more confident with the radius than with the tangent where segment, sector, straight line, diameter and circumference were all seen. In **part (b)**, even though plenty gave 90°, some gave 180°, maybe from a misunderstanding so treated 'the size of angle *ACB*' as the same as 'the angle sum of the triangle *ACB*'.

Answers: **(a)(i)** Radius **(ii)** Tangent **(b)** 90

INTERNATIONAL MATHEMATICS

Paper 0607/12
Paper 12 (Core)

Key messages

To succeed in this paper, candidates need to have completed the full Core syllabus, show clearly all necessary working and check answers for sense and accuracy. Candidates should be reminded of the need to read questions carefully, focusing on key words or instructions.

General comments

Showing workings enables candidates to access method marks in case their final answer is incorrect. Workings are vital in two-step problems, in particular with algebra and or problem solving such as **Questions 4**, **11** and **14**. 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 be rewarded if the answer is inaccurate. Candidates must take note of the form or the units that are needed, for example, in **Question 7(c)** and **Question 15**.

The questions that presented least difficulty were **Questions 2**, **4**, **5(b)**, **7(a)**, **8**, and **11**. Those that proved to be the most challenging were **Question 7(b)** and **Question 14**, both on percentages, **Question 10**, polygons, **Question 13**, prime factors, **Question 15**, standard form, and **Question 17(b)**, describing transformations. In general, candidates attempted the vast majority of questions rather than leaving many blank. Those that were sometimes left blank were **Questions 6**, **13** and **17**.

Comments on specific questions

Question 1

Candidates generally did well with this opening question. Errors included rounding to the nearest thousand, 43 000 or truncating to 42 600. A few candidates did not add the zeros in the tens and units columns so left their answer as 427.

Answer: 42 700

Question 2

This was a well answered question where more candidates did better giving the co-ordinates of point *A* than the plotting of point *B*.

Answers: **(a)** (2, 4)

Question 3

As this is a version of a multiple choice question, it should not be left blank, and in all cases candidates filled in all the rows of the table.

Answer: Discrete, Continuous, Discrete, Continuous

Question 4

Candidates did well reading the chart to find the relevant information. This question had various stages so it was important to show working so a mark could be awarded if the answer was incorrect as well as so that candidates could check their work.

Answer: 4

Question 5

In part **(a)**, some candidates' lines were not drawn with a ruler so were very inaccurate. Drawing the lines of symmetry in a polygon with odd number of sides is harder than if the polygon was, say, a hexagon as each vertex has to be joined to the mid-point of the opposite side rather than vertex to vertex then the mid-side lines can be draw when the centre has been located. A few candidates only drew some of the lines or drew wrong lines that went vertex to vertex. Candidates were more successful shading four squares to complete the diagram in part **(b)**.

Question 6

Some candidates did not understand what they had to do and did not notice that the column headings in the second table were not the same as the first. There were others who understood what to do but made arithmetic errors completing the cumulative frequency.

Answer: 25 52 82 110

Question 7

This was another question testing reading of charts. A few candidates gave 16 as their answer to part **(a)** but this is the number of girls that are less than or equal to 14 years old. Part **(b)** was a multi-step problem where candidates had to add up the number of students who are 15 or 16, then divide by the total number of students, 50, (which was given in the question) then finally multiply by 100 to calculate the percentage. This was not done particularly well. In part **(c)** some students left their answer as $\frac{14}{50}$, without cancelling down to the simplest fraction. As in part **(a)**, some candidates included those students who were 13 years old rather than just those less than 13. Candidates need to be clear what is the difference in meaning between students that are less 13 years old and 13 year old or less. Most left their answer as a fraction although it might be an incorrect one.

Answers: **(a)** 10 **(b)** 38 **(c)** $\frac{7}{25}$

Question 8

Candidates did not take enough care here because, although the methods were correct, arithmetic errors occurred frequently when carry digits were forgotten. As this is a one mark question, the answer had to be exactly 30.

Answer: 30

Question 9

The major problem here was that the number of zeros was incorrect and so 2400 was a frequent wrong answer. If the correct working was present, these candidates did get a mark. Some tried to cube each dimension before add all three together. Others multiplied two dimensions and added the third.

Answer: 24 000

Question 10

As stated before, this was not done well. Some wrote down an incorrect figure without any method, others measured the diagram even though it says, 'not to scale'. The quickest way to find the answer is to divide 360 by 5, the number of sides, but some found the sum of the internal angles of a pentagon and stopped or did go as far as dividing 540 by 5 to get 108. However, if candidates are going to use a long method, they have to show the whole method before marks can be awarded. In this case, the 108 must be subtracted from 180 to get the external angle.

Answer: 72

Question 11

This is the formula for the area of a triangle with the area, A, and the height, h, given so the length of the base, b, has to be found. So, this was not a straightforward substitution question as the equation has to be re-arranged first before the substitution.

Answer: 7

Question 12

For part **(a)**, candidates need to know that anything to the power zero is 1 and this fact is often tested. The common wrong answers were 8 or zero. In part **(b)**, some cancelled the p out of the expression and so tried to evaluate 63×36. Some used the powers as figures that multiply the $6p$ and the $3p$ so gave $364p$ as their answer. Often the coefficients were added or the powers multiplied.

Answers: **(a)** 1 **(b)** $18p^9$

Question 13

Some appeared not to understand the instruction, 'the product of prime factors' and so instead listed the factors of 88. Some gave a calculation that equalled 88 such as 44×2 which was awarded a method mark. To get full marks, candidates had to give the calculation only using prime numbers so $2 \times 2 \times 2 \times 11$ was also acceptable as the final answer.

Answer: $2^3 \times 11$

Question 14

This and **Question 16** had the most marks on the paper. Many candidates went as far as working out the difference between cost and selling price, \$9, and this did get a method mark. Some went on to divide 84 or 75 by 9 which was totally incorrect. Those that did write down the correct method did not cancel first but ended up dividing 900 by 75 (where slips were often made). Instead, if they cancelled fully, they could have had a much simpler calculation of 3×4 to deal with.

Answer: 12

Question 15

Without a calculator the simplest way to do this calculation is to combine the powers of ten first, then the multiplication of 7 and 8 to get 56×10^6. This value is not in the correct form so has to be re-written. The answer has to be given with only one digit in front of a decimal point so the power of ten increases by one.

Answer: 5.6×10^7

Question 16

Marks were available if candidates plotted the point (2, 3) and drew the line $x = 1$. Many reflected the point in the line $y = 1$ or the x-axis rather than the correct line.

Answer: (0, 3)

Question 17

These two parts were the ones most frequently left blank by candidates. For part **(a)** some candidates subtracted the vector from the point rather than adding. For part **(b)**, candidates must use the correct word for the transformation – so one of reflection, translation, enlargement and rotation is required – and in this case the correct answer is translation. The second mark is for the vector. Candidates must remember that as the question asks for a single transformation, an answer of two transformations automatically gets no marks.

Answers: **(a)** (8, 5) **(b)** Translation $\begin{pmatrix} -3 \\ 2 \end{pmatrix}$

INTERNATIONAL MATHEMATICS

Paper 0607/13
Paper 13 (Core)

Key messages

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General comments

Showing workings enables candidates to access method marks in case their final answer is incorrect. Workings are vital in two-step problems, in particular with algebra and or problem solving such as **Questions 4**, **11** and **14**. 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 be rewarded if the answer is inaccurate. Candidates must take note of the form or the units that are needed, for example, in **Question 7(c)** and **Question 15**.

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Answers: **(a)** (8, 5) **(b)** Translation $\begin{pmatrix} -3 \\ 2 \end{pmatrix}$

INTERNATIONAL MATHEMATICS

Paper 0607/21
Paper 21 (Extended)

Key messages

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

Candidates must give their answers in the correct form and know that giving the answer as the product of prime factors does not require them to calculate an exact answer.

Some candidates do not have a clear understanding of the demands of some questions, e.g. in **Question 11(b)** most candidates did not realise their answer would need to be an inequality.

General comments

Candidates were well prepared for the paper and demonstrated excellent algebraic skills. Some candidates lost marks through careless numerical slips, particularly when dividing by a decimal in **Question 1** and handling negative numbers in **Question 5**. Candidates should make all of their working clear and not merely write a collection of numbers scattered over the page. Candidates should always make sure their diagrams are clear especially when shading regions in **Question 8**. Some candidates showed a lack of understanding between finding the midpoint of a line and the length of the line and often found the gradient instead.

Comments on specific questions

Question 1

Most candidates made a good attempt at this question. Common errors were rounding 0.00298 to 0.2; in fact, sometimes the decimals on the denominator were rounded to 0. A small number of candidates attempted to calculate an exact answer despite the instructions to round to one significant figure. A lot of candidates had difficulty dividing by 0.008.

Answer: 1 000 000

Question 2

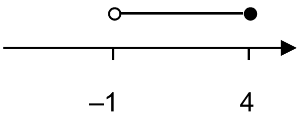
Candidates had some difficulty with this question despite being given the product of prime factors. One common mistake was to get the HCF and LCM the wrong way round. A number of candidates omitted to give their answers in the correct form and wasted time working out exact answers. This was particularly evident in **part (c)** working out $\sqrt{7056}$.

Answers: **(a)** $2^3 \times 3^{(1)} \times 7^2$ **(b)** $2^4 \times 3^2 \times 7^3$ **(c)** $2^2 \times 3^{(1)} \times 7^{(1)}$

Question 3

Virtually all candidates answered this question completely correctly. Common errors were seen with the solid and empty circles at –1 and 4.

Answer:



Question 4

Almost all candidates scored full marks. A small number of candidates made numerical slips when cancelling.

Answer: $\frac{5}{24}$

Question 5

Most candidates made a good start on this question. Calculating with negative numbers proved a challenge for some candidates. Many managed to score at least one mark for a pair of values that satisfied one equation. Candidates should be encouraged to check their answers by substitution.

Answer: $x = -5$, $y = -3$

Question 6

(a) This was well attempted. The common difficulty was dealing with the negative *x* co-ordinate.

(b) Stronger candidates completed this well although many still struggled to convert $\sqrt{80}$ correctly. A number of candidates tried to find the gradient of the line.

Answers: **(a)** $(-1, 8)$ **(b)** $4\sqrt{5}$

Question 7

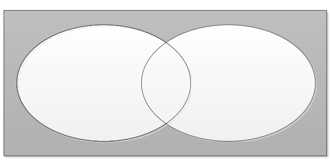
The most successful candidates converted to ordinary numbers before adding and usually got at least one mark. A common error was not leaving the answer in standard form. Many candidates demonstrated a real lack of understanding of the laws of indices and a common wrong answer was 11.9×10^9.

Answer: 6.23×10^5

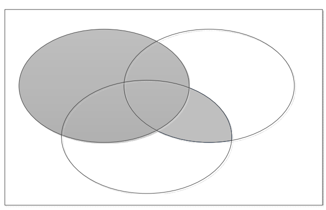
Question 8

This was well attempted but some candidates gave ambiguous shading. If candidates change their mind they should sketch out the diagram again.

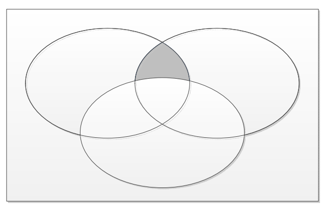
Answers: **(a)**



(b)



(c)



Question 9

This proved a challenge for many candidates and correct answers for **part (a)** were rarely seen. Common wrong answers were 70° and 40°. The second part of the question was more accessible and many candidates scored full marks here.

Answers: **(a)** 110° **(b)** 45°

Question 10

Very good attempts were seen and it was pleasing to see working set out in a clear manner.

Answer: 3.6

Question 11

Virtually all candidates could factorise the quadratic correctly in **part (a)**. However, many candidates did not seem to understand how to solve an inequality. In **part (b)**, many candidates started again and were looking for one numerical solution.

Answers: **(a)** $(x-5)(x+2)$ **(b)** $x < -2$, $x > 5$

Question 12

Very good attempts were seen by the majority of candidates here. Almost all attempted to multiply top and bottom by $3-\sqrt{2}$ and many successfully got 7 on the denominator. Manipulating the numerator caused more problems and even strong candidates had trouble simplifying their answer by dividing both terms by 7.

Answer: $6\sqrt{2}-4$ or $2\left(3\sqrt{2}-2\right)$

Question 13

Many candidates showed good algebraic skills here. Common errors were missing the squared terms and slips when simplifying the negative terms –9*ab* – 10*ab*.

Answer: $6a^2-19ab+15b^2$

INTERNATIONAL MATHEMATICS

Paper 0607/22
Paper 22 (Extended)

Key messages

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 familiar with the basic conversion of units.

Candidates need to be aware of the four rules of number when the numbers are given in standard form.

General comments

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

Candidates must read the questions carefully to ensure they answer the question asked, using all the given information.

Many candidates lost marks through careless numerical slips.

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

The majority of candidates answered this question correctly. Candidates who did not score full marks were able normally to score one mark by correctly finding one angle on the diagram.

Answer: 120

Question 2

Although there were many correct solutions to this part, a number of candidates made the careless mistake of only finding the area of one face.

Answer: 54

Question 3

There were many excellent solutions to this question. A few candidates found the lowest common multiple.

Answer: 6

Question 4

This question tested the candidates' understanding of functions. Correct answers were in the minority. The popular incorrect answer was where candidates gave their answer as a continuous range.

Answer: –3, –1, 1

Question 5

This question was well answered by many candidates. There were two common mistakes; not being able to correctly identify the hypotenuse and candidates being unable to 'evaluate' $\left(\sqrt{91}\right)^2$.

Answer: 3

Question 6

This question demonstrated the excellent algebraic skills of many candidates. The majority of candidates answered the question correctly, although there were some candidates who attempted the rearrangement in the wrong order.

