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INTERNATIONAL MATHEMATICS

Paper 0607/11
Paper 11 (Core)

Key Messages

To succeed in this paper, candidates need to have completed the full Core syllabus, be able to apply formulae, show all necessary working clearly and check their working for sense and accuracy.

General comments

Showing workings enables candidates to access method marks in case their final answer is wrong. Workings are vital in two-step problems, in particular with algebra and others towards the end of the paper. Also, candidates must make sure that they do not make numerical errors especially in questions that are only worth one mark. Candidates must take note of the form that is required for answers, for example, in **Questions 7** and **9(b)**.

The questions that presented least difficulty were **Questions 1**, **2**, **3**, **5(a)**, **9(a)** and **11(b)**. Those that proved to be the most challenging were all parts of **Question 6**, and sketching the graph in **Question 8**. In general, candidates attempted the vast majority of questions rather than leaving them blank. Virtually all candidates attempted all parts of the first five questions. The questions that received the most number of blank responses were all parts of **Question 6** (similar triangles) and **Question 9(b)** (standard form).

Comments on specific questions

Question 1

Candidates did well with this opening question. For part **(a)**, the vast majority of candidates were correct although, occasionally, the answer was given as 2 200, 20 002 or 20 000 200. In the following part, 26 was the common wrong answer from not using the correct order of operations i.e. 20 – 7 = 13, 13 × 2 = 26 instead of, 7 × 2 = 14, 20 – 14 = 6. Virtually all candidates gave the correct answer to part **(c)**.

Answers: **(a)** 20 200 **(b)** 6 **(c)** 30

Question 2

This question was extremely well done.

Answer: 5

Question 3

This was by far the best answered question on the paper with nearly all candidates getting all four parts correct. For part **(d)**, the only error was for a few candidates to work out the bus fare for all the candidates instead of just the ones who actually travelled by bus.

Answers: **(b)** 2 **(c)** 14 **(d)** 16

Question 4

Some candidates were not accurate enough with their measuring or gave the supplement of the angle.

Answer: 75

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Question 5

For the range in part **(a)**, some candidates left their answer as 5 – 1 or listed all the values. Candidates were more successful at picking out the mode for part **(b)**. Frequently, candidates worked out the mean when they were asked for the median. Some found the number half way between the sixth and seventh term in the un-ordered list. Candidates must remember that the first step, when finding the median, is to order all the data, not just one copy of each value.

Answers: **(a)** 4 **(b)** 1 **(c)** 2.5

Question 6

This question was the one that candidates found the most challenging on the whole paper, especially part **(a)(iii)**. It was not always clear whether candidates' misunderstandings lay with the notation used in the question or the relationship between the triangles as shown by the diagram. The first two parts tested the same skill but, unusually perhaps, many candidates only got one answer correct and it was part **(a)(ii)** that was more likely to get a mark. Part **(a)(iii)** caused all kinds of difficulties with adjacent, congruent, opposite, parallel, supplementary and small given as wrong answers with parallel being the most common, perhaps due to that word being in the question. It was extremely rare to see the correct second phrase to part **(a)(iii)** with same angles being common but that was not enough of an explanation. Part **(b)** was also not handled very successfully by candidates with 7 cm (from 2 + 1 = 3 so 6 + 1 = 7), or 12 cm (6 × 2) being wrong answers. A method mark was available for recognition or use of the scale factor needed to go from one triangle to the other. Other very similar questions have been on recent papers where candidates have done better. Maybe this was because here it followed a challenging selection of part questions rather than being a whole question in its own right.

Answers: **(a) (i)** *BDE* or *CDE* **(ii)** *AED* or *CED* **(iii)** Similar....alternate angles are equal **(b)** 9

Question 7

With this syllabus, formulae for circles and solids are given on the second page of the exam paper so candidates should be able to select the correct one, but many did not. The difficulty in this case, was the requirement for the answer to be left in terms of π. Many got as far as the correct answer, 8π, and then worked this out as 25.136 which could not be given full marks.

Answer: 8π

Question 8

Candidates find questions on this area of the syllabus challenging. However, this session there was a higher than usual number getting both marks for an accurate sketch. Also, there were candidates who were awarded one mark for showing some understanding of what was required in their sketch.

Question 9

Many candidates did well with part **(a)**, finding the speed of an aircraft, especially considering the formula for speed is not given. Candidates were not so good at changing their speed into standard form, with many leaving this part blank, making errors with the power of 10 or errors with the number of digits in front of the decimal point.

Answers: **(a)** 750 **(b)** 7.5×10^2

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Question 10

Candidates did well with both parts of this question. Some extracted only one factor in part **(a)** and, if done correctly, this was worthy of a method mark. Some decided that if they extracted $2p$, then the second term was zero rather than 1 so gave their answer as $2p(3q)$. Some treated the expression as an equation to solve. Part **(b)** again was done well, but some candidates' first algebraic move did not take account of the signs and frequently ended up with $5x + 2x = 4 + 6$. If candidates' first step was correct, giving $3x = 2$, a common error was to give $x = 1.5$ as the answer.

Answers: **(a)** $2p\,(3q + 1)$ **(b)** $\frac{2}{3}$

Question 11

In general, all parts of this question were done well with part **(b)** being answered correctly most often, maybe as it just required all numbers in the diagram to be added. Some, who did not understand the notation, gave 6, 4, 4 as their answer to part **(a)** rather than the number of elements that are not in the union of set S and set F i.e. the number of elements outside the two intersecting sets. This however, did not affect the two parts concerning probability. where many did well. The question did not ask for the probability to be in a particular form so the correct decimal or percentage got the mark as well as the fractions given below.

Answers: **(a)** 11 **(b)** 25 **(c)** $\frac{4}{25}$ **(d)** $\frac{14}{25}$

Question 12

There were three main methods used by candidates. If candidates chose to equate coefficients this necessitated multiplying each equation by a different value which resulted in many places that errors could be made. A second method is to rearrange one equation to give x in terms of y and then substitute this into the other equation. Candidates can get confused with this method and substitute back into the equation they have already used. This session, a significant number rearranged both equations to make x the subject (or y), equated the two resulting equations and solved this in a similar way to **Question 10(b)**. Part **(b)** was different to what has been seen on this paper recently by putting the equations into context. A good number got this correct and it did not depend on having the correct answer to part **(a)**, if candidates realised that 8 burgers and 8 drinks cost \$24 then a quarter of this is the cost of 2 burgers and 2 drinks.