Answer: $[\pm]\sqrt{\dfrac{y+1}{2}}$

Question 7

(a) The majority of candidates found this part to be a challenge. Although candidates realised that the conversion involved factors of 3600 and 1000, many were unable to apply these factors correctly.

(b) Candidates scored more marks on this part as it was marked as a follow through.

Answers: **(a)** 72 **(b)** 54

Question 8

Few candidates scored full marks. Candidates need to practise converting numbers in standard form to an equivalent number so that basic addition, or subtraction, can be carried out.

Answer: 2.62×10^{21}

Question 9

Many candidates scored the mark. However, there were a number of candidates who had an incorrect factor of 10.

Answer: 0.01

Question 10

This question was correctly answered by many candidates, showing a clear understanding of circle theorems. There were some careless numerical slips in **part (b)**.

Answers: **(a)** 130 **(b)** 72

Question 11

This question proved to be an excellent discriminator. Although virtually all candidates scored some marks, few scored full marks.

The common errors occurred where candidates did not use different operations on the number and the indices.

Answers: **(a)** $3x^8$ **(b)** $2x^4$

Question 12

Candidates attempted the solution using different methods. Candidates who set up an equation, then found a constant and then substituted were more successful than candidates who tried to 'proportion' the given information and the demand.

Answer: 0.5

Question 13

Many candidates scored full marks. However, a significant number of candidates made careless numerical slips in both parts, e.g. $6\sqrt{2}+3\sqrt{2}=8\sqrt{2}$.

Answers: **(a)** $9\sqrt{2}$ **(b)** $5\sqrt{2}-2$

Question 14

Although some candidates scored full marks, many candidates did not factorise both the numerator and denominator correctly.

Answer: $\dfrac{x}{x+1}$

Question 15

(a) The majority of candidates scored full marks, but a significant number gave their final answer as $\log\dfrac{9}{32}$.

(b) This part proved to be a challenge for many candidates, who did not appear to be confident in evaluating numbers in different bases.

Answers: **(a)** $\dfrac{9}{32}$ **(b)** 0.5

Question 16

The majority of candidates scored this mark showing that the trigonometrical ratios of 'special angles' was well known.

Answer: 60

INTERNATIONAL MATHEMATICS

Paper 0607/23
Paper 23 (Extended)

Key messages

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 digit' must be between 1 and 10.

Some candidates do not have a clear understanding of the demands of some questions, e.g. in **Question 15**, candidates were asked to factorise completely.

Candidates need to realise that it is easier to work with the external angles of a polygon rather than the internal angles.

In questions involving changing the subject, the answer must collect the new subject terms before the question can be completed.

General comments

Candidates were well prepared for the paper and demonstrated excellent algebraic skills.

Some candidates lost marks through careless numerical slips, particularly with decimal numbers and simple arithmetic operations, especially in **Question 5**.

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

Nearly all candidates answered this question correctly. Mistakes occurred when candidates listed extra non-prime numbers.

Answer: 53

Question 2

Although there were many correct answers, this question showed a lack of understanding of vectors.

Answer: $\begin{pmatrix} 3 \\ 6 \end{pmatrix}$

Question 3

Virtually all candidates answered this question completely correctly. The common error was where candidates assumed there was another angle of 36.

Answer: 72

Question 4

Although many candidates were successful, the common mistake was where candidates divided the total by 7.

Answer: 18

Question 5

There were many correct answers to this question. However, a significant number of candidates started the question correctly but then could not divide 2.10 by 6 correctly.

Answer: 0.35

Question 6

This question was correctly answered by the majority of candidates. The common error was omitting to give the 'number' part between 1 and 10.

Answers: **(a)** 5.8×10^4 **(b)** 8.09×10^{-3}

Question 7

There were very few correct answers to this question. Candidates who tried working with the interior angles were unable to solve their initial equation. Candidates who approached the question looking at the exterior angles were, in general, successful.

Some candidates used trial and error but normally gave up at $n = 12$.

Answer: 18

Question 8

Although there were many correct solutions, there were an equal number of answers of –3.

Answer: 3

Question 9

Again, there were many correct answers. Candidates who did not score full marks normally scored one mark from realising that the total of the two numbers must be 92.

Answer: 40 and 52

Question 10

Virtually all candidates scored full marks showing that candidates are well versed in factorising quadratics.

Answer: 8, –3

Question 11

The majority of candidates scored one mark, but many candidates omitted to simplify their answer.

Answer: $8\sqrt{2}$

Question 12

This question was challenging for the majority of candidates. Although many candidates equated the given volume to the volume of a sphere, progress was then limited to the best candidates.

A number of candidates did not give the correct formula for volume of a sphere despite it being given on the formula page.

Answer: 2

Question 13

This question proved to be an excellent discriminator with all marks from zero to four being seen in similar proportions.

Some candidates were unable to find the midpoint, others were unable to find the gradient of a perpendicular line, and then many did not score the last mark due to careless arithmetic errors.

Answer: $[y =]\frac{1}{2}x + \frac{5}{2}$

Question 14

This question was poorly answered by the majority of candidates. Candidates started the question correctly by eliminating fractions but then did not realise that they had to collect both terms in *x*.

The best candidates were able to complete the question.

Answer: $x = \frac{5A}{2A-3}$

Question 15

Many candidates assumed that the question was simply the difference of two squares. Candidates who spotted the initial factor of 5 normally completed the question correctly.

Answer: $5(x-5y)(x+5y)$

Question 16

Candidates who started the question by drawing a tree diagram were more successful. This approach is to be encouraged when answering similar questions.

There were many correct attempts that were spoiled by poor arithmetic errors. Final answers of more than 1 were not uncommon.

Answer: 0.225

INTERNATIONAL MATHEMATICS

Paper 0607/31
Paper 31 (Core)

Key messages

- Candidates must remember to write their answers correct to three significant figures unless stated otherwise in the question.
- Candidates must show all their working out in order to gain method marks if their answer is not correct.
- Candidates need to have studied all the topics in the syllabus.

General comments

Most of the candidates appeared to have a graphics calculator this session. A few candidates, however, did not always use it correctly. It should be remembered that using a graphics calculator is an integral part of this syllabus. Most candidates managed to attempt all the questions in the time allocated. There was a full range of marks which would suggest that the level of the paper was suitable. Some candidates lost marks because they did not answer to the correct level of accuracy. It is important that candidates show all their working out. Correct working can lead to the awarding of method marks even if the final answer is incorrect.

Comments on specific questions

Question 1

(a) (i) Most candidates calculated the total amount correctly.

(ii) This part was also nearly always correctly answered.

(iii) Although many candidates found the correct answer here, there were others who had problems finding the percentage.

(b) Many candidates answered correctly, but some gave the change as 0.50.

(c) The most common mistake here was to include the $600 in the answer. Some candidates incorrectly used the compound interest formula.

Answers: **(a)(i)** 783 **(ii)** 96 **(iii)** 80 **(b)** 12, 0.60 **(c)** 120

Question 2

(a) (i) The majority of candidates could show that the total number was 315.

(ii) This part was not well answered. Many candidates gave 450, 45 or 4.5 as their answer.

(b) Although many candidates found the correct answer here, 18 was a common incorrect answer.

Answers: **(a)(ii)** 36 **(b)** 24

Question 3

(a) (i) Most candidates knew how to give an answer to two decimal places but some rounded incorrectly.

(ii) There were fewer correct answers here, with 356 being a common incorrect answer.

(iii) More candidates managed to give the answer to the nearest hundred correctly.

(b) Not all candidates gave their answer to the nearest whole number as requested and some had the answer completely incorrect through poor use of their calculator. Candidates should be aware that, when a specific degree of accuracy is requested in a question, there will be a mark for giving their answer in that format.

(c) This was well answered.

(d) Some candidates wrote $\frac{38}{100}$ but were unable to cancel it.

(e) Most candidates managed to list all four factors of 63. Some omitted 21 and others added 2 as a factor.

(f) Some candidates had problems putting the four numbers in ascending order. Practice at putting numbers into equivalent forms would help with this type of question.

Answers: **(a)(i)** 3562.85 **(ii)** 3560 **(iii)** 3600 **(b)** –25 **(c)** 12.5 **(d)** $\frac{19}{50}$ **(e)** 3, 7, 9, 21 **(f)** 0.5^2, 55%, 0.59, $\frac{3}{5}$

Question 4

(a) (i) The majority of the candidates knew what a positive integer was.

(ii) Fewer candidates knew what a square number was.

(iii) Although there were many correct answers seen, some candidates thought that 1 was a prime number.

(b) (i) Many candidates had the correct answer here.

(ii) This confused some candidates and $\frac{1}{10}$ or $\frac{2}{10}$ were common answers.

(iii) In this part, $\frac{3}{10}$ was the most common, and incorrect, answer.

Answers: **(a)(i)** 1 or 7 or 9 or 27 **(ii)** 1 or 9 **(iii)** 7 **(b)(i)** $\frac{3}{10}$ **(ii)** 0 **(iii)** $\frac{5}{10}$

Question 5

(a) (i) Most candidates managed to find the range.

(ii) Most candidates managed to find the mode.

(b) Few candidates found the correct mean. Common incorrect answers were 55 and 13.75.

(c) All candidates managed to complete the bar chart.

Answers: **(a)(i)** 50 **(ii)** 30 **(b)** 46.25

Question 6

(a) Nearly all candidates completed the pattern correctly.

(b) Nearly all candidates completed the table correctly.

(c) Many candidates did find the correct expression for the sum to n terms but $n + 2$ was also a common incorrect answer.

(d) Many candidates continued the table to find the correct answer. Those who used their incorrect formula correctly gained follow through marks.

Answers: **(b)** 5, 7, 9 **(c)** $2n – 1$ **(d)** 35

Question 7

There were very few completely correct answers. Most candidates managed to get two or three angles correct.

Answer: $p = 48$, $q = 30$, $r = 29$, $s = 61$, $t = 47$

Question 8

Cumulative frequency appears to be a topic that many candidates had not studied sufficiently as many were unable to answer the question.

(a) Few candidates were able to complete the cumulative frequency table correctly.

(b) Some candidates picked up follow through marks here if they plotted their points correctly as long as their numbers were increasing. Many candidates left this part blank.

(c) (i) Some candidates managed to find the correct median. However, quite a few candidates used 50 on the x-axis instead of 200 on the cumulative frequency axis.

(ii) Very few candidates knew how to find the inter-quartile range from the graph.

(iii) Some candidates managed to read this value correctly from their graph.

Answers: **(a)** 80, 140, 260, 320 **(c)(i)** 54 to 56 **(ii)** 22 to 26 **(iii)** 400 – the value from their graph.

Question 9

(a) Most candidates found the length of the diameter correctly. Some wrote 80 or 160 as their answer.

(b) Quite a few candidates found the length of the arc but other just wrote 220.

(c) Some candidates gained follow through marks here by adding 380 to their previous answer.

(d) There were very few correct answers for the time. Some candidates picked up one mark by dividing their distance by the speed.

(e) Some candidates managed to find the area. Others forgot to divide the area of the circle by two.

Answers: **(a)** 220 **(b)** 346 **(c)** 726 **(d)** 9.67 or 9.68 **(e)** 36 600 to 36 610

Question 10

(a) Very few candidates managed to sketch this correctly.

(b) Quite a few candidates managed to use Pythagoras correctly.

(c) Only a handful of candidates managed to find the correct bearing. The majority left this part blank.

Answers: **(b)** 351 **(c)** 099.8

Question 11

(a) Most candidates managed to solve the equation but –2 and 4 were also common answers.

(b) Most candidates managed to expand the brackets but some forgot the minus sign before the three.

(c) Many candidates found this part difficult. They should be guided by the number of marks available as to the likely number of factors in the expression.

(d) **(i)** Most candidates found the correct answer but 3 was also frequently seen, from 12 ÷ 4.

(ii) Here too a similar error was made meaning that 48 was frequently seen.

(e) Very few candidates could subtract two fractions.

Answers: **(a)** –4 **(b)** x^2+2x-3 **(c)** $xy\left(xy^2-3\right)$ **(d)(i)** 8 **(ii)** 18 **(e)** $\frac{y}{15}$

Question 12

(a) Those who attempted this part managed it fairly well. However, there were some candidates who need more practice transferring what is on their calculator to the paper.

(b) **(i)** Some candidates managed to find the intercepts correctly but a few omitted the negative sign.

(ii) Many of the candidates managed to find the *y*-intercept.

(c) Few candidates found the correct minimum. Many omitted the negative sign or rounded incorrectly.

(d) Few correct answers for the points of intersection were seen. Once again, the negative sign was omitted or the rounding was not correct.

Answers: **(b)(i)** (–1.5, 0) and (2, 0) **(ii)** (0, –9) **(c)** (0.25, –9.19) **(d)** –1.22 and 2.42

INTERNATIONAL MATHEMATICS

Paper 0607/32
Paper 32 (Core)

Key messages

Familiarity with the use of a graphics calculator is essential in this paper. Candidates must remember to write their answers correct to three significant figures unless stated otherwise in the question. Candidates must show all their working out in order to gain method marks if their answer is not correct. Candidates need to have covered all the topics on the syllabus.

General comments

Most candidates managed to attempt all the questions in the time allocated. Some candidates lost marks because they did not answer to the correct level of accuracy. It is important to show all working out – if it is correct then partial marks can be awarded if the final answer is incorrect. Most of the candidates appeared to have a graphics calculator this session. A few candidates, however, did not always use it correctly.

Comments on specific questions

Question 1

(a) Very few candidates managed to get all four labels correct.

(b) Many candidates managed to measure the angle correctly.

Answers: **(a)** radius sector chord tangent **(b)** 58

Question 2

Nearly all candidates managed the first and third rows correctly. Many put $\times 2$ in the second row.

Answer: 19, 15, 11
$\div 2$
22, 67, 202

Question 3

(a) (i) Many candidates knew how to find the range.

(ii) Here too, most candidates found the correct mean.

(b) Many candidates could complete the table correctly.

(c) Those candidates who knew how to find the angles were generally successful in drawing the pie chart. However, there were some candidates who were unsure of how to attempt this part.

Answers: **(a)(i)** 13 **(ii)** 13.3 **(b)**

8	18	26
15	7	22
23	25	48

Question 4

(a) The majority of the candidates could write the number correctly, although a few added an extra 0.

(b) (i) Nearly all candidates could write down a multiple of 9 but a few candidates wrote 3, confusing factor and multiple.

(ii) Most candidates knew what an even number was but a few did write down an odd number.

(c) (i) This was well done.

(ii) This was also well done.

(iii) This was not so well attempted as not all candidates knew how to find a cube root.

(d) Most candidates managed to put the brackets in the correct place.

(e) Fewer candidates managed to answer this part correctly. Some rounded incorrectly to 2.54 and others used their calculator incorrectly.

(f) (i) This part was poorly done with the most common answer being 0.03.

(ii) This was also poorly attempted, with only a few candidates writing the number correctly in standard form.

Answers: **(a)** 7061 **(b)(i)** any multiple of 9 **(ii)** 22 or 24 or 26 or 28 **(c)(i)** 25 **(ii)** 1331 **(iii)** 16
(d) $3\times(6+5)-4=29$ **(e)** 2.55 **(f)(i)** 0.0316 **(ii)** 3.1626×10^{-2}

Question 5

(a) (i) Most candidates managed to find the correct time.

(ii) There were many correct answers for the speed seen.

(b) (i) Most candidates could work out the correct percentage. Some gave 3.12 as their answer and others rounded up to 4.

(ii) Many candidates found the correct number of local trains.

Answers: **(a)(i)** 08 55 **(ii)** 70 **(b)(i)** 3 **(ii)** 39

Question 6

(a) Many candidates calculated the area of the paper correctly.

(b) Very few candidates found the correct shaded area. More work on finding the area of compound shapes would be beneficial to candidates.

(c) Some candidates picked up a method mark by writing their answer to **part (b)** divided by their answer to **part (a)**.

(d) Some candidates managed to name both shapes correctly. Most candidates managed to give one correct name.

Answers: **(a)** 280 **(b)** 116 **(c)** $\frac{29}{70}$ **(d)** Trapezium and Parallelogram

Question 7

Although there were many fully correct answers, some candidates managed to find x but then made errors finding y and z.

Answer: $x = 14$, $y = 9$, $z = -1$

Question 8

(a) (i) Most candidates could find the perimeter but some gave the area as their answer.

(ii) Most could convert to metres but some multiplied by 100 or divided by 10.

(b) Most found the angle by using the sum of the angles in a triangle but a few candidates used trigonometry. As this part was only worth one mark, these candidates should have been alerted to the fact that relatively little work was required.

(c) Many candidates found the sides correctly but fewer gave the correct angles. Some candidates also multiplied these by 3.

(d) Few candidates could give the correct mathematical word here.

Answers: **(a)(i)** 56 **(ii)** 0.56 **(b)** 16 **(c)** 75, 72, 21; 90, 74, 16 **(d)** similar

Question 9

(a) There were few fully correct answers here. Most candidates wrote 6, 11, 8, 15.

(b) This part was either answered correctly or candidates were awarded the mark because their answer was correct for their Venn diagram.

(c) Here too the answer was either correct or correctly followed through.

Answers: **(a)** 6, 3, 8, 7 **(b)** 24 **(c)** $\frac{8}{24}$

Question 10

Few candidates found the correct perimeter, with many adding 2×30 to their answer. Working out the perimeter of compound shapes is a topic where extra practice would be beneficial.

Answer: 250

Question 11

(a) Most candidates managed to factorise correctly.

(b) Many candidates found the correct value for x.

(c) Very few candidates managed to simplify this completely. Some did cancel parts correctly. Others cross-multiplied. Candidates would do well to practise simplifying algebraic expressions.

(d) Many candidates could show the inequality on the number line. However, some had the line going in the wrong direction and others did not have an enclosed circle at 3.

(e) The inequality proved difficult for many candidates. Again, candidates need to practise solving inequalities.

(f) Quite a few candidates managed to solve the simultaneous equations. As with all the other algebra topics, candidates need practice in the area of solving such equations.

Answers: **(a)** $5(x-3)$ **(b)** 3 **(c)** $\frac{6b}{a}$ **(d)** closed circle at 3, line going to the left **(e)** $x > 1.5$
(f) $x = 6$, $y = -1$

Question 12

This was not well attempted. Few candidates appeared to know what the terms lowest common multiple or highest common factors meant.

Answer: HCF = 18, LCM = 216

Question 13

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

(b) Very few candidates found the correct answer. The most common answers were $\frac{25}{36}$ (the probability of not getting a six on both throws) and $\frac{5}{6}$ (the probability of not getting a six on one throw).

Answers: **(b)** $\frac{35}{36}$

Question 14

(a) Most candidates found the midpoint correctly.

(b) Here too there were many correct answers. A few candidates rounded incorrectly to 5.7 or 5.65.

(c) There were quite a few correct answers seen for the gradient. Some candidates found it to be –1.

(d) Fewer candidates could find the equation of the line.

Answers: **(a)** (0, 3) **(b)** 5.66 **(c)** 1 **(d)** $y = x + 3$

Question 15

(a) There were many good attempts at sketching the graph but some candidates need more practice in transferring what is on their calculator screen to the paper.

(b) Some candidates tried to solve this algebraically and often without success. They should always be encouraged to use their graphics calculator to solve equations when they have drawn the graph.

Answers: **(b)** 2.5 and –0.25

INTERNATIONAL MATHEMATICS

Paper 0607/33
Paper 33 (Core)

Key messages

Familiarity with the use of a graphics calculator is essential in this paper. Candidates must remember to write their answers correct to three significant figures unless stated otherwise in the question. Candidates must show all their working out in order to gain method marks if their answer is not correct. Candidates need to have covered all the topics on the syllabus.

General comments

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Answer: 19, 15, 11
$\div 2$
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15	7	22
23	25	48

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(a) The majority of the candidates could write the number correctly, although a few added an extra 0.

(b) (i) Nearly all candidates could write down a multiple of 9 but a few candidates wrote 3, confusing factor and multiple.

(ii) Most candidates knew what an even number was but a few did write down an odd number.

(c) (i) This was well done.

(ii) This was also well done.

(iii) This was not so well attempted as not all candidates knew how to find a cube root.

(d) Most candidates managed to put the brackets in the correct place.

(e) Fewer candidates managed to answer this part correctly. Some rounded incorrectly to 2.54 and others used their calculator incorrectly.

(f) (i) This part was poorly done with the most common answer being 0.03.

(ii) This was also poorly attempted, with only a few candidates writing the number correctly in standard form.

Answers: **(a)** 7061 **(b)(i)** any multiple of 9 **(ii)** 22 or 24 or 26 or 28 **(c)(i)** 25 **(ii)** 1331 **(iii)** 16 **(d)** $3 \times (6 + 5) - 4 = 29$ **(e)** 2.55 **(f)(i)** 0.0316 **(ii)** 3.1626×10^{-2}

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Answers: **(a)(i)** 08 55 **(ii)** 70 **(b)(i)** 3 **(ii)** 39

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(c) Some candidates picked up a method mark by writing their answer to **part (b)** divided by their answer to **part (a)**.

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(c) Many candidates found the sides correctly but fewer gave the correct angles. Some candidates also multiplied these by 3.

(d) Few candidates could give the correct mathematical word here.

Answers: **(a)(i)** 56 **(ii)** 0.56 **(b)** 16 **(c)** 75, 72, 21; 90, 74, 16 **(d)** similar

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(a) Most candidates managed to factorise correctly.

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(f) Quite a few candidates managed to solve the simultaneous equations. As with all the other algebra topics, candidates need practice in the area of solving such equations.

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This was not well attempted. Few candidates appeared to know what the terms lowest common multiple or highest common factors meant.

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Answers: **(b)** $\frac{35}{36}$

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(d) Fewer candidates could find the equation of the line.

Answers: **(a)** (0, 3) **(b)** 5.66 **(c)** 1 **(d)** $y = x + 3$

Question 15

(a) There were many good attempts at sketching the graph but some candidates need more practice in transferring what is on their calculator screen to the paper.

(b) Some candidates tried to solve this algebraically and often without success. They should always be encouraged to use their graphics calculator to solve equations when they have drawn the graph.

Answers: **(b)** 2.5 and –0.25

INTERNATIONAL MATHEMATICS

Paper 0607/41
Paper 41 (Extended)

Key messages

Candidates should be familiar with the rubric on the front cover of the paper, particularly with reference to accuracy. Unless a question states otherwise or if an answer is not exact, three significant figure accuracy is required and this includes answers from graphics calculators.

Candidates should also show working for most questions. Candidates should be familiar with the required use of a graphics calculator. Use of extra facilities of a graphics calculator may not always earn full marks.

General comments

The overall standard of most candidates was of a good level and many candidates did show their working and gave their answers to a suitable level of accuracy. However the key message on accuracy did apply to a number of candidates.

There continues to be a number of candidates who only use the graphics calculator in questions involving graphs. The potential use in statistics and equation solving is frequently overlooked. Candidates were able to complete the paper in the available time. Well answered questions were in statistics, sequences, trigonometry, probability and functions. Questions on rates of interest, mensuration, average speed, vectors and an algebra problem leading to a quadratic equation proved to be more challenging.

A number of candidates did find the paper to be quite difficult and may have been able to achieve a higher grade at core level.

Comments on specific questions

Question 1

(a) Most candidates were successful with this question involving mode, range, median, mean and inter-quartile range from a list of values. Only a few candidates used a graphics calculator and the inter-quartile range was found to be challenging to some candidates.

(b) Interpreting results in statistics is usually challenging and this question, asking about the suitability of the mode, proved to be no exception. The answer required was to mention that this particular mode was the highest value of all the data. Many candidates simply described the mode and stated that the mean is a better average.

Answers: **(a)(i)** 18 **(ii)** 10 **(iii)** 12.5 **(iv)** 13.25 **(v)** 6.5

Question 2

This question involved using and comparing simple and compound interest. The different rates and the types of interest made the question more demanding than usual.

It may be that candidates did not take the time to read the information thoroughly, as incorrect rates of interest were quite often seen as well as errors in the type of interest.

(a) Many candidates applied the simple interest and compound interest correctly, giving a money answer correct to a suitable accuracy. A few candidates treated the second stage of the investment as simple interest and a few incorrect interest rates were seen.

(b) This straightforward simple interest question was usually correctly answered. A few candidates used compound interest and a few gave the interest as the final answer.

(c) This question required a comparison between two investments and was found to be much more challenging than the previous two parts.

The stronger candidates answered the question efficiently showing good clear working. Many candidates also showed good methods and their only difficulty was dealing with the number of years, often overlooking the first year of the first investment. These candidates usually earned three of the four marks.

Some candidates found the challenge of comparing these two investments too difficult and a number of candidates omitted this part.

Answers: **(a)** \$3167.94 **(b)** \$3144

Question 3

(a) This straightforward sequence question was well answered.

(b) (i) This straightforward sequence question was well answered.

(ii) The *n*th term of the sequence was usually correctly given. A few candidates gave the rule of the sequence, i.e. $n + 2$, instead of the *n*th term.

(c) This part asked candidates to use previous answers to find another *n*th term, which was for a more complicated sequence.

Many candidates overlooked this instruction and used much longer methods since they treated this sequence as completely new. Many of these candidates were successful, although they did a lot of work for only two marks.

Answers: **(a)** 4, 10, 18, 28 **(b)(i)** 13, 15 **(ii)** $2n + 3$ **(c)** $n^2 + 7n + 6$

Question 4

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

(b) The type of correlation was almost always correctly stated.

(c) (i) The equation of the line of regression was usually answered correctly. A large number of candidates gave the coefficients to only two significant figures. There were also candidates who did not use the graphics calculator and found the equation of their drawn line of best fit.

(ii) Most candidates substituted correctly into their equation.

(iii) This second statistical interpretation question was answered more successfully than in **Question 1(b)**. Candidates were usually able to explain that this given value was outside the range of data used for the line of regression.

Answers: **(b)** positive **(c)(i)** $t = 10.6x + 5.70$ **(ii)** 29.0

Question 5

This mensuration question in context proved to be one of the discriminating and challenging questions of this paper.

Quite a high number of students omitted all three parts of this question.

(a) This 'show that' question required candidates to use the arc length or area of a sector and equate this with the circumference or the area of a whole circle.

Most candidates found this question difficult. There were some very good solutions which showed every step of the working. There were also solutions with 'doubtful' working and others that used the value to be shown.

(b) Although this part was often omitted, those candidates who attempted this part were often more successful than in **part (a)**. The correct answers were almost always by finding the difference between the areas of the given sectors and adding the area of the base. A large number of candidates attempted to use πrl, using the radii of the sectors as the sloping heights. This was fine but the obstacle of working out the radius of the top of the cup proved to be too difficult for most of these candidates.

(c) This was found to be the most difficult part of the question with most candidates using the volume factor to find a similar area. Only the very strong candidates realised that if the volume factor is 8 then the area factor is 4.

Answers: **(b)** 241 cm^2 **(c)** 963 or 964 cm^2

Question 6

(a) Almost all candidates translated the object triangle correctly.

(b) Drawing the stretch was much more challenging, particularly with the invariant line. There were many correct answers and many which had a correct stretch factor but used the base of the object triangle instead of the *x*-axis as the invariant line. A few used the *y*-axis as the invariant line.