Answers: **(a)** $x = 2$, $y = 1$ **(b)** 6

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INTERNATIONAL MATHEMATICS

Paper 0607/12
Paper 12 (Core)

Key Messages

To succeed in this paper, candidates need to have completed the full Core syllabus, be able to apply formulae, show all necessary working clearly and check their working for sense and accuracy.

General comments

Showing workings enables candidates to access method marks in case their final answer is wrong. Workings are vital in two-step problems, in particular with algebra and others towards the end of the paper. Also, candidates must make sure that they do not make numerical errors especially in questions that are only worth one mark. Candidates must take note of the form that is required for answers, for example, in **Questions 7** and **9(b)**.

The questions that presented least difficulty were **Questions 1**, **2**, **3**, **5(a)**, **9(a)** and **11(b)**. Those that proved to be the most challenging were all parts of **Question 6**, and sketching the graph in **Question 8**. In general, candidates attempted the vast majority of questions rather than leaving them blank. Virtually all candidates attempted all parts of the first five questions. The questions that received the most number of blank responses were all parts of **Question 6** (similar triangles) and **Question 9(b)** (standard form).

Comments on specific questions

Question 1

Candidates did well with this opening question. For part **(a)**, the vast majority of candidates were correct although, occasionally, the answer was given as 2 200, 20 002 or 20 000 200. In the following part, 26 was the common wrong answer from not using the correct order of operations i.e. 20 – 7 = 13, 13 × 2 = 26 instead of, 7 × 2 = 14, 20 – 14 = 6. Virtually all candidates gave the correct answer to part **(c)**.

Answers: **(a)** 20 200 **(b)** 6 **(c)** 30

Question 2

This question was extremely well done.

Answer: 5

Question 3

This was by far the best answered question on the paper with nearly all candidates getting all four parts correct. For part **(d)**, the only error was for a few candidates to work out the bus fare for all the candidates instead of just the ones who actually travelled by bus.

Answers: **(b)** 2 **(c)** 14 **(d)** 16

Question 4

Some candidates were not accurate enough with their measuring or gave the supplement of the angle.

Answer: 75

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Question 5

For the range in part **(a)**, some candidates left their answer as 5 – 1 or listed all the values. Candidates were more successful at picking out the mode for part **(b)**. Frequently, candidates worked out the mean when they were asked for the median. Some found the number half way between the sixth and seventh term in the un-ordered list. Candidates must remember that the first step, when finding the median, is to order all the data, not just one copy of each value.

Answers: **(a)** 4 **(b)** 1 **(c)** 2.5

Question 6

This question was the one that candidates found the most challenging on the whole paper, especially part **(a)(iii)**. It was not always clear whether candidates' misunderstandings lay with the notation used in the question or the relationship between the triangles as shown by the diagram. The first two parts tested the same skill but, unusually perhaps, many candidates only got one answer correct and it was part **(a)(ii)** that was more likely to get a mark. Part **(a)(iii)** caused all kinds of difficulties with adjacent, congruent, opposite, parallel, supplementary and small given as wrong answers with parallel being the most common, perhaps due to that word being in the question. It was extremely rare to see the correct second phrase to part **(a)(iii)** with same angles being common but that was not enough of an explanation. Part **(b)** was also not handled very successfully by candidates with 7 cm (from 2 + 1 = 3 so 6 + 1 = 7), or 12 cm (6 × 2) being wrong answers. A method mark was available for recognition or use of the scale factor needed to go from one triangle to the other. Other very similar questions have been on recent papers where candidates have done better. Maybe this was because here it followed a challenging selection of part questions rather than being a whole question in its own right.

Answers: **(a) (i)** *BDE* or *CDE* **(ii)** *AED* or *CED* **(iii)** Similar....alternate angles are equal **(b)** 9

Question 7

With this syllabus, formulae for circles and solids are given on the second page of the exam paper so candidates should be able to select the correct one, but many did not. The difficulty in this case, was the requirement for the answer to be left in terms of π. Many got as far as the correct answer, 8π, and then worked this out as 25.136 which could not be given full marks.

Answer: 8π

Question 8

Candidates find questions on this area of the syllabus challenging. However, this session there was a higher than usual number getting both marks for an accurate sketch. Also, there were candidates who were awarded one mark for showing some understanding of what was required in their sketch.

Question 9

Many candidates did well with part **(a)**, finding the speed of an aircraft, especially considering the formula for speed is not given. Candidates were not so good at changing their speed into standard form, with many leaving this part blank, making errors with the power of 10 or errors with the number of digits in front of the decimal point.

Answers: **(a)** 750 **(b)** 7.5×10^2

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Candidates did well with both parts of this question. Some extracted only one factor in part **(a)** and, if done correctly, this was worthy of a method mark. Some decided that if they extracted $2p$, then the second term was zero rather than 1 so gave their answer as $2p(3q)$. Some treated the expression as an equation to solve. Part **(b)** again was done well, but some candidates' first algebraic move did not take account of the signs and frequently ended up with $5x + 2x = 4 + 6$. If candidates' first step was correct, giving $3x = 2$, a common error was to give $x = 1.5$ as the answer.

Answers: **(a)** $2p\,(3q + 1)$ **(b)** $\frac{2}{3}$

Question 11

In general, all parts of this question were done well with part **(b)** being answered correctly most often, maybe as it just required all numbers in the diagram to be added. Some, who did not understand the notation, gave 6, 4, 4 as their answer to part **(a)** rather than the number of elements that are not in the union of set S and set F i.e. the number of elements outside the two intersecting sets. This however, did not affect the two parts concerning probability. where many did well. The question did not ask for the probability to be in a particular form so the correct decimal or percentage got the mark as well as the fractions given below.

Answers: **(a)** 11 **(b)** 25 **(c)** $\frac{4}{25}$ **(d)** $\frac{14}{25}$

Question 12

There were three main methods used by candidates. If candidates chose to equate coefficients this necessitated multiplying each equation by a different value which resulted in many places that errors could be made. A second method is to rearrange one equation to give x in terms of y and then substitute this into the other equation. Candidates can get confused with this method and substitute back into the equation they have already used. This session, a significant number rearranged both equations to make x the subject (or y), equated the two resulting equations and solved this in a similar way to **Question 10(b)**. Part **(b)** was different to what has been seen on this paper recently by putting the equations into context. A good number got this correct and it did not depend on having the correct answer to part **(a)**, if candidates realised that 8 burgers and 8 drinks cost \$24 then a quarter of this is the cost of 2 burgers and 2 drinks.