(c) This part required candidates to combine a rotation with a reflection to reach a given image. This also proved to be a good discriminating question and the level of success was similar to **part (b)**. Most candidates gained the first mark with an angle of rotation of either 90° or 270°. The challenge for the next two points was to realise that many points could be chosen for the centre of rotation and then the equation of the line of reflection had to be deduced. There were many correct but different answers. The most common choice for the centre of rotation was the point (0, 1) if an anticlockwise rotation of 90° had been already chosen and this made the line of reflection more straightforward.

Answers: **(a)** Translation $\begin{pmatrix} -5 \\ 6 \end{pmatrix}$ **(c)** 90° anticlockwise, centre $(a, a + 1)$ then line $x = a + 3$ or 90° clockwise, centre $(b + 5, b)$ then line $y = b + 3$

Question 7

(a) The distance travelled was often calculated correctly. The conversion of 2 hours 45 minutes into 2.75 hours was usually done although 2.45 hours was often seen. A few candidates divided the speed by the time.

(b)(i) The overall average speed of a journey was much more challenging. The stronger candidates succeeded whilst many did not include the 30 minutes of stoppage time. There were candidates who did not deal with the 180 km at 85 m/h correctly. A few candidates even worked out the average of the two speeds, a very basic error at extended level.

(ii) Units of time did make this part challenging. The well organised candidates worked with hours and minutes and added each stage to reach the final arrival time. Others worked in hours, in decimal form to find the total time of the journey and then converted to hours and minutes. The less successful candidates were confused with units and frequently a decimal value in hours was incorrectly converted into hours and minutes.

Answers: **(a)** 192.5 km **(b)(i)** 69.4 km/h **(ii)** 04 12

Question 8

(a) Bearings, although also a core topic, often cause candidates difficulty and this question was no exception. There were many correct answers, usually from candidates who drew North lines above the points *B* and *C*.

Many candidates found the angle at *C* to be 35° but did not reach the angle between *BC* and the North line as 60°.

A few candidates thought that a bearing was a distance and calculated the length of *BC* and gave it as their answer.

(b) This was the most successful part of the whole question with candidates either using right-angled trigonometry or the sine rule. Candidates had to show that the answer rounded to 104.6 so a more accurate value was required and this final mark was often lost.

(c) This was also a successful part of the question requiring the calculation of the area of each of two triangles.

The first area was found to be quite straightforward by using either $\frac{1}{2}$ base × height or $\frac{1}{2}ab\sin C$.

The second area was more challenging as candidates had to calculate a side, using the sine rule, followed by use of $\frac{1}{2}ab\sin C$. There were more complicated methods involving a side and then a perpendicular height.

The stronger candidates succeeded in earning all six marks whilst most candidates scored some of the marks.

Final answers were occasionally out of range as a result of premature approximation.

(d) The length of a perpendicular from a point onto a line always proves to be more challenging than to be expected. It is the realisation of which length is required that causes the difficulty rather than the simple trigonometry calculation. There were many correct answers together with calculations of a wrong length as well as quite a number of omissions.

Answers: **(a)** 300° **(c)** 9780 m^2 **(d)** 93.2 m

Question 9

(a) This completion of a tree diagram was very well answered. A few candidates misinterpreted the context as the denominators of their fractions were for an incorrect numbers of balls in the respective bags.

Candidates should take care in reading information at the beginning of a question since so many marks depend on a correct start.

(b) (i) This product of two probabilities was very well answered, almost always from using the tree diagram.

(ii) This sum of two products of probabilities was also well answered although not quite as successful as the previous part. Some candidates only gave one product whilst a few others gave three.

Answers: **(b)(i)** $\frac{6}{56}$ **(ii)** $\frac{2760}{4032}$

Question 10

(a) This straightforward rearrangement of an equation was almost always correctly answered.

(b) (i) The instruction to use substitution did not help many candidates who demonstrated an uncertainty of how to start. The stronger candidates connected **part (a)** with this part and did substitute for *y* to reach an equation in *x*. Many others tried to take a square root of the second equation which did not lead to anything.

(ii) The solving of a quadratic equation was more successful as this topic is so well practised. Most candidates continue to use the formula rather than a sketch from their graphics calculator. Many candidates solved the equation correctly and some of these candidates went on to interpret their solutions. Many lost the context of this part and gave the zeros of the quadratic equation they had just solved instead of the *y* co-ordinates of the two points of intersection.

Answers: **(a)** $y = 8 - 3x$ **(b)(ii)** (1.04, 4.88), (3.76, –3.28)

Question 11

As mentioned in **Question 9(a)**, many marks depend on a correct start, which in this case is a correct sketch. The other point to make is the need to give answers correct to three significant figures, not two as was often seen.

(a) Many candidates gave a sketch which earned full marks. A few lost one mark as a result of branches overlapping an asymptote too much. Others did not have the centre branch crossing the *x*-axis.

A number of candidates had a completely incorrect sketch as a result of incorrectly entering the function into the calculator. It is impossible to follow through incorrect sketches as the nature of the properties change significantly.

(b) Those with a correct sketch almost always gave a correct minimum point although often with two significant figure answers.

(c) Those with a correct sketch usually gave correct equations of asymptotes. Numerical answers without $x =$ ... were quite often seen and such answers do not earn marks.

(d) (i) This part required candidates to realise that *x* co-ordinates of points of intersection were needed. As the question did not instruct candidates to use their sketch, quite a number tried to solve the problem algebraically. Those candidates who found the points of intersection usually scored full marks although, as in **part (b)**, answers were often to less than three significant figures.

(ii) This was the most demanding question of the whole paper. It required the use of the answers to the previous part and the use of the asymptotes to solve an inequality. Only the strongest candidates succeeded with this question. Many tried algebra, as in the previous part, and many simply omitted this question.

Answers: **(b)** (–0.930, –0.252) **(c)** $x = -2$, $x = 3$ **(d)(i)** –2.12, –0.747, 2.53
(ii) $x < -2.12$, $-2 < x < -0.747$, $2.53 < x < 3$

Question 12

(a) Most candidates scored full marks in solving f(x) = 11. A number of candidates calculated f(11) perhaps anticipating that the first part of a function question is always an evaluation of f(x) with a given x.

(b) The inverse of f(x) was generally well answered. The frequently seen denominator of –3 was accepted. A number of candidates made sign errors when rearranging terms.

(c) This question was much more challenging to many candidates. Only a few gave the answers directly from the factors of the quadratic equation already there. Many candidates multiplied the brackets and this often led to leaving the expression or to incorrect answers.

(d) (i) Only a handful of candidates gave the answer immediately as x. Most candidates found the inverse of g(x) first and then substituted g(x) into their inverse and only a few of these candidates arrived at the final answer of x. Some even stopped at $\frac{2x}{x}$.

(ii) This part was answered more successfully with most candidates showing an understanding of a composite function. A few candidates made the error of f(f(x)) = f(x) $\times$ f(x).

(iii) The addition of algebraic fractions is a high level topic and this question certainly endorsed this. There were many correct answers from candidates showing very good manipulative skills. One unnecessary process was to multiply out the brackets in the common denominator and errors were often seen here. Some candidates gave only the numerator as the final answer and a few candidates were unable to make a correct first step.

Answers: **(a)** –2 **(b)** $\frac{5-x}{3}$ (c) $\frac{5}{3}$, $-\frac{3}{2}$ **(d)(i)** x **(ii)** $11x-7$ **(iii)** $\frac{26-8x}{(5-3x)(2x+3)}$

Question 13

(a) (i) This vector subtraction was usually correctly answered. A few candidates seemed to have limited knowledge of basic vector geometry and errors **a** + **c** and **a** – **c** were seen.

(ii) The stronger candidates gave a correct position vector from a correct route usually from **a** added to $\frac{1}{3}$ of their answer to **part (i)**. Many candidates made errors with directions and many used $\frac{1}{2}$ instead of $\frac{1}{3}$. An indication of a correct route, e.g. $\overrightarrow{OA}+\overrightarrow{AP}$ would have earned a method mark.

(iii) The comments for **part (ii)** apply to this part and only a few candidates were able to deal with this vector geometry correctly. Again, there was a mark for a correct route stated.

(b) This was a final mark testing the understanding of the result of **part (a)(iii)**. Only a small number of candidates gave the correct answer of collinear or an equivalent statement. Many gave answers about lengths even though the question was only asking about three points.

Answers: **(a)(i)** **c** – **a** **(ii)** $\frac{2}{3}\mathbf{a}+\frac{1}{3}\mathbf{c}$ **(iii)** 2**a** **(b)** collinear

INTERNATIONAL MATHEMATICS

Paper 0607/42
Paper 42 (Extended)

Key messages

- Candidates should include sufficient working to gain method marks.
- 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 fewer significant figures. This was particularly common on some answers following curve sketching.
- Candidates should be familiar with the expected uses of graphics display calculator. In particular the ranges given on the axes provided should be used in the settings of the calculator.
- 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 quite straightforward and accessible to most of the candidates with omission rates very low. Just one or two parts of questions proved difficult for all but the very best candidates. The work from the best candidates was very impressive indeed. Marks across a substantial range were seen and there were sufficient lower demand questions for less able candidates to show what they knew, leading to few very low marks.

Whilst most candidates displayed knowledge of the use of a graphics display calculator, a few are still plotting points when a sketch graph is required. This is rarely successful. Familiarity with other uses such as 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

The numerical parts of this question were done exceptionally well and **part (a)(ii)** was also usually correct. As was to be expected, **part (b)(ii)** proved more challenging, with a number of candidates looking for quadratic or cubic functions rather than an exponential function. The successful candidates were fairly evenly split between those who quoted the geometric progression formula leading to $8 \times 2^{n-1}$ and those using a more instinctive approach leading to 2^{n+2} or 4×2^{n}.

Answers: **(a)(i)** –1, –8, **(ii)** $34 - 7n$ **(b)(i)** 128, 256 **(ii)** 2^{n+2}

Question 2

Part (a)(i) was very well done although just a few candidates treated it as a reverse percentage rather than a straightforward percentage decrease. In **part (a)(ii)** it was fairly common to see a correct original fraction but with decimals in the numerator, which was often left unsimplified or converted to a decimal or percentage. Considering this was a reverse percentage, **part (b)** was very well done. Just a few candidates simply added on 15% to 80.75. Although **part (c)** was more challenging it was quite well done although a significant number of candidates omitted to subtract 76.5% from 100%.

Answers: **(a)(i)** \$55.25 **(ii)** $\frac{99}{320}$ **(b)** \$95 **(c)** 23.5%

Question 3

Parts (a)(i) and **(ii)** were well done by most candidates. Sometimes in **part (i)** the reflection was in the wrong line and in **part(ii)** the rotation was about the wrong centre. Whilst better candidates did **parts (a)(iii)** and **(b)** well a significant number gave a combination of transformation when the question specifically asked for a single transformation; these received no credit. In **part (b)** many candidates, including some of the best, gave $\frac{1}{2}$ or –2 as the scale factor. Better candidates did **part (c)** well although a significant number used the wrong invariant line.

Answers: **(a)(i)** Image at (2, 4), (3, 6), (6, 6), (6, 4) **(ii)** Image at (–4, –2), (–6, –3), (–6, –6), (–4, –6)
(iii) Reflection in $y = -x$ **(b)** Enlargement, centre (0, 0), scale factor $-\frac{1}{2}$
(c) Image at (2, –4), (6, –4), (6, –8), (3, –8)

Question 4

The sketch in **part(a)** was usually correct, with many candidates using the asymptotes to good effect. Just a few drew straight lines or tried to plot the points. **Part (b)** was also well done. In **part (c)**, a number of candidates did not realise that a single number was the required answer. Algebraic answers and inequalities were fairly common. The sketch in **part (d)(i)** was usually correct as was the equation of the asymptote in **part(d)(ii)**. However, some gave $x = 1$ or simply 1. Those with correct sketches were usually able to solve the equation in **part(e)** but some did not give both answers correct to three significant figures.

Answers: **(b)** –1, 2 **(c)** 2 **(d)(ii)** $y = 1$ **(iii)** –0.892, 2.62

Question 5

Part (a) was usually correct although a number used a power of 5 instead of 6 and some omitted to round the answer to the nearest 100. Just a few used simple interest. **Part (b)** was one of the more difficult questions on the paper and it was pleasing to see how well it was done. Most candidates were able to start correctly and those using the twelfth root were usually able to solve the equation. Those using logs were somewhat less successful.

Answers: **(a)** \$22 100 **(b)** 1.50

Question 6

Most candidates identified the correct interval in **part (a)(i)** although a few gave 97, 10 or 55. **Part (a)(ii)** was very well done with most candidates able to find and plot the cumulative frequencies. Very few plotted at other points than the right-hand end of the interval. A number, however, drew a frequency diagram rather than a cumulative frequency curve and this meant they were ineligible for credit in **parts (iii)(a)** and **(b)**. Both parts of **(iii)** were well done although some omitted to subtract from 200 in **part (iii)(b)**. In **part(b)(i)** some candidates, despite showing the midpoints, used them incorrectly in evaluating the mean. The frequency densities and histogram were usually correct although a number divided each frequency by 10 rather than the width of the interval.

Answers: **(a)(i)** $50 < t \leqslant 60$ **(iii)(a)** 52 to 55 **(iii)(b)** approximately 20
(b)(i) 52.5 **(ii)** 1.3, (3.9) 11, 8.4, 1.9

Question 7

In **part (a)**, most candidates were able to write down the correct equation and solve it. Some omitted to multiply the speed by the time and some divided the 8 by 3. The proofs in **part (b)(i)** were usually well presented and correct. A few were unable to expand the bracket correctly. The sketch in **part (b)(ii)** was almost always correct with just a few setting incorrect ranges on their graphics calculator. Although many could use the calculator to solve the equation, many were unable to choose the correct one from the solutions and gave two possible answers for the volume, or the incorrect one.