Answers: **(a)** $x = 2$, $y = 1$ **(b)** 6

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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 wrong. Workings are vital in two-step problems, in particular with algebra and others towards the end of the paper. Also, candidates must make sure that they do not make numerical errors especially in questions that are only worth one mark. Candidates must take note of the form that is required for answers, for example, in **Questions 7** and **9(b)**.

The questions that presented least difficulty were **Questions 1**, **2**, **3**, **5(a)**, **9(a)** and **11(b)**. Those that proved to be the most challenging were all parts of **Question 6**, and sketching the graph in **Question 8**. In general, candidates attempted the vast majority of questions rather than leaving them blank. Virtually all candidates attempted all parts of the first five questions. The questions that received the most number of blank responses were all parts of **Question 6** (similar triangles) and **Question 9(b)** (standard form).

Comments on specific questions

Question 1

Candidates did well with this opening question. For part **(a)**, the vast majority of candidates were correct although, occasionally, the answer was given as 2 200, 20 002 or 20 000 200. In the following part, 26 was the common wrong answer from not using the correct order of operations i.e. 20 – 7 = 13, 13 × 2 = 26 instead of, 7 × 2 = 14, 20 – 14 = 6. Virtually all candidates gave the correct answer to part **(c)**.

Answers: **(a)** 20 200 **(b)** 6 **(c)** 30

Question 2

This question was extremely well done.

Answer: 5

Question 3

This was by far the best answered question on the paper with nearly all candidates getting all four parts correct. For part **(d)**, the only error was for a few candidates to work out the bus fare for all the candidates instead of just the ones who actually travelled by bus.

Answers: **(b)** 2 **(c)** 14 **(d)** 16

Question 4

Some candidates were not accurate enough with their measuring or gave the supplement of the angle.

Answer: 75

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Question 5

For the range in part **(a)**, some candidates left their answer as 5 – 1 or listed all the values. Candidates were more successful at picking out the mode for part **(b)**. Frequently, candidates worked out the mean when they were asked for the median. Some found the number half way between the sixth and seventh term in the un-ordered list. Candidates must remember that the first step, when finding the median, is to order all the data, not just one copy of each value.

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Question 6

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Answer: 8π

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Question 12

There were three main methods used by candidates. If candidates chose to equate coefficients this necessitated multiplying each equation by a different value which resulted in many places that errors could be made. A second method is to rearrange one equation to give x in terms of y and then substitute this into the other equation. Candidates can get confused with this method and substitute back into the equation they have already used. This session, a significant number rearranged both equations to make x the subject (or y), equated the two resulting equations and solved this in a similar way to **Question 10(b)**. Part **(b)** was different to what has been seen on this paper recently by putting the equations into context. A good number got this correct and it did not depend on having the correct answer to part **(a)**, if candidates realised that 8 burgers and 8 drinks cost \$24 then a quarter of this is the cost of 2 burgers and 2 drinks.

Answers: **(a)** $x = 2$, $y = 1$ **(b)** 6

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INTERNATIONAL MATHEMATICS

Paper 0607/21
Paper 21 (Extended)

Key message

Candidates need to show all of their working. Incorrect answers without working cannot be given credit, whereas partial credit can be awarded if a correct method is shown. Candidates should make all of their working clear and not merely write a collection of numbers scattered over the page. This makes it easier for both the candidate and the Examiner to follow.

General comments

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

Many candidates lost marks through careless numerical slips, particularly with negative numbers and simple arithmetic operations. More work is needed on the concepts of HCF and LCM and also on the implications of large samples. Candidates should always leave their answers in their simplest form, and more work on simplification would be beneficial as many candidates lost marks through incorrect simplification of a correct answer.

Comments on specific questions

Question 1

(a) Nearly all candidates answered this part correctly.

(b) Many candidates appeared not to understand the order of operations and how the use of brackets can affect a question.

Answer: **(a)** 10 – (4 + 3) + 2 = 5 **(b)** (10 – 5) x (7 + 2) = 45

Question 2

This question showed that more work is needed on the basic facts concerning angles in a polygon.

(a) Many candidates were confused with the exterior and interior angles of a pentagon.

(b) Candidates who were successful in part **(a)** invariably correctly answered this part. Even although there were follow through marks available, candidates who were unable to answer part **(a)** correctly were also unable to find the exterior or interior angle of a hexagon.

Answer: **(a)** 108 **(b)** 132

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Question 3

(a) Nearly all candidates answered this part correctly.

(b) This part proved to be demanding. Candidates needed to handle both the negative and fractional index.

Answer: **(a)** 1 **(b)** $\frac{1}{4}$

Question 4

This question proved to be very demanding for all but the best of candidates.

(a) Many candidates gave the correct factors.

(b) Candidates were confused with HCF and LCM, with many giving their answers in the incorrect order.

Answer: **(a)** 1, 3023 **(b)(i)** 1 **(ii)** *pq*

Question 5

(a) Although there were many correct answers, a significant number of candidates collected their x terms on the LHS, which led to problems with their final answer.

(b) This part was well answered as there were follow through marks available. The common error was not to make clear whether the end point was included in the answer.

Answer: **(a)** $x < 4$

Question 6

(a) This part was well answered.

(b) (i) This part proved to be challenging for the majority of candidates. Candidates did not know the connection between the sample size and the population and gave an answer relating to the highest frequency.

(ii) This part was well answered.

Answer: **(a)** $\frac{62}{200}$ **(b)(i)** Large sample **(ii)** 372

Question 7

(a) There were correct answers to this part.

(b) (i) Again, there were many correct answers, with candidates realising that the only possible answer was for the new value to be the median.

(ii) This part proved to be more challenging. A common mistake was to add one to the median giving an answer of 41.

Answer: **(a)** 40 **(b)(i)** 40 **(ii)** 68

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Question 8

(a) There were very few correct answers, with the common incorrect answer being –2.

(b) Fully correct answers were rarely seen. Candidates who started their solution by correctly finding $\frac{a}{b}\times 10^{-2}$, could not simplify this expression correctly.

Answer: **(a)** –3 **(b)** $\frac{10a}{b}$

Question 9

There were many correct answers. The common error was confusion with C and D.

Answer: A: $2x + 3$, B: $-3x$, C: $x^2 - 3$, D: $3 - x^2$

Question 10

(a) The majority of candidates scored some marks. The common error was omitting to take out one of the factors.

(b) There were many fully correct solutions. Errors occurred when candidates were trying to simplify their expression after a correct initial stage.

Answer: **(a)** $2(2a + 5b)(2a - 5b)$ **(b)** $\frac{8x-19}{(2x-3)(x-5)}$

Question 11

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

Answer: **(a)** 3 **(b)** 75

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INTERNATIONAL MATHEMATICS

Paper 0607/22
Paper 22 (Extended)

Key message

Candidates need to show all of their working. Incorrect answers without working cannot be given credit, whereas partial credit can be awarded if a correct method is shown. Candidates should make all of their working clear and not merely write a collection of numbers scattered over the page. This makes it easier for both the candidate and the Examiner to follow.

General comments

Candidates were, in general, well prepared for the paper and demonstrated very good algebraic skills. However, many candidates did not take sufficient care and so lost marks through careless numerical slips, particularly when working with negative numbers and simple arithmetic operations. Candidates should always leave their answers in their simplest form as stated in the rubric of the paper. Many candidates lost marks through incorrect simplification of a correct answer. Candidates need to be reminded that the equation of any straight line passing through the origin will be of the form $y = mx$.

Comments on specific questions

Question 1

Many candidates obtained the answer of 5 but were unable to deal successfully with the modulus sign and gave their second answer as -5.

Answer: –1, 5

Question 2

There were many fully correct answers to this part of the question. There were a number of different approaches that led to the correct answer. Some candidates realised that the nth term was dependent on n^2 but were unable to fully complete the question.

Answer: $n^2 - 2n$

Question 3

This question proved to be too demanding for all but the best of candidates. Candidates needed to handle both the negative and fractional index.

Answer: $\frac{27}{64}$

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Question 4

There were two different approaches to solving this question. Candidates who multiplied the left hand side of the equation by $\frac{\sqrt{2}-1}{\sqrt{2}-1}$ were more successful. Candidates who cross-multiplied invariably made mistakes on the simplification of their surds.

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

Question 5

(a) Although the majority of candidates scored full marks, many candidates made careless numerical errors.

(b) This part discriminated well between candidates. Candidates who correctly identified $\sin\alpha = \frac{y}{8}$, usually completed the question correctly.

Answer: **(a)** 25 **(b)** 4.8

Question 6

(a) This part was well answered.

(b) This part was more challenging than part **(a)**. There were many correct answers, but the common mistake was dealing with the signs after taking a common factor of $-t$.

Answer: **(a)** $(x-8)(x+3)$ **(b)** $(q+1)(p-t)$

Question 7

Although there were many correct answers to this question, it clearly demonstrated that many candidates find simplifying fractions a difficult topic and more work on this would be beneficial. Many candidates who arrived at the correct expression of $\frac{15}{56}+\frac{15}{56}$ then spoilt their working by simplifying to $\frac{30}{112}$.

Answer: $\frac{30}{56}$

Question 8

(a) This part was answered correctly by the majority of the candidates, although some weaker candidates were confused with 'inversely as the square root'.

(b) As this mark was a follow through, virtually all candidates scored this mark.

(c) Many candidates thought that the reverse operation of 'square root' was 'square root'. A significant number of candidates who obtained a correct expression of $\left(\frac{6}{y}\right)^2$ then spoilt the answer with an incorrect expansion.

Answer: **(a)** $y = \frac{6}{\sqrt{x}}$ **(b)** 2 **(c)** $\left(\frac{6}{y}\right)^2$

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Question 9

This question was a good discriminator between the candidates. Fully correct answers were rarely seen.

Answer: **(a)** – 2 **(b)** 3^p

Question 10

(a) The majority of candidates scored all 3 marks. However a significant number of candidates thought that the line cutting the *x*-axis meant that $x = 0$.

(b) Although many candidates realised that this part depended on gradients of parallel lines, they did not realise that a line passing through the origin would not have a constant term.

Answer: **(a)(i)** (4, 0) **(ii)** (0, 3) **(iii)** (2, 1.5) **(b)** $y = \frac{4}{3}x$

Question 11

Candidates could draw an enlargement of scale factor 2, but struggled with the invariant line.

Question 12

This question proved to be a challenge for all but the most able candidates. Candidates should remember that the shape of the graph meant that *a* must be negative.

Answer: $a = -1$, $b = 4$, $c = 0$

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INTERNATIONAL MATHEMATICS

Paper 0607/23
Paper 23 (Extended)

Key message

Candidates need to show all of their working. Incorrect answers without working cannot be given credit, whereas partial credit can be awarded if a correct method is shown. Candidates should make all of their working clear and not merely write a collection of numbers scattered over the page. This makes it easier for both the candidate and the Examiner to follow

General comments

Candidates were, in general, well prepared for the paper and demonstrated very good algebraic skills. However, many candidates did not take sufficient care and so lost marks through careless numerical slips, particularly when working with negative numbers and simple arithmetic operations. Candidates should always leave their answers in their simplest form as stated in the rubric of the paper. Many candidates lost marks through incorrect simplification of a correct answer.

Comments on specific questions

Question 1

(a) Nearly all candidates answered this part correctly.

(b) Candidates showed a good understanding of sequences with many scoring full marks.

Answer: **(a)** 23 **(b)** $4n - 1$

Question 2

(a) Many candidates answered this part correctly. The common error, which occurred when solving $\frac{x}{5} = -4$, was the incorrect answer of $-\frac{4}{5}$.

(b) Although there were many correct answers, there were slips with negative signs with an answer of $\frac{3}{5}$ seen in a significant number of scripts.

Answer: **(a)** –20 **(b)** $-\frac{3}{5}$

Question 3

Candidates found this question difficult. Many candidates attempted the question using long multiplication and division of the original numbers. Candidates were expected to write the numbers correct to one significant figure and then complete the operations.

Answer: 30 or 27

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Question 4

(a) This question proved to be too demanding for all but the best of candidates. Candidates needed to handle both the negative and fractional index.

(b) (i) Nearly all candidates answered this part correctly.

(ii) Although nearly all candidates scored the first mark, candidates who were able to correctly simplify $\sqrt{x^6}$ were in the minority.

Answer: **(a)** $\frac{1}{125}$ **(b) (i)** x^{12} **(ii)** x^3

Question 5

Although there were many correct answers, the majority of candidates started the question with the premise that the three 'circles' would all be intersecting as a standard configuration. Candidates must be familiar with the drawing of subsets in a Venn diagram.