Answers: **(a)** $x+2\left(x+\frac{1}{4}\right)=8$, 2.5 **(b)(iii)** 318

Question 8

All three answers in **part (a)** were almost always correct. **Part (b)(i)** was also very well done with just a few adding $\frac{1}{6}$ and $\frac{1}{6}$ and others making errors in multiplication. The most common mistake in **part (b)(ii)** was to omit to consider the other order of events giving the answer $\frac{1}{18}$. **Part (c)** did prove more difficult with significant numbers giving the answer $\frac{125}{216}$ from $\left(\frac{5}{6}\right)^3$.

Answers: **(a)(i)** $\frac{1}{3}$ **(ii)** $\frac{2}{3}$ **(iii)** $\frac{2}{3}$ **(b)(i)** $\frac{1}{36}$ **(ii)** $\frac{1}{9}$ **(c)** $\frac{215}{216}$

Question 9

Both parts of **(a)** were very well done although some candidates gave a gradient of –5 or $+\frac{1}{5}$ in **part (ii)**. The solution to the quadratic equation in **part (b)(i)** was usually correct with approximately equal numbers choosing factorisation or formula methods. Very few sketches were seen. Better candidates did **part (b)(ii)** well but weaker candidates often did not see the connection between the parts. Some who did realise the connection had inequalities the wrong way or used $\leqslant$ instead of <.

Only the best candidates succeeded with **part (c)**. It was expected that a 'completing the square' method would be used and this was almost always the route to the correct answers. Many candidates used substitution of (1, 5) and (0, 1) into $y = ax^2 + bx + c$, but this very rarely produced correct solutions for a and b.

Answers: **(a)(i)** $y = 5x - 3$ **(ii)** $y=-\frac{1}{5}x+2$ **(b)(i)** correct working leading to –2, $\frac{2}{3}$ **(ii)** $-2 < x < \frac{2}{3}$
(c) $a = -4$, $b = 8$, $c = 1$

Question 10

The bearing in **part (a)(i)** was usually correct but the one in **part (ii)** much less so. **Parts (b)** and **(c)** were both done very well with accurate Cosine Rule and Sine Rule calculations. Some candidates gave the correct values in the Cosine Rule but evaluated incorrectly on the calculator. Just a few tried to use the wrong rule or used right-angled triangle techniques. **Part (d)(i)** was well done by many but in finding the area of triangle *ABC*, many used the wrong angle leading to $\frac{1}{2}\times 115\times 120\times \sin 65$. With the problems of dealing with both areas of similar figures and the change of units, **part (d)(ii)** proved much more challenging and only the best were successful.

Answers: **(a)(i)** 125° **(ii)** 305° **(b)** 69.3 m **(c)** 60.3° **(d)(i)** 8730 m^2 **(ii)** 349 cm^2

Question 11

Both parts of **(a)** were very well done with few incorrect answers. **Part (b)** was also well done although some made sign errors in transforming the function and just a few left the function in terms of *y*. A few also confused $f^{-1}(x)$ and $(f(x))^{-1}$. **Part (c)** was usually correct with just a few confusing the order of the composite functions and also a few forgetting to add the 1. Some candidates incorrectly simplified the final answer by dividing by 2. Most recognised the transformation in **part (d)** as a translation but a significant number gave the wrong vector. **Part (e)** proved much more difficult but, nevertheless, there were many correct answers.

Answers: **(a)(i)** 10 **(ii)** 1 **(b)** $\frac{x-1}{2}$ **(c)** $4x^2 + 4x + 2$ **(d)** translation $\begin{pmatrix} 0 \\ -2 \end{pmatrix}$ **(e)** 3

INTERNATIONAL MATHEMATICS

Paper 0607/43
Paper 43 (Extended)

Key message

Candidates are expected to answer all questions on the paper so full coverage of the syllabus is essential.

Communication and suitable accuracy are also important aspects of this examination and candidates should be encouraged to show clear methods, full working and to give answers to three significant figures or to the accuracy asked for in a particular question. Candidates are strongly advised not to round off during their working.

The graphics calculator is an important aid and candidates are expected to be fully experienced in the appropriate use of such a useful device. It is hoped that the calculator has been used as a teaching and learning aid throughout the course. There is a list of functions of the calculator that are expected to be used and candidates should be aware that more advanced functions will usually remove the opportunity to show working. There are often questions where a graphical approach can replace the need for some complicated algebra and candidates need to be aware of such opportunities.

General comments

The candidates were very well prepared for this paper and there were many excellent scripts, showing all necessary working and a suitable level of accuracy. Candidates were able to attempt all the questions and to complete the paper in the allotted time.

A few candidates needed more awareness of the need to show working, either when answers alone may not earn full marks or when a small error could lose a number of marks in the absence of any method seen.

The sketching of graphs does continue to improve although the potential use of graphics calculators elsewhere is often not realised.

Topics on which questions were well answered include transformations, percentages, histograms, curve sketching, ratio, probability, vectors, quadratic and simultaneous equations.

Difficult topics were compound functions, compound interest, scale factor of area/volume and mensuration.

There were mixed responses in other questions as will be explained in the following comments.

Comments on specific questions

Question 1

(a) (i) This was nearly always correct.

(ii) This was also nearly always correct.

(b) This was a discriminating part with many candidates unable to recognise that a double reciprocal function leads to the output being the same value as the input. Several earned a method mark for getting as far as g(5) = 0.2 but quite a few were unable to take their solution past $\frac{1}{0.2}$ to its simplest form of 5 as a final answer.

(c) Overall another challenging part, with only a small number of candidates earning full marks. Many earned the method mark for combining the functions correctly to obtain $3(x + 2)^2 – 2$ (=10) but only the better candidates were able to expand the brackets correctly.

(d) Most candidates gained the method mark here but poor processing of $(3x – 2 + 2)^2$ in particular led to no further credit.

Answers: **(a)(i)** 10 **(ii)** 0.1 **(b)** 5 **(c)** 0 and −4 **(d)** $\frac{1}{9x^2}$

Question 2

(a) Overall a well answered question, with the majority of candidates scoring full marks. A few lost a mark for rounding one of the values to $182 as the question dealt with money. Many candidates understood the basic principles of ratio but worked in hours, when the question stated minutes, leading to incorrect rounding of values and inaccurate final answers. Nearly all recognised the need to divide the total by their divisor but a few misread $379.50 as $379. Only a handful did not give an answer here.

(b) (i) A well answered part with most gaining full marks by use of the direct method, although several found 5 per cent first and then subtracted from $70.20. A few lost a mark here for rounding to $66.7 with the correct answer of $66.69 not seen anywhere in the working. Candidates should realise that if a money answer is exact, as this one was, then the exact answer should be given, rather than rounding it.

(ii) Reverse percentage questions still confuse a large number of candidates with many finding the classic wrong answers of $64.58 and $75.816 by multiplication by (in this case) 0.92 or 1.08. Very few method marks were awarded here for recognition of $70.2 = 108 per cent.

(c) (i) This “show that” question on simple interest was generally well answered. However, some candidates are using “of” in their solutions instead of “x” for multiplication leading to zero marks. A few lost the accuracy mark by writing $450 + $78.75 = $528.25

(ii) Most candidates were able to score the first mark in this part by setting up an appropriate equation and many went on to gain the second mark for correctly finding the fifth root of 1.0335… which was often given as the final answer. Several candidates went on further to gain full marks for the correct interpretation of their result as a percentage.

Answers: **(a)** $88, $181.50, $110 **(b)(i)** $66.69 **(ii)** $65 **(c)(ii)** 3.35

Question 3

(a) (i) Most scored full marks here with the *x* and *y* scales easy to interpret and plotting the remaining points from the table. However, some candidates omitted this part.

(ii) Most scored the mark here.

(b) (i) This was nearly always correct.

(ii) This was also nearly always correct.

(c) (i) This part of the question required readings from a graphics calculator and candidates need to know that this does not change the rules about 3 significant figure accuracy. Candidates were awarded one mark if they rounded all numbers to 2 significant figures.

(ii) This strict follow through part was answered correctly by most candidates but several attempted the answer based on their line of best fit or by looking at the graph.

Answers: **(a)(ii)** Negative **(b)(i)** 8 **(ii)** 18.3 **(c)(i)** $y = 97.0 – 9.84x$ **(ii)** 21.2

Question 4

(a) This was a straightforward calculation of the estimated mean from grouped data but with the additional complication of an answer required to the nearest gram. Many candidates are still dividing their correct cumulative total by the number of groups instead of, in this case, the total number of peaches. This led to a totally unrealistic final answer.

(b) Generally a well answered part, with most candidates recognising that this was a probability without replacement question. Some candidates lost the final mark for not giving the answer in its simplest form as requested in the question.

(c) (i) Most candidates gained both marks for correctly dividing the frequency by the bar width, although a few used the upper class limit.

(ii) This histogram was particularly well answered with most candidates gaining full marks. There was some variation in the *y*-axis scale seen.

Answers: **(a)** 171 **(b)** $\frac{44}{595}$ **(c)(i)** 0.1, 0.9, 1.1, 0.5, 0.7

Question 5

(a) (i) The majority of candidates scored the mark here but several did have the signs transposed, presumably from working along the vector route in the opposite direction to that required.

(ii) Most were correct here and those that had the wrong answer to part **(a)(i)** usually picked up full marks here by division of their previous answer by 3.

(iii) Several candidates lost the mark in this part.

(iv) This was not as well answered as the previous parts, but most candidates picked up at least one mark for either the **p** or the **q** value correct.

Part **(b)** was not answered very well. The method of squaring the scale factor for area was challenging for all but the best candidates.

(b) (i) Only a minority of candidates managed to earn both marks here.

(ii) Again, it was a minority who were awarded full marks.

Answers: **(a)(i)** $-6\mathbf{p} + 6\mathbf{q}$ **(ii)** $-2\mathbf{p} + 2\mathbf{q}$ **(iii)** $4\mathbf{p}$ **(iv)** $-6\mathbf{p} + 2\mathbf{q}$ **(b)(i)** 216 **(ii)** 96

Question 6

This multi-part question was essentially testing candidates' knowledge of Pythagoras' Theorem and basic trigonometry but with the added complication of being able to visually identify 2D triangles correctly from a 3D square based pyramid.

(a) A very straightforward part with most candidates using the supplied formula correctly. Only a small number did not gain the additional mark for the units of volume generally answering cm^2.

(b) Generally well answered with most gaining full marks for a routine use of Pythagoras.

(c) Most gained full credit here but a few forgot to halve their answer to part **(b)** hence scoring zero. Another straightforward use of Pythagoras part, although some candidates had difficulty in identifying the correct triangle to be used.

(d) Several candidates were unable to identify the correct angle to be calculated and often found *DVP* scoring zero. A method mark was awarded on many occasions for candidates following through their parts **(b)** or **(c)**. Those that scored zero in part **(c)** tended to score zero here as well

(e) (i) This was generally not well answered with many unable to visualise the correct right-angled triangle and lengths to be used to calculate the required slant height. Again many forgot to halve $\sqrt{72}$ before applying Pythagoras.

(ii) This part was only answered well by the stronger candidates and, generally, those that had struggled earlier on with this question carried on with misunderstandings of the required angle/triangle.

(f) A lot of candidates struggle to understand the concept of scale factor when applied to area/volume and this part was no different. Several did pick up the method mark for dividing 24 by their part **(a)** but most gained no further credit.

Answers: **(a)** 192 cm^3 **(b)** 12 (**c)** 10 **(d)** 53.1 **(e)(i)** 9.06 **(ii)** 62.1° **(f)** 4

Question 7

This mensuration question had the added difficulty of a smaller hemisphere removed from a larger one. The supplied formula was for a sphere and many candidates forgot to halve values in their calculations. The vast majority of candidates still fully evaluate their answers rather than leave pi in their calculations as long as possible and only a few gave the exact final answer.

(a) Most candidates answered this part well, although a few did find the correct volumes and then added them together. The weaker candidates who did not use the formula for a hemisphere usually picked up method mark here.

(b) This was one of the more challenging questions on the paper. Candidates found it difficult to score full marks due to either forgetting to add on the surface area of the smaller internal hemisphere or subtracting the smaller circle or in many cases both. Here each calculated term had to be fully correct for a hemisphere to score credit.

Answers: **(a)** 6810 **(b)** 2200

Question 8

(a) Mostly all correct, with only a small number being awarded no marks. However, some candidates inverted their *x* and *y* co-ordinates.

(b) Mostly all correct with only a small number not scoring anything here. However, again some candidates inverted their *x* and *y* co-ordinates.

(c) There was a good set of responses to this part with most recognising that the single transformation was a reflection. Some candidates are still incorrectly identifying the *y*-axis as the line $y = 0$. Only a small number lost all marks for responding with more than one transformation.

Answers: **(a)** (−1, 5) **(b)** (−1, −5) **(c)** Reflection, *y*-axis

Question 9

Most parts of this question required readings from a graphics calculator and candidates need to know that this does not change the rules about 3 significant figure accuracy. Candidates also need to know that there are specific functions on the calculator to answer these questions and not to simply move the cursor around the screen as this will not lead to accurate answers. A small number of candidates omitted this question, suggesting a lack of experience with a graphics calculator.

(a) (i) This was not a well answered part as the vast majority of candidates did not appear to have their axes set on a suitable scale on their graphics calculator to show the curve maximum slightly to the right of the *y*-axis. In most questions, the axes on the question paper give the window that should be used on the calculator.

(ii) A good set of answers here with most responses fully correct with only a small number being awarded no marks.

(iii) A well answered part with the vast majority scoring the mark.

(b)(i) A much better set of graphs were seen here with most fully correct, although a few lost one mark for intersecting the *x*-axis.

(ii) The 3 significant figure accuracy rule was not observed very well here with a large number of candidates having 0.49 as their *y* co-ordinate.