Question 6

(a) Many candidates were able to demonstrate their knowledge of trigonemtric ratios, giving the correct answer.

(b) This part proved to be challenging for the majority of candidates. Candidates did not know the connection between $\cos x$ and $\cos(180 - x)$.

Answer: **(a)** $\frac{12}{5}$ **(b)** $-\frac{12}{13}$

Question 7

(a) Although there were correct answers to this part, many candidates omitted to *completely* factorise the expression.

(b) Again, there were many correct answers, but the common mistake was handling the signs after taking a common factor of -3.

Answer: **(a)** $3(x + 5y)(x - 5y)$ **(b)** $(5p - 3)(3a + 2b)$

Question 8

(a) The common mistake made by candidates was giving p and q as vectors and not as constants.

(b) There were many fully correct answers to this part of the question. The two common mistakes were made in evaluating $(-6)^2$ and in simplifying $\sqrt{52}$.

Answer: **(a)** $p = 4$ $q = -6$ **(b)** $2\sqrt{13}$

Question 9

There were many correct answers. The common problem was with candidates who did not realise that triangle *BTD* was isosceles.

Answer: 20°

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Question 10

(a) The majority of candidates scored both marks. The common error was where candidates simply substituted x by 11 in the expression.

(b) Many candidates did not gain the second mark as they did not simplify their expression, leaving the answer as $10 - 6x + 3$.

(c) Although the majority realised the demands of the question, there were many errors with negative signs.

Answer: **(a)** –7 **(b)** 13 – 6x **(c)** $\frac{5 - x}{3}$

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INTERNATIONAL MATHEMATICS

Paper 0607/31
Paper 31 (Core)

Key messages

To complete this paper well, candidates must have covered the full syllabus. They should also be encouraged to show all their working out and write answers to 3 significant figures. They also need to have a graphics calculator and be confident in its use.

General Comments

Candidates appeared to have had enough time to complete the paper as most attempted all the questions. Candidates need to be careful about the accuracy of their answers. If no specific accuracy is asked for in the question, then all answers should be given exactly or to 3 significant figures. Giving answers to fewer significant figures will result in a loss of marks. Candidates should ensure that they have the correct equipment for the examination. Many appeared not to have a ruler with them to draw a straight line.

Comments on Specific Questions

Question 1

This question was reasonably well answered by most candidates.

(a) The majority of candidates could write down a factor of 84 that was greater than 10.

(b) Many candidates gave factors instead of multiples here.

(c) Although most of the answers were either 23 or 29, a few gave wrong answer or answers outside the given range.

(d) Mainly well done, with the most common wrong answers being 0 and 8

(e) There were some correct answers, but many candidates put 8 as the answer and others calculated 64^3.

(f) This was well done on the whole, with only a few candidate giving acute or reflex angles.

(g) The order of rotational symmetry of the parallelogram was poorly done with some students leaving it blank.

Answers: **(a)** 12 or 14 or 21 or 28 or 42 or 84 **(b)** any multiple of 12 **(c)** 23 or 29 **(d)** 1 **(e)** any angle greater than 90 or less than 180 **(g)** 2

Question 2

(a) Most candidates correctly gave an answer to the nearest 100.

(b) Many candidates also managed to answer to 2 decimal places.

(c) The most common wrong answer was to give 3 decimal places instead of 3 significant figures.

(d) This was very well done with most candidates being able to simplify the expression.

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(e) This was generally well done, although a few candidates did not add –3 to –4 correctly .

Answers: **(a)** 3600 **(b)** 2.64 **(c)** 3.09 **(d)** $4a + 2b$ **(e)** –7

Question 3

(a) (i) This part was very well attempted with most candidates working out the square root correctly.

(ii) Some candidates found $0.34^2 + 1.27^2$, but otherwise it was well done.

(iii) This was mainly well done with very few incorrect answers.

(iv) Most managed to subtract the fractions correctly. Some candidates wrote the answer as a decimal.

(v) Many candidates also managed to find the percentage although others tried dividing by 45 instead of multiplying.

(vi) This part was not well attempted although many candidates did get 1 mark for 10.8 seen in their working out. Many wrote the answer as 0.35.

(b) A large number of candidates did not know how to calculate ratios and there were some strange answers to this part.

(c) This part was well done on the whole, with many candidates getting the correct answer. Unfortunately some left the decimal in the answer to the number of dragon fruit.

Answers: **(a)(i)** 13.5 **(ii)** 2.5921 **(iii)** 30 **(iv)** $\frac{5}{8}$ **(v)** 28.71 **(vi)** 0.356 **(b)** 24 : 28 **(c)** 11 and 0.31

Question 4

(a) Some candidates managed to find the sector angle but $\frac{3}{9}$ was frequently seen for the answer.

(b) If the angles were wrong then most candidates received 1 mark for having the labels correct.

Answers: **(a)** 120

Question 5

(a) Some candidates managed to get the correct answer but many others tried to use compound interest on this part. Many of the candidates forgot to give only the interest for the answer.

(b) Candidates found this compound interest question difficult and more work in this area would be beneficial. The most common incorrect answers were 36 and 636.

Answers: **(a)** 37.80 **(b)** 36.72

Question 6

(a) There were many correct answers for the ratio but also some incorrect ones such as 2.5 : 1.25 ; 1 or 25 : 12.5 : 10 or 50 : 25 : 20

(b) (i) There were many correct answers and others received marks for some of the costs being correct. Others candidates just added the four numbers.

(ii) Most candidates gained a follow through mark here for finding the cost of 1 cupcake.

(iii) Most candidates gained a follow through mark here for finding the profit.

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(iv) There were very few correct answers to this part. Many candidates used $\frac{28}{50} \times 100$.

Answers: **(a)** 10 : 5 : 4 **(b)(i)** 2.20 **(ii)** 0.22 **(iii)** 0.28 **(iv)** 127

Question 7

(a) This was well done with most candidates getting the correct line of symmetry.

(b) More care needed to be taken with this part as few candidates counted the squares correctly to find the area of the shape. A common answer was 16.

(c) There were very few correct answers to this part. Candidates were not able to correctly work out which numbers they should be using in Pythagoras' Theorem.

(d) Many candidates gained a follow through mark here for converting their answer to metres. However, some candidates multiplied by 100 instead.

Answers: **(b)** 18 **(c)** 17.7 **(d)** 0.177

Question 8

(a) Many candidates wrote the correct answer but hexagon and polygon were also given.

(b) Some candidates managed to get 108 but another common answer was 72, sometimes with working out (in which case they received a method mark), but often without.

Answers: **(a)** pentagon **(b)** 108

Question 9

(a) Nearly all candidates managed to find the next two terms in the sequence.

(b) There were few correct answers for the *n*th term. The most common answer was $n - 4$.

Answers: **(a)** –1, –5 **(b)** $19 - 4n$

Question 10

(a) The points were plotted accurately. However, some candidates mixed up the axes.

(b) It appeared as if a lot of the students just measured the line *AB* because 7, without any working out, was a common answer. Candidates should remember that if the question states 'calculate', measuring a diagram is not sufficient for credit.

(c) This was reasonably well done although some candidates gave the answer as 1.

(d) There were few correct answers for the equation of the line. Candidates need to practise finding equations of parallel lines through a specific point.

Answers: **(b)** 7.07 **(c)** –1 **(d)** $y = -x + 1$

Question 11

(a) Most of the points were plotted correctly. The one point that was plotted wrongly the most was (10, 170) as quite a few candidates plotted (10, 190) instead.

(b) About half of the candidates had the correct answer for the type of correlation. Another common answer was increasing.

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(c) Parts **(i)** and **(ii)** were correct on the whole, but not all candidates plotted the mean point on the graph for part **(iii)** and the line in part **(iv)** was often not a straight line at all. It appeared as if many candidates did not have a ruler with them.

(d) Most candidates gained follow through marks for this part by reading the correct value from their line.

Answers: **(b)** positive **(c)(i)** 4.21 **(ii)** 70.1 **(d)** 110

Question 12

(a) The majority of graphs needed to be drawn more clearly and carefully. Some candidates drew a quadratic graph and others just omitted the question completely. Perhaps they did not all have a graphics calculator or perhaps they did not know how to use it correctly.

(b) If the graph was drawn correctly then the zeros were also correct.

(c) There were only a handful of correct answers here for the local maximum and minimum points. Some were close but it looked as if they had used the trace button instead of the intersection.

(d) Hardly any candidates had a correct answer for this part. Most either missed it out or put 8 and 2 into the equation for x. It appears that they did not really read the question properly.

Answers: **(b)** 1, –1 and –2.5 **(c)** (0.180, –5.19) and (–1.85, 3.15) **(d)(i)** 1 **(ii)** 3

Question 13

For parts **(a)**, **(b)** and **(c)** there were many good attempts at the various transformations.

(d) Very few candidates knew the correct mathematical name. Many wrote diamond, parallelogram or quadrilateral.

Answers: **(d)** rhombus

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INTERNATIONAL MATHEMATICS

Paper 0607/32
Paper 32 (Core)

Key messages

To complete this paper well, candidates must have covered the full syllabus. They should also be encouraged to show all their working out and write answers to 3 significant figures. They also need to have a graphics calculator and be confident in its use.

General Comments

Candidates appeared to have had enough time to complete the paper as most attempted all the questions. Candidates need to be careful about the accuracy of their answers. If no specific accuracy is asked for in the question, then all answers should be given exactly or to 3 significant figures. Giving answers to fewer significant figures will result in a loss of marks. Candidates should ensure that they have the correct equipment for the examination. Many appeared not to have a ruler with them to draw a straight line.

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This question was reasonably well answered by most candidates.

(a) The majority of candidates could write down a factor of 84 that was greater than 10.

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(d) Mainly well done, with the most common wrong answers being 0 and 8

(e) There were some correct answers, but many candidates put 8 as the answer and others calculated 64^3.

(f) This was well done on the whole, with only a few candidate giving acute or reflex angles.

(g) The order of rotational symmetry of the parallelogram was poorly done with some students leaving it blank.

Answers: **(a)** 12 or 14 or 21 or 28 or 42 or 84 **(b)** any multiple of 12 **(c)** 23 or 29 **(d)** 1 **(e)** any angle greater than 90 or less than 180 **(g)** 2

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(a) Most candidates correctly gave an answer to the nearest 100.

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(ii) Some candidates found $0.34^2 + 1.27^2$, but otherwise it was well done.

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(a) Some candidates managed to find the sector angle but $\frac{3}{9}$ was frequently seen for the answer.

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Answers: **(a)** 120

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For parts **(a)**, **(b)** and **(c)** there were many good attempts at the various transformations.

(d) Very few candidates knew the correct mathematical name. Many wrote diamond, parallelogram or quadrilateral.

Answers: **(d)** rhombus

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INTERNATIONAL MATHEMATICS

Paper 0607/33
Paper 33 (Core)

Key messages

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Answers: **(b)** positive **(c)(i)** 4.21 **(ii)** 70.1 **(d)** 110

Question 12

(a) The majority of graphs needed to be drawn more clearly and carefully. Some candidates drew a quadratic graph and others just omitted the question completely. Perhaps they did not all have a graphics calculator or perhaps they did not know how to use it correctly.

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Question 13

For parts **(a)**, **(b)** and **(c)** there were many good attempts at the various transformations.

(d) Very few candidates knew the correct mathematical name. Many wrote diamond, parallelogram or quadrilateral.

Answers: **(d)** rhombus

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INTERNATIONAL MATHEMATICS

Paper 0607/41
Paper 41 (Extended)

Key message

There is always the need for a full syllabus coverage as the paper requires candidates to answer all the questions.

All questions, unless otherwise stated, require answers to be exact or correct to 3 significant figures and this includes questions when using a graphics calculator.

Candidates must be aware that they have a responsibility to communicate their methods.

General comments

The overall standard was good with most candidates being able to attempt all or most of the questions, as well as completing the paper in the time allowed.

With the exception of answers from graphs and the regression equation, candidates gave their answers to a suitable level of accuracy.

Most candidates presented their working in a clear and concise way.

Topics on which questions were well answered were drawing and sketching graphs, scatter diagrams, patterns and sequences, sets and Venn diagrams, angles in circles, cumulative frequency and functions.

Some difficulties were seen in domain and range, mensuration, vector geometry, algebraic fractions and a multi-topic question involving trigonometry and algebra.

Comments on specific questions

Question 1

(a) Candidates were generally able to draw the two lines correctly and many went on to indicate the correct region.

(b) Finding a value from the required region proved to be much more challenging and a large number of candidates omitted this part. The 2 decimal place answer required use of algebra or a graphics calculator and many candidates only gave the best possible from their drawing, which inevitably was either inaccurate or only to 1 decimal place.