(iii) The 3 significant figure accuracy rule was not observed very well here with a large number of candidates having 0.098 as their *x* co-ordinate.

(iv) This was a discriminating part with very few candidates realising that this was a translation of +1 in the *x* direction. Some thought it was a translation in the opposite direction.

Answers: **(a)(ii)** (0, 10), (3.70, 0) **(iii)** 3.54 **(b)(ii)** (1.47, 0.488) **(iii)** 0.0982 and 2.98 **(iv)** 1.10 and 3.98

Question 10

(a) A slight twist on the usual quadratic equation in that candidates had to slightly rearrange the terms to get it into the form $ax^2 + bx + c = 0$ before solving which unfortunately some did not achieve. Several either missed or ignored the instruction "show all your working" and used the equation solver on their graphics calculators to produce the correct answers and so were awarded only two marks as they showed no working.

(b) This was another challenging part with only a few candidates making the successful link between parts **(a)** and **(b)**. Many responses had the inequalities reversed scoring zero.

(c) Only a handful of candidates scored full marks here but several scored three marks for both correct values seen, presumably from use of their graphics calculator. Some incorrect processing and non-mathematical methods resulted in an answer of $x = 1$ being seen on many occasions but with no marks awarded as it came from incorrect working.

Answers: **(a)** 1.40 and −2.15 **(b)** $x > 1.40$ and $x < -2.15$ **(c)** $-1.75 \leqslant x \leqslant 1$

Question 11

(a) Most responses were fully correct here, possibly in part due to the solutions being positive integers, although a fair number of candidates did not read the "show all your working" comment and only gained two marks with their graphics calculator. Most candidates used the elimination method rather than the substitution approach.

(b) A well answered part with most responses recognising the link to part **(a)** and either fully correct or follow through answers seen.

(c)(i) Very few candidates scored full marks here with most responses missing the "exact" answers requirement in the question. However several candidates did pick up two marks here for correct 3 significant figure answers seen. Many responses scored the method mark for linking parts **(b)** and **(c)(i)** successfully.

(ii) An elegant and pleasing end to the paper but with very few gaining the mark from the correct combination of their answers to part **(c)(i)**, although those with decimal answers generally managed to gain this as well.

Answers: **(a)** $x = 5$, $y = 2$ **(b)** $a = 10$, $b = 4$ **(c)(i)** $p = \log 5$, $q = \log 2$ **(c)(ii)** 1

INTERNATIONAL MATHEMATICS

Paper 0607/51
Paper 51 (Core)

Key messages

The space below a table should be used to show the working required to find the entries in the table. In this paper, credit for communication was given for such working seen.

Candidates need to know what *simplest form* means with regard to algebraic expressions.

In a question with three parts **(i)**, **(ii)** and **(iii)**, these parts are probably related in some way. For example, **Question 1(b)(iii)** was most easily solved by equating **parts (i)** and **(ii)**.

It is important to read all of the question and to read it carefully. For instance, in **Question 2(b)(iii)** many candidates found x but overlooked the next line, which asked for three sides of a triangle.

General comments

This task required candidates to handle the relationship between sides, perimeters and areas for rectangles and right-angled triangles. Candidates showed very good skills in doing so and, in particular, the relevant tables were often fully correct.

Comments on specific questions

Question 1

(a) The large majority of candidates were able to show the calculations that gave the perimeter and the area of the rectangle. The most common error was to give the calculation for the area only.

(b) Most candidates completed the table for equable rectangles correctly. For many of these calculations a calculator would have been used. Only a few candidates showed the calculations they had done and so many missed an opportunity for communication.

Answer:

4.5	3.6	16.2	16.2
7	2.8	19.6	19.6
10	2.5	25	25
12	2.4	28.8	28.8
22	2.2	48.4	48.4

(c) The evaluation of $(x - 2)(y - 2)$ for different values of x and y was done correctly and resulted in answers of 4, provided the candidate's table in **part (b)** was correct. Nearly all candidates gained credit for communication here by showing the multiplications which gave 4.

Answer: last column is always 4

(d) A large number of candidates interpreted the question as asking for what one noticed about $(x-2)(y-2)$. But the question wanted candidates to use $(x-2)(y-2) = 4$ to find integer values of x and y. Of the candidates who had understood this, many still used decimals, as had been seen in the previous table. A few correctly realised that both the length and the width had to be integers and so they could use 2×2 or 1×4 to get 4.

Answer: 4 by 4 and 3 by 6

Question 2

(a) As in **Question 1(a)** most candidates could correctly give the calculations for the area and the perimeter of the right-angled triangle. As before there were a few who only showed the area calculation.

(b) (i) Nearly all candidates knew that the perimeter of the right-angled triangle was $x + x + 16 + 20$. Most left their answer in this (or a similar) unsimplified form. Credit was only given to those who simplified this expression as required by the question.

Answer: $2x + 36$

(ii) As in **part (i)**, nearly all candidates knew that the area of the right-angled triangle was $\frac{1}{2} \times 20 \times x$.

There were only a few who simplified this expression as required.

Answer: $10x$

(iii) Here candidates could make an equation by equating their expressions in **part (i)** and **part (ii)**. For doing so credit for communication was given.

The majority of candidates used other methods, sometimes using an area and perimeter of 45. These methods were often not clear from their working. It may be that the table, later on in **part (d)**, allowed them another way of finding the answer.

Several of the candidates who found the value of x did not complete the answer by finding the length of the hypotenuse. Credit was, in this instance, given if the correct hypotenuse appeared in the table in part (c). Candidates are urged to read all of the question, which asked for the length of *each* side.

Answer: 4.5, 20, 20.5

(c) The majority of candidates gained most of the marks for this question with many giving a completely correct table.

There was a large amount of space below the table for working. Only a few candidates made use of this and many did not show the calculations they typed into the calculator. In particular, credit for communication was given to those who showed how to find 4.8 for x in the third row and 10.6 for z in the last row.

Answer:

6.5	7.2	9.7	23.4	23.4
4.5	20	20.5	45	45
4.8	14	14.8	33.6	33.6
5.6	9	10.6	25.2	25.2

(d) Nearly all candidates answered this question correctly using their answers from the previous table.

Here $(x - 4)(x - 4)$ always gives 8. For showing the multiplications used candidates gained credit for communication.

Answer: last column is always 8

(e) Most candidates were unsure how to proceed and there was a similar misreading of the question as in **Question 1(c)**. Candidates had to find integers that gave 8 when multiplied together. A few candidates were successful in using 2×4 or 1×8 to get 8. This gave sides of 6, 8 or 5, 12 in the right-angled triangle.

After finding two sides there are then various methods for finding the hypotenuse when the triangle is equable and credit for communication was given for showing one of those methods. Some fully correct answers were seen but none of those indicated a method for finding the hypotenuse.

Answer: 6, 8, 10 and 5, 12, 13

INTERNATIONAL MATHEMATICS

Paper 0607/52
Paper 52 (Core)

Key messages

Candidates need to understand what is meant by *simplest form* with regard to algebraic expressions.

The instruction *Show clearly* emphasises that reasons must be given. These reasons might take the form of algebraic working or diagrams with appropriate arrows to indicate connections.

General comments

Candidates showed good skills in deducing the correct numbers for the various number walls. Nearly all the number walls were correctly completed.

Comments on specific questions

Question 1

(a) All but a few candidates completed the number wall correctly.

Answer:
```
   9
 4   5
```

(b) Candidates were expected to notice that the largest number, 3, when placed in the middle of the bottom row, would be added twice to get the bricks above. The majority of candidates were able to describe this sufficiently.

In swapping over the 2 and the 3 in the bottom row some candidates correctly noticed that the brick above the 2 and the 3 does not change while the brick above the 1 and the 2 is now above the 1 and the 3, thus increasing the numbers on the upper bricks.

A few candidates only said that 3 was the largest number, which was insufficient to gain credit.

Question 2

(a) Nearly all the candidates filled in the bricks correctly.

Answer:
```
    20
  8    12
3    5    7
```

(b) The large majority of candidates knew to put the 4 on one of the middle bricks in the bottom row. Dependent on whether the other middle brick had a 2 or a 3 this gave a total of 22 or 24 respectively. Hardly any incorrect additions were seen.

(c) Most candidates had no difficulty in using addition and subtraction as appropriate to fill in the number wall. The most common error, though not seen that often, was to write 3 instead of –3 for the brick at the left end of the bottom row.

Answer:

			31			
		14		17		
	4		10		7	
–3		7		3		4

Question 3

(a) The middle row was correctly completed by most candidates, with a few writing multiplications instead of additions. Several candidates did not simplify the top row and occasionally b^2 was seen instead of 2*b*.

Answer:

	$a + 2b + c$	
$a + b$		$b + c$

(b) Most candidates correctly substituted 4 and 7 into their expression as the question required and then solved the resulting equation. Credit for communication was given for this approach. Some candidates tried out different numbers in the number wall before reaching their conclusion.

Answer: –2

Question 4

(a) Errors seen in **Question 3(a)** were seen and compounded here. There was a significant number of candidates who did not simplify the expressions in the bricks as the question required.

Answer:

		$a + 3b + 3c + d$		
	$a + 2b + c$		$b + 2c + d$	
$a + b$		$b + c$		$c + d$

(b) Candidates were expected to write their expression from **part (a)** equal to 34. Some successful candidates started by substituting integers into their expression, demonstrating that, close to 34, only totals of 32 and 40 were possible.

Several candidates deduced that $8x = 34$ and such a statement was credited with communication.

For solving the equation most candidates preferred to complete a number wall with 34 on the topmost brick. By successive halving for each row they showed that the bricks in the bottom row were all 4.25, not an integer. In this instance credit was given although the question asked that their expression be used.

(c) The large majority of candidates found values for *a*, *b*, *c*, *d* and *e*. Usually this was done by completing the first four rows and then seeing which possibilities there were for the bottom row.

Credit for communication was given for doing this. It was also possible to gain communication credit by writing relevant equations and showing how to work with them.

The most common error, though not seen too often, was to use 0 or negative numbers in the bottom row.

Answer: $a = 4, b = 4, c = 2, d = 1, e = 7$ or $a = 3, b = 5, c = 1, d = 2, e = 6$

Question 5

(a) Only candidates who had simplified their expression in **Question 4(a)** could spot the connection.

Many candidates showed that for $a = b = c = d = 1$ their expression became 1 + 3 + 3 + 1, which gives clear link to Row 3. A common incorrect line of thought was to take $a = 1$, $b = 3$, $c = 3$, $d = 1$. Several candidates gave Row 3 correctly but, without justification, this did not receive full credit.

(b) Some candidates could successfully write down the answer by looking at the 4th row of the number wall. Others, particularly those who could see no connection in **part (a)**, preferred to complete a full number wall to reach the answer. As the question did not ask for simplification any correct expression received full credit.

Some candidates, on seeing, in **part (c)**, that 43 should be the total, incorrectly adjusted their coefficients to fit.

Answer: $a + 4b + 6c + 4d + e$

(c) Only those with a correct expression in **part (b)** were able to gain the mark here. Nearly all the candidates who answered **part (b)** correctly were successful in checking their result in **Question 4(c)**.

(d) Many candidates, who were unsuccessful in **part (a)**, could recover here by making a complete number wall. This was by far the most popular method and very many correct answers were seen, with only a few numerical slips. Candidates could gain credit for communication in this way. Alternatively, communication could be gained by evaluating 1 × 2017 + 4 × 2017 + 6 × 2017 + 4 × 2017 + 1 × 2017 or, more efficiently, 16 × 2017.

Answer: 32 272

INTERNATIONAL MATHEMATICS

Paper 0607/53
Paper 53 (Core)

Key messages

Candidates need to understand what is meant by *simplest form* with regard to algebraic expressions.

The instruction *Show clearly* emphasises that reasons must be given. These reasons might take the form of algebraic working or diagrams with appropriate arrows to indicate connections.

General comments

Candidates showed good skills in deducing the correct numbers for the various number walls. Nearly all the number walls were correctly completed.

Comments on specific questions

Question 1

(a) All but a few candidates completed the number wall correctly.

Answer:
9
4 5

(b) Candidates were expected to notice that the largest number, 3, when placed in the middle of the bottom row, would be added twice to get the bricks above. The majority of candidates were able to describe this sufficiently.

In swapping over the 2 and the 3 in the bottom row some candidates correctly noticed that the brick above the 2 and the 3 does not change while the brick above the 1 and the 2 is now above the 1 and the 3, thus increasing the numbers on the upper bricks.

A few candidates only said that 3 was the largest number, which was insufficient to gain credit.

Question 2

(a) Nearly all the candidates filled in the bricks correctly.

Answer:
20
8 12
3 5 7

(b) The large majority of candidates knew to put the 4 on one of the middle bricks in the bottom row. Dependent on whether the other middle brick had a 2 or a 3 this gave a total of 22 or 24 respectively. Hardly any incorrect additions were seen.

(c) Most candidates had no difficulty in using addition and subtraction as appropriate to fill in the number wall. The most common error, though not seen that often, was to write 3 instead of –3 for the brick at the left end of the bottom row.

Answer:

31
14 17
4 10 7
–3 7 3 4

Question 3

(a) The middle row was correctly completed by most candidates, with a few writing multiplications instead of additions. Several candidates did not simplify the top row and occasionally b^2 was seen instead of 2*b*.

Answer:

$a + 2b + c$
$a + b$ $b + c$

(b) Most candidates correctly substituted 4 and 7 into their expression as the question required and then solved the resulting equation. Credit for communication was given for this approach. Some candidates tried out different numbers in the number wall before reaching their conclusion.

Answer: –2

Question 4

(a) Errors seen in **Question 3(a)** were seen and compounded here. There was a significant number of candidates who did not simplify the expressions in the bricks as the question required.

Answer:

$a + 3b + 3c + d$
$a + 2b + c$ $b + 2c + d$
$a + b$ $b + c$ $c + d$

(b) Candidates were expected to write their expression from **part (a)** equal to 34. Some successful candidates started by substituting integers into their expression, demonstrating that, close to 34, only totals of 32 and 40 were possible.

Several candidates deduced that $8x = 34$ and such a statement was credited with communication.

For solving the equation most candidates preferred to complete a number wall with 34 on the topmost brick. By successive halving for each row they showed that the bricks in the bottom row were all 4.25, not an integer. In this instance credit was given although the question asked that their expression be used.

(c) The large majority of candidates found values for *a*, *b*, *c*, *d* and *e*. Usually this was done by completing the first four rows and then seeing which possibilities there were for the bottom row.

Credit for communication was given for doing this. It was also possible to gain communication credit by writing relevant equations and showing how to work with them.

The most common error, though not seen too often, was to use 0 or negative numbers in the bottom row.

Answer: $a = 4$, $b = 4$, $c = 2$, $d = 1$, $e = 7$ or $a = 3$, $b = 5$, $c = 1$, $d = 2$, $e = 6$

Question 5

(a) Only candidates who had simplified their expression in **Question 4(a)** could spot the connection.

Many candidates showed that for $a = b = c = d = 1$ their expression became 1 + 3 + 3 + 1, which gives clear link to Row 3. A common incorrect line of thought was to take $a = 1$, $b = 3$, $c = 3$, $d = 1$. Several candidates gave Row 3 correctly but, without justification, this did not receive full credit.

(b) Some candidates could successfully write down the answer by looking at the 4th row of the number wall. Others, particularly those who could see no connection in **part (a)**, preferred to complete a full number wall to reach the answer. As the question did not ask for simplification any correct expression received full credit.

Some candidates, on seeing, in **part (c)**, that 43 should be the total, incorrectly adjusted their coefficients to fit.

Answer: $a + 4b + 6c + 4d + e$

(c) Only those with a correct expression in **part (b)** were able to gain the mark here. Nearly all the candidates who answered **part (b)** correctly were successful in checking their result in **Question 4(c)**.

(d) Many candidates, who were unsuccessful in **part (a)**, could recover here by making a complete number wall. This was by far the most popular method and very many correct answers were seen, with only a few numerical slips. Candidates could gain credit for communication in this way. Alternatively, communication could be gained by evaluating $1 \times 2017 + 4 \times 2017 + 6 \times 2017 + 4 \times 2017 + 1 \times 2017$ or, more efficiently, 16×2017.

Answer: 32 272

INTERNATIONAL MATHEMATICS

Paper 0607/61
Paper 61 (Extended)

Key messages

To do well on this paper, candidates needed to be able to manipulate algebraic expressions well for the investigation (***section A***) and to understand trigonometric graphs for the modelling (***section B***).

General comments

For the investigation it was necessary to have a good understanding of how to answer 'show that' questions and how to use the given 'show that' information to answer other questions. Candidates were, in general, able to attempt all questions in both the investigation and the modelling. There were some very good scripts seen.

Comments on specific questions

Section A Investigation: Equable Shapes

Question 1

Candidates had a good knowledge of the formulas for finding the area and the perimeter of a rectangle. Several different arrangements of the perimeter formula were seen; e.g. length × 2 + width × 2 or length + length + width + width or (length + width) × 2. All were, of course, perfectly acceptable. To improve an answer to this type of numerical 'show that' question it is best to work the area and the perimeter out separately and not to try to work them side by side. It is also better not to assume that $A = P$ at the beginning.

Answer: $3.6 \times 4.5 = 16.2$
$2 \times (3.6 + 4.5) = 16.2$

Question 2

(a) This expression was usually correct. Candidates should be able to simplify such expressions, although such answers as $10 \times y$ were not penalised.

Answer: $10y$

(b) This expression was also usually correct and again such answers should be simplified if possible. Some candidates chose to factorise, e.g. $2(y + 10)$ which is, of course, acceptable.

Answer: $2y + 20$

(c) Most candidates managed to connect the two previous expressions correctly and to solve their equation, getting the correct answer for y. The algebra was set out clearly and answers were at least reduced to $\frac{10}{4}$ if not written as a decimal.

Answer: 2.5

Question 3

(a) Answers for this equation were usually correct. Candidates should understand that a question that includes the words "Write down" should not need any explanation or working seen. Thus there was not any need to write A = and P = to show how the equation was formed.

Answer: $xy = 2x + 2y$

(b) Unlike **part (a)**, the candidates were now asked to show that two equations were equivalent. The best method was to start with the given equation and to expand the brackets. This led very quickly to the equation found in **part (a)**. To improve the quality of such answers candidates should make sure that further working out does not obscure previous working: e.g. when subtracting 4 from both sides of the equation they should make sure that the original 4s can still be seen. Some candidates tried to start with the equation from **part (a)** and soon found that they could not get very far. In this case candidates should make it clear where they have re-started their answer.

(c) The most common method of solution involved some structure or logic in trials in the working out. To make progress candidates needed to take the hint of using **part (b)** and substitute integer values for x to find integer values of y. Using $x = 1$ to $x = 6$ would have produced all the required results and duplicated the $x = 3$ and $y = 6$ with $x = 6$ and $y = 3$, so that the candidates would have realised they had covered all possibilities.

Answer: 3 by 6
4 by 4

Question 4

There were many excellent responses to this "show that" question and also many candidates who gained one mark out of the two. The first part was to find the hypotenuse which needed to be shown by square rooting the sum of the other two sides. Candidates who did not show that a square root was needed at some stage lost this first mark. The second part was to show that the perimeter equalled 21.6 by adding together twice the hypotenuse with the base of 6. Various equivalences were seen and were perfectly acceptable like $\sqrt{60.84}$ instead of 7.8 and 3 + 3 instead of 6. Many candidates felt the need to find the area even though it was given in the question.

Question 5

(a) The key to a good answer here was again to follow the instructions in the question. This told the candidates to find expressions, in terms of a and h, for the area and the perimeter. Most candidates did do this and most of them labelled their expressions with A and P. Having done this it was quite a simple task to equate them to complete the 'show that' section of this question.

(b) (i) Practice on squaring expressions would definitely be useful for candidates. Many candidates scored one mark for the RHS of the equation correctly squared and some gained both marks. Common errors to look out for on the LHS were $(ah - 2a)^2 = ah^2 - \dots$, $(ah - 2a)^2 = ah^2 - 4a^2$, $(ah - 2a)^2 = \dots - 4a^2$. On the RHS candidates regularly forgot to square the 2 or treated the $\left(\sqrt{a^2 + h^2}\right)^2$ as $(a^2 + h^2)^2$ and then quite often expanded this bracket incorrectly as well.

(ii) Few candidates realised that if they had not managed to work through the 'show that' successfully in **part (i)** that they still had the correct answer from the question in **part (i)** to use in **part (ii)**. Candidates should realise that 'Show that' questions are there to help them move forward in following questions so they should be on the lookout for places to use the information they have been given in one question in another question. Single bracket factorising is also something that it would be good for candidates to practise.

Answer: $\dfrac{4h}{h-4}$

(iii) Integer or whole number was the most common answer to this question. Candidates need to realise the significance of an expression in a denominator.

Answer: $h > 4$

(c) Candidates might have found it useful to look back at the diagram in **Question 5** or even to do a sketch themselves. Again they did not need correct answers to previous questions because a^2 could have been calculated from the equation given in **part (b)(i)**.

Answer: 27

Section B Modelling: Carbon Dioxide Measurements

Question 1

(a) (i) There were generally very good responses to this sketch. Most candidates knew or could work out the connection between $\sin x$ and $\sin 2x$. Marks were sometimes lost for carelessness when the maxima and minima went too far above or below 1 or −1. Marks were very rarely lost for missing the $x = 180$ point.

(ii) This question was well answered. Candidates had obviously been well prepared in the use and vocabulary of trigonometrical graphs.

Answer: 180

(b) This question was also well answered.

Answer: 60

(c) This question was also well answered and as it was not asked as a 'write down' question most candidates should be commended for also showing their working.

Answer: 9

Question 2

(a) Most candidates could apply their skills used in **Question 1** to the scenario in this question.

Answer: Period = 12
$b = 30$

(b) The value of a was sometimes calculated rather than being written down. This is absolutely fine and should be encouraged especially for the weaker candidates who can then be more confident of having the correct answer. Some candidates chose the value of 1 for a and some did not follow through with their value of b as found in **part (a)**.

Answer: 4

Question 3

(a) Excellent clearly plotted points were usually seen. The first point was occasionally missed.

(b) A very well answered question, especially the writing down of the value of c. Candidates knew how to find the equation of a straight line although some took quite a lot of working out to find the value of the gradient, which, given the easy figures could probably have been written down. Most candidates also remembered to write an equation and not an expression.

Answer: $y = \frac{1}{6}x + 393$

Question 4

There were many and varied answers to this question. Candidates did not appear to be sure of how to combine the expressions to give the complete model. Some of those who correctly chose to add the expressions often gave an answer of $2y$ or divided their expression by 2. Others added their $30x$ to the $\frac{1}{6}x$ or their 4 to their 393. It would be helpful for candidates to practice adding and indeed subtracting, multiplying and dividing expressions and equations. Candidates should also remember that a model is an equation and not an expression so '$y =$' was expected.

Answer: $y = 4\sin 30x° + \frac{1}{6}x + 393$

Question 5

Most candidates labelled the points on the axes correctly. A common error was to start at 393 and move in increments of 2 on the *y*-axis. The *x*-axis was sometimes labelled with years, despite the axis title of 'Number of months'.

Question 6

(a) The easiest and most accurate way to answer this question was to put the model into the calculator and trace the maximum. Candidates should be encouraged to do this without being told to use their graphical calculators.

Answer: 405.5

(b) This answer could have been read from the model on a graphical calculator or obtained by substitution into their model. Candidates made more errors in the calculation of the number of months than in the reading or the substitution. Commonly 40 months was used rather than 41, presumably because candidates did not consider that the 'end of May' meant an extra month and therefore they worked to the beginning of May.

Answer: 401.8

Question 7

Candidates found this question rather more difficult to calculate and there were a variety of answers for both the year and the month. Any working out was usually difficult to follow. Candidates should be reminded that all working may gain marks so they should keep it as clear as possible.

Answer: February 2019

Question 8

Comments were many and varied and most candidates tried to answer this question. The idea of extrapolation was not well known and the most common ideas were that either the amount of carbon dioxide would be very large or that other factors would come into play. Most of these answers were not connected to the given model.

INTERNATIONAL MATHEMATICS

Paper 0607/62
Paper 62 (Extended)

Key messages

To score high marks on this paper candidates needed to follow through the questions as a whole, noticing how previous questions and answers affected subsequent questions. They also needed to plot, draw and sketch graphs carefully and to use their graphical calculators, with sensible scales, to draw good sketches.

General comments

The communication was generally good. The main improvement needed in the modelling section is to be able to make good, appropriate comments on the suitability of models. These comments are not about the shape of the graph but should be related to the context of the question.

Comments on specific questions

Section A Investigation: Number Walls

Question 1

(a) This question was answered correctly by almost all the candidates.

Answer: 9
4 5

(b) Most candidates saw the reason as the fact that the largest number was now being added twice and explained it in this way. Some explained that 3 being larger than 2 would increase the total when added to 1. Overall the explanations were good and even the briefest were accurate.

Question 2

(a) This number wall was completed correctly by most candidates.

Answer: 20
8 12
3 5 7

(b) There were some slightly different variations of correct number walls as answers to this question. The most common answers totalled 24 although a total of 22 was also an option. Almost all the candidates answered this question correctly.

(c) Again this question was frequently correct. The common mistake was to put a 3 in the first cell in the bottom row instead of a −3. Checking by working backwards could have helped these candidates to rectify this.

Answer: 14 17
7
–3 3

Question 3

(a) Most candidates moved from the numerical examples to this algebraic question with ease. Quite a few candidates wrote the expressions in numerical rather than alphabetical order. They were not penalised for this although it may not have helped them with questions further on in the paper. Candidates should be encouraged to write all algebraic expressions in alphabetical order.

Answer: $a + 3b + 3c + d$
$a + 2b + c$ $\quad$ $b + 2c + d$
$b + c$ $\quad$ $c + d$

(b) Most candidates were successful in this 'show that' question. The best responses worked clearly through the steps including the division to obtain the decimal answer. To improve this type of answer candidates should continue after the division to complete their answer with a statement saying that this shows that *a* cannot be an integer.

(c) A collection of short equations and/or trials led most candidates to both sets of correct values. To improve their chances of gaining marks in the future, candidates should be encouraged to set their work out as methodically as possible and to choose their trials logically setting them out carefully.

Answer: 3 5 1 2 6
and
4 4 2 1 7

Question 4

(a) In this question many candidates confused *a*, *b*, *c* and *d* with the coefficients of the total expression and substituted $1 = a$, $3 = b$, $3 = c$ and $1 = d$. This was the most common error. Other candidates did not answer the first part of the question, by writing down a row number and not showing the connection between the expression for the total and the numbers in the row. Candidates should know and understand words such as coefficients so that they can use them properly in their explanations.

Answer: Row 3 gives the coefficients of *a*, *b*, *c* and *d*

(b) The expression was usually correct. A few candidates slipped up by putting 4 as the coefficient for *c* rather than 6.

Answer: $a + 4b + 6c + 4d + e$

(c) Most candidates set out their calculations so that they could be easily checked to come to a total of 43. Some of those who did not get 43 tried to make the sums work rather than checking their expression in **part (b)**. Candidates should realise that if they cannot get the answer given then it is worthwhile spending a little time checking their own previous work.