Answers: **(b)** 4.52

Question 2

(a) Most candidates completed the scatter diagram correctly. A few had a problem with the vertical scale.

(b) Most candidates correctly stated that the correlation was negative. It was a fairly weak correlation, leading to an answer of no correlation occurring quite often.

(c) There were mixed responses here, with good candidates giving the correct equation with correct accuracy. A large number of candidates did not use 3 significant figures and lost one of the two

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marks. Many others found an equation from their graph, indicating a need to be more aware of this facility on the graphics calculator.

(d) (i) Using the regression equation was much more successful and many gained a follow through mark.

(ii) There was a whole variety of answers to this part and only a few candidates did indicate the fact that the correlation was weak. If candidates had indicated no correlation in part **(b)** then they were awarded a mark if they repeated this here.

Answers: **(b)** negative **(c)** $y = -0.429x + 72.2$ **(d)(i)** 61 **(ii)** the correlation is weak

Question 3

(a) The sketch of this cubic graph was almost always correct.

(b) Many candidates were unfamiliar with this type of symmetry. Only a few recognised this graph as having rotational symmetry and even fewer gave the full description. Often there was a description of a transformation rather than symmetry. This part was omitted by many candidates.

(c) The two local turning points were also often correctly answered. A number of candidates appeared to need more experience on local maximum and minimum points as they gave the highest and lowest points on the grid.

(d) Domain and range continue to be demanding topics and this range question proved to be no exception. Again, many candidates omitted this question whilst others gave either inaccurate values or the answers to the reverse of this inequality. There were some very good and accurate answers from the stronger candidates.

Answers: **(b)** rotational symmetry, order 2, centre (0, 4) **(c)** (–1, 6) and (1, 2) **(d)** $x < -1.53$ and $-0.347 < x < 1.88$

Question 4

(a) (i) The table of values from the patterns in the diagrams was usually correctly answered. A few candidates gave unsimplified answers to the algebraic answers but were still given full marks.

(ii) The particular values from the pattern was very well answered, usually by using the expression in part **(a)** but occasionally counting through the sequence.

(b) (i) The next value in this different pattern was also very well answered.

(ii) The quadratic expression for this nth term was more challenging and different approaches were seen. There were some very good answers.

Answers: **(a)(i)** 28, 13, $4n$, $2n - 1$ **(ii)** 199 **(b) (i)** 40 **(ii)** $n^2 + 3n$

Question 5

This mensuration question was challenging for all candidates and required good spatial awareness, especially part **(c)**

(a) This part required the use of trigonometry or Pythagoras to find the length of a chord of a circle. There were some good answers and methods were clearly presented. Good presentation came to the rescue of a large number of candidates who used approximated values in their working leaving final answers out of range. The chord's length then had to be multiplied by the length of the cylinder to find the area of a rectangle. The presence of the cylinder led a number of candidates into using formulae connected to circles.

(b) The calculation of the angle was quite well done, although often not to more than 3 significant figures to be able to show that it rounded to the given answer. Some candidates used a right-angle triangle and others used the cosine or sine rule.

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(c) This part was much more discriminating, requiring candidates to find the cross-sectional area consisting of sectors, triangles and a segment. Only the stronger candidates were able to cope with this challenge and they did show good methodical working to arrive at an accurate answer. Some of these candidates overlooked the need to change m^3 into litres. As in part **(a)**, there was often inappropriate circular formula being used. Candidates should be encouraged to gain experience with this type of problem solving and strategies to deal with various situations involving a range of mathematical knowledge.

Answers: **(a)** 2.83 m^2 **(b)** 77.88…° **(c)** 5980 litres

Question 6

(a) (i) This simple vector addition was usually correctly answered.

(ii) This more complicated vector geometry question was found to be much more challenging and candidates need to be sure about adding vectors and that positive or negative vectors do depend on direction. There were frequent sign errors in the answers as well as a number of correct but unsimplified answers, which did not earn full marks.

(b) This was a "show that" question although it only required the same type of approach as part **(a)(ii)**. The comments for part **(a)(ii)** therefore apply here. A large number of candidates omitted this part.

(c) (i) Written conclusions do not come easily to candidates who often try to write too much. In this case all that was wanted was "equal and parallel". Many candidates gave only one of these.

(ii) Again, many candidates tried to write too much rather than simply state the mathematical name of a shape. Even though this answer would appear to depend on part **(i)**, there was more success in this part, presumably from the diagram and a sensible deduction.

Answers: **(a)(i)** $\mathbf{a} + \mathbf{b}$ **(ii)** $-\frac{2}{3}\mathbf{a} + \frac{1}{3}\mathbf{b}$ **(c)(i)** equal and parallel **(ii)** parallelogram

Question 7

(a) The completion of the Venn diagram was well answered, with most candidates interpreting the written information correctly.

(b) (i) This straightforward probability from the Venn diagram was well answered.

(ii) This part required the recognition of a more complicated set and to give the answer again as a probability. Most candidates did recognise the region, although a few gave the number of elements instead of a probability fraction.

(c) (i) This part required the product of two probabilities and was quite well answered. A number of candidates did not reduce the second denominator by 1, even though they may have reduced the numerator by 1.

(ii) This was similar to part **(i)** but required values from the Venn diagram and the realisation that this event could happen in two ways and so the product needed to be doubled. A large number of candidates only gave the single product.

Answers: **(b)(i)** $\frac{42}{200}$ **(ii)** $\frac{9}{200}$ **(c)(i)** $\frac{870}{39800}$ **(ii)** $\frac{1920}{39800}$

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Question 8

(a) (i) The angle was usually correctly answered, using angles in a right-angled triangle.

(ii) This part was found to be more challenging, with many candidates finding that five points on the circle had the effect of disguising a cyclic quadrilateral.

(b) (i) This required candidates to give pairs of equal angles and a geometrical reason in each case. There were a few good answers with reasons very clearly stated. A number of candidates gave the pairs of angles but did not give the supporting reasons. Others gave descriptions of similar triangles, such as one is an enlargement of another.

(ii) The calculation of a side was much more accessible and many candidates answered this successfully.

(iii) The ratio of areas was found to be more demanding. There were many candidates who did square a ratio of lengths, realising that not much would be required for 1 mark. A number of candidates calculated the two areas in some way and this method was unlikely to arrive at the exact fraction required.