Answer: $3 + 4 \times 5 + 6 + 4 \times 2 + 6 = 43$
OR
$4 + 4 \times 4 + 6\times2 + 4 + 7 = 43$

Question 5

(a) Most candidates looked at the start of the pattern and extended it by answering, $3a$, $4a$ and then ha. To improve understanding candidates should be encouraged to read questions very carefully and to look for connections between questions. Reading the question really carefully would have revealed to them that the 'total' column was for the bottom row of each number wall. Looking at the previous questions and answers as in **Question 4** might have helped the candidates see the connection between the height of the row and numbers in the row.

Answer: $4a$
$8a$
$2^{(h-1)}a$

(b) A few candidates managed to restart from an incorrect answer to **part (a)**. Using $ha = 96$ gave the most common answer of 16.

Answer: 3

(c) Only a very few were able to start again to find the correct height of the wall. Those using *ha* correctly were able to achieve a method mark. Better candidates with the correct expression in **part (a)** used logarithms to solve this problem.

Answer: 23

Question 6

This final challenge was tackled by many of the candidates. Some managed to find at least one of the two heights. Various methods were tried too. Some, often quite successfully, grew long number walls with consecutive numbers in the bottom row. Others created equations using x, $x + 1$, $x + 2$ etc. and others used rather more random trials.

Answer: 3 and 5 only

Section B Modelling: Ranges

Question 1

(a) Many candidates plotted correctly and drew a good curve to join the points. There were some plotting errors and flat 'tops' and a few polygons.

(b) Most candidates read the lower value correctly. Many candidates did not record the second value as well and subsequently lost the mark. The values were read accurately. Candidates should be encouraged to rule lines on their graphs when answering questions like this. Seeing the line cut the graph in two places might have helped some candidates to give both answers.

Answer: 25 to 27
and
63 to 65

(c) Most candidates answered this correctly although 40° was also fairly common and related back to the graphs that had flat tops. Some candidates also gave a range, such as 40° to 50°.

Answer: 45

(d) This question was answered correctly by many candidates. There was also a good number who gave the answer as 10. These candidates were probably reading from their flat topped curves again and did not choose a point to use for substitution. Candidates should note that 'find' implies a calculation whilst 'write down' does not.

Answer: $r = 10.2$ ($\sin 2x$)

(e) Many of the calculations gave an acceptable negative value. Most candidates explained the negative result with words such as "opposite direction" and "backwards". Usually 'explain' questions need an answer related to the scenario so candidates who tried to explain using the shape of the sine curve did not score the mark.

Answer: −3.52… to −3.42…
The shot lands behind him

Question 2

(a) Answers that did not state that the range would be 0 needed to have a comment about landing. That the range was 0 was a very common answer. There were a few candidates who left the ball going straight up but did not complete this explanation. Candidates should be encouraged not to be too brief and to give complete explanations.

(b) The drawing of this second graph was equally as good as the first. There was still some inaccuracy and pencils were sometimes too thick.

(c) Candidates often compared the graphs or curves and not the ranges or the results. Candidates should be taught that the suitability of a model depends on its results and not on the graph that is drawn.

Answer: The ranges are close

Question 3

(a) Some good sketches were seen. Some were careless and, for example, missed the origin. Exponential curves were also seen fairly frequently. Although a range for r was not given, a reasonable arch-shaped curve should have been able to be drawn by the candidates on their calculators.

(b) Again, a number of good curves were seen. Candidates needed to use a sensible scale on the r axis for their first graph so that they could see that the second graph needed to be plotted below the first one. The comments were often not specific enough to warrant the mark. Candidates should read these questions very carefully so that they answer the particular question that is asked. The suitability of the model to predict the range could really be summed up in a short sentence – "not particularly good for most angles because the model always overestimates the range".

Question 4

(a) Many correct curves were seen, usually when a reasonable scale had been written onto the R-axis. Without a scale, the curves often tipped downwards or were basically straight lines.

(b) There was quite a variation between those candidates who worked through this algebra rather effortlessly to those who only managed to substitute 15 in two of the three places. Many did manage to correctly substitute 15 and 19.85 and then found the algebra too complex. Candidates should practice working with divisors and powers in equations.

Answer: 0.25

(c) A quick sketch of the model would really have helped the candidates to make a correct comment on its suitability. They would have seen that the range started to decrease around v = 20 and even became negative after v = 26. This would have given them plenty to say.

INTERNATIONAL MATHEMATICS

Paper 0607/63
Paper 63 (Extended)

Key messages

To score high marks on this paper, candidates needed to be able to understand restrictions on variables in algebraic contexts and to use their graphical calculators to draw good sketches and to trace values. They should also be aware that they should work to more figures than required in the answer and to show this in their working especially in 'show that' questions.

General comments

The communication was quite good and candidates are attempting more questions throughout the paper. Some candidates produced very good work in both the investigation and the modelling.

Comments on specific questions

Section A – Investigation: Chequered Flags

Question 1

(a) Candidates had no difficulty with the counting for this first question.

Answer: 10
10

(b) (i) This question was answered well with a few mistakes in the algebraic expressions. Many candidates did not feel the need to simplify their algebraic expressions. Unsimplified expressions were acceptable although candidates should be encouraged to simplify easy expressions such as $\frac{2n}{2}$ and $\frac{4n}{2}$.

Answer:

	Size of flag				
	2 by 3	2 by 4	2 by 5		2 by n
Black	3	4	5		n
White	3	4	5		n

	Size of flag				
	4 by 2	4 by 3	4 by 4		4 by n
Black	4	6	8		$2n$
White	4	6	8		$2n$

(ii) This question was also well answered. A significant number of candidates did not simplify their answers.

Answer: $3n$
$3n$

(c) Many candidates did not realise that a 1 row by 24 column flag was different to a 24 row by 1 column flag. Many other candidates did not allow for the 1 by 24 flags and others just missed one or two pairs of factors of 24. Candidates should be encouraged to find factors using a methodical format so that none are forgotten.

Answer: 8

(d) Most candidates saw the pattern and were able to give the correct answer to this question.

Answer: $\frac{mn}{2}$

Question 2

(a) Again, counting did not cause any problems.

Answer: 8
7

(b) There were two questions to this part. Candidates did tend to answer "No" to the first part. In the second part they often wrote down a restriction for *m* or for *n* but not for both. Alternatively they said that both *m* and *n* had to be even, probably not realising that only one needed to be even to make *nm* even.

(c) These tables were usually completed correctly. Some candidates thought that when the flag changed size there would be more white than black squares.

Answer:

	Size of flag	
	3 by 1	3 by 3
Black	2	5
White	1	4

	Size of flag		
	5 by 1	5 by 3	5 by 5
Black	3	8	13
White	2	7	12

(d) There were several correct variations to the answers to this question, mostly depending on how the candidate visualised the patterns.

Answer: $\frac{mn}{2}+\frac{1}{2}\ (\text{black})$
$\frac{mn}{2}-\frac{1}{2}\ (\text{white})$

Question 3

(a) This was a simple counting question.

Answer: 8
8
8

(b) (i) Once candidates had established the pattern they had no difficulty in completing both parts of this table. Some of them did not realise the connection with the size of the flag and lost the mark for the algebraic triples.

Answer:

	Size of flag						
	3 by 1	3 by 2	3 by 3	3 by 4	3 by 5		3 by n
Black	1	2	3	4	5		n
White	1	2	3	4	5		n
Grey	1	2	3	4	5		n

	Size of flag					
	6 by 1	6 by 2	6 by 3	6 by 5		6 by n
Black	2	4	6	10		$2n$
White	2	4	6	10		$2n$
Grey	2	4	6	10		2n

(ii) Again most candidates realised what the connection was and were able to write it down, even if unsimplified.

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

(iii) Candidates should take care when reading questions. Very few answered the first part with the required "No" or even a "Yes". Secondly the question asked for a restriction on *n* but there were just as many answers about *m* or *mn*. Candidates should be aware that what they say in a statement may be true but if it does not answer the question then their answer may not be awarded the marks.

Question 4

(a) There were some excellent answers to this 'Show that' question. Usually, the intermediate figure of 224 was also shown. The answer was sometimes left as the figure without a statement which, in this case, was acceptable. To achieve higher marks in future, candidates should add a statement to the fact that it cannot be true because the number of black squares has been worked out to be a decimal.

(b) The various answers showed that candidates should study factors more carefully. Many forgot the 1 × 18 pair which is commonly missed out when listing factors of numbers. Also, in this situation, it needed to be realised that a 2 by 9 flag was not the same as a 9 by 2 flag so they should both be listed.

Answer: 1×18 18×1
2×9 9×2
3×6 6×3

Question 5

Candidates were able to give some good answers about at least one or two of the variables. Answers about all of the variables, *m*, *n* and *p* were not so common. Many candidates stated that at least one of them should be a whole number, which, since *m* and *n* were given as the rows and columns of the chequered flag was a little too obvious for the final question in this investigation.

Answer: m or *n* or *mn* is a multiple of *p*

Section B Modelling: Areas of Polygons

Question 1

(a) Most candidates saw the pattern in the table and used it to correctly complete their answers, sometimes with a few arithmetical errors. Some candidates did not appreciate the limit of the 24 m or did not read the question carefully enough.

Answer:

Width m	Length m	Area m^2
3	9	27
4	8	32
5	7	35
6	6	36

(b) 'Maximum rectangle' was a common answer to this question. Other words quite often used were 'regular' and 'quadrilateral'. Candidates should learn the names and properties of shapes and solids.

Answer: Square

Question 2

This 'show that' question was in two parts. First, candidates needed to find the height of the triangle using Pythagoras' Theorem and then use their answer to find the area of the triangle. The height was sometimes left in exact form, such as $4\sqrt{3}$ or $\sqrt{48}$, which was acceptable. For the area, candidates needed to calculate an answer that would correct back to 27.7 as 1 decimal place. Figures in the range 27.68 to 27.72 were acceptable. Many candidates did not write down these figures and just wrote the final answer as given in the question. Candidates should be aware of the necessity to give more figures than the answer in this type of 'show that' question.

Question 3

(a) (i) This straightforward 'show that' question was answered well by many candidates. Some took a very long route to get to the answer, using exterior angles and/or interior angles, sum of angles in a triangle and angles in an isosceles triangle. When longer methods are used the whole method must be seen, which meant that some candidates did not get this mark.

(ii) Most candidates showed a good use of trigonometry in right-angled triangles to find the value of h correctly.

Answer: 3.30

(iii) This question was well answered with most areas within range. 7.9 was acceptable as an answer only when it came from 3.29 in **part (ii)**. Candidates should remember to show all their working as, in this case, 7.9 was not acceptable if only 3.3 was seen in the previous part.

Answer: 7.93

(iv) Most candidates showed a correct figure of 39.6… before equating it to 40. Again it was necessary to show the value of the area with more figures before correcting back to the given answer.

(b) The instruction given was to use the method as set out in **part (a)**. Those candidates, who methodically followed this, changing the 5 for the pentagon to a 6 for the hexagon, soon achieved the correct area. Candidates should be reminded to set out their working clearly both to help themselves as well as for the chance of achieving marks if they were to go wrong. Much of the working shown here was jumbled and difficult to follow.

Answer: 41.6

Question 4

(a) (i) Candidates found it very difficult to change from a numerical value to the algebraic replacement of n. There were some good attempts by those who went back to the beginning and started with $a = \frac{360}{n}$. Those who tried to adapt the given model and work backwards did not make much progress.

Answer: $0.5 \times \frac{24}{n} \times \frac{\frac{12}{n}}{\tan\frac{360}{2n}} \times n$

(ii) Candidates need to relate models/equations/expressions to the 'real life' scenario of the question. Realising that n stood for the number of sides should have made them think, at the very least, about whole numbers if not about polygons as well.

Answer: Integer or $n \geqslant 3$

(b) Many candidates showed the substitution of 8 for the octagon into the model and some equated this to a value with more figures than the given answer, as was the expectation. Again it should be noted by candidates that just writing the given answer after the sum is not enough for a 'show that' question. It is necessary to show what the sum works out to first.

(c) Candidates were given ranges of values for both n and A. Many did not show that they could use their graphical calculators with these ranges to help them to draw an accurate enough sketch of the model. Some of the sketches did appear to tend towards an asymptote around $A = 50$. Some went above and some started to slope downwards. Many sketches started at the n-axis at approximately 8 and went virtually vertical before bending right towards the 50 level. If candidates were to think about the investigation as a whole they would find that they had already calculated an area for $n = 3$ in **Question 2** and they were given the areas for $n = 5$ and 8 and had also calculated it for $n = 6$. All this information would have given many candidates a much better idea of the correct sketch.

(d) Some candidates did find the correct answer presumably from using the trace on their calculators. Candidates need to know how to use these functions for all kinds of equations. Some candidates gave a decimal answer which was not appropriate for the number of sides of a polygon.

Answer: 9

(e) This time the question directed the candidates to use their graph. Most of those who had answered **part (d)** correctly were able to answer this part correctly too. Without a correct graph on the calculator this question was difficult to answer.

Answer: 45.8

(f) (i) Thinking in context, like giving the answer to **part (d)** as a whole number and not a decimal, is essential to answering many questions correctly. This skill would have also helped more candidates to get the correct answer for this question. Many candidates did not actually answer this question.

Answer: Circle

(ii) Candidates need to know how to work with and give an answer as an exact value. There were some candidates who worked with the circle to find the radius and subsequently the area. Most of the working and the answers were in decimal form.

Answer: $\frac{144}{\pi}$

(g) Despite being the last question many candidates did try to modify the model. The more successful ones either worked through the basic steps following **Question 3(a)** as they had done for **Question 3(b)** or realised that $144 = \frac{24^2}{4} = \left(\frac{24}{2}\right)^2$.

Answer: $\dfrac{P^2}{4n\tan\dfrac{180}{n}}$