Answers: **(i)** 58° **(ii)** 67° **(b)(ii)** 7.5 cm **(iii)** $\frac{4}{9}$

Question 9

(a) (i) The median from the cumulative frequency curve was usually correctly found. A few candidates read the graph from 50 instead of 80, as the total frequency was 160.

(ii) The lower quartile from the cumulative frequency curve was usually correctly found.

(iii) The interquartile range from the cumulative frequency curve was usually correctly found.

(b) The table of frequencies was usually completed correctly, using the cumulative frequency curve.

(c) Histograms tend to be a searching topic of the syllabus. In this case candidates demonstrated a continued improvement and almost all who had part **(b)** correct gained full marks here.

Answers: **(a)(i)** 23 kg **(ii)** 17 kg **(iii)** 10 kg **(b)** 16, 42, 60

Question 10

Overall this question was found to be quite demanding and, apart from part **(a)(i)**, many candidates omitted it.

(a) (i) The graph was usually sketched correctly.

(ii) The horizontal asymptote for this exponential function proved to be testing as often the sketches in part **(i)** (even though they gained full marks) did not lead to this line.

(b) (i) This trigonometrical graph was more demanding but was still sketched clearly by many candidates. The few candidates who did not have their calculators set in degrees did not cope with this sketch.

(ii) There was more success here than in part **(a)(ii)** endorsing the fact that vertical asymptotes are easier to recognise than the horizontal ones. A number of candidates displayed the need for more practice with some of the aspects of using the graphics calculator as stated in the syllabus.

(c) Many candidates realised that the x co-ordinates of the points of intersection were needed. Of these candidates a number lost marks by not giving their answers to 3 significant figures. There seemed to be an impression that as the question asks for a sketch then less accurate answers will be required and this is not the case.

Answers: **(a)(ii)** $y = -3$ **(b)(ii)** $x = -3$ and $x = 3$ **(c)** –2.38, 0.515

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Question 11

(a) This straightforward ratio question was very well answered.

(b) (i) Many candidates did not realise that a percentage change in each of the 2 quantities would not change the ratio. There was much working done for only 1 mark.

(ii) This reverse percentage question was quite well answered. It was a little more complicated than usual as two quantities had to be combined. A number of candidates need to be more familiar with the fact that, in these questions, the given value is not 100%.

(c) This was the most challenging question on the whole paper. Only a few candidates introduced x as the increase to set up an equation. There were many attempts using values or the given ratio, rarely leading to anything. It was a good question for the very strongest of the candidature to demonstrate their ability. Many candidates omitted this part.

(d) This overall percentage change as a result of two different changes was also found to be demanding. The efficient method of multiplying 1.08 by 0.92 was not often seen. Many candidates used a chosen amount of money which often led to success. Again, this part was frequently omitted.

Answers: **(a)** \$53 000, \$42 400 **(b)(i)** 5 : 4 **(ii)** \$90 000 **(c)** \$5300 **(d)** decrease by 0.64%

Question 12

(a) This cosine rule "show that" question with a side equal to x kilometres was another discriminating part. There were some excellent solutions with good presentation. The main difficulty was to decide that x was not the side opposite the given angle and many candidates were unable to realise this.

(b) (i) This part required solving a quadratic equation and was removed from the context of part **(a)**. This was therefore more successfully answered, usually by using the formula rather than the graphics calculator.

(ii) This part returned to the context, simply requiring candidates to realise that the distance asked for was the larger of the two values found in part **(i)**. Many of the candidates who had correct answers to part **(i)** did give the correct answer here whilst many found the difference between the two roots found in part **(i)**.

(c) This part required the difference described in part **(ii)** and then to divide it by the given speed. It also required an answer in hours to be changed into hours and minutes. This was another challenging question for many candidates. Again, stronger candidates answered the question well. Many did not find the correct distance and many did not correctly change the decimal in hours into hours and minutes

Answers: **(b)(i)** 10.94, 54.84 **(ii)** 54.84 km **(c)** 1 hour 28 minutes

Question 13

(a) This numerical composite function question was generally well answered.

(b) This algebraic composite function question was generally well answered.

(c) This inverse of a linear function was also well answered.

(d) The algebraic fraction was much more discriminating. There were many correct answers by factorising the quadratic denominator. There was also incorrect cancelling seen such as simply crossing out the 3 from the numerator and the denominator. Candidates seemed to need more awareness of the fact that only factors can be cancelled.

Answers: **(a)** 42 **(b)** $3x + 7$ **(c)** $\frac{x+2}{3}$ **(d)** $\frac{1}{2x+1}$

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INTERNATIONAL MATHEMATICS

Paper 0607/42
Paper 42 (Extended)

Key Messages

To succeed in this paper, candidates should:

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

General Comments

Many candidates were able to reach a good level in this paper. In general work was well set out and methods clearly shown and no script indicated a significant lack of time to complete the paper. Candidates performed well in general in the questions on algebra, statistics and angles, while vectors and set notation appeared to be more challenging. Candidates appear reluctant to use sketches as a means of solving various equations although this can be a very effective method when the calculator functions are used efficiently. Some candidates should take more care over forming certain digits especially when writing in a hurry. A badly written 6 can often look like a 0, or vice versa, while 3 and 5 can look very similar and, surprisingly, so can 4 and 9.

Comments on Specific Questions

Question 1

A small number of candidates mistakenly used compound interest in part **(b)** and simple interest in part **(c)**. Candidates are reminded that they must read the question carefully to decide what is required.

(a) Most candidates gave the simple steps of dividing 600 by 5 and multiplying by 4, which was all that was required.

(b) The simple interest formula was used successfully by most candidates with the principal added on to give the required answer. Some mistakenly applied the formula to the amount of money spent rather than to the amount remaining.

(c) (i) Most candidates correctly used the compound interest formula in this part, but those who preferred to calculate the amounts year by year sometimes lost accuracy by rounding their interim answers instead of keeping the full value on their calculators.

(ii) Some very neat solutions involving logs were presented although a few candidates gave 20 as their final answer instead of 21. There was no evidence of any of the candidates using an appropriate sketch to obtain this result and a few candidates spent considerable time using a trial and improvement method, not always successfully.

Answers: **(b)** 537.60 **(c)(i)** 532.18 **(ii)** 21

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Question 2

(a) This part was answered well by most candidates with only a few reversing the division to find the number of kilometres per Yuan instead.

(b) The arrival time of the train was usually found correctly.

(c) The average speed of the train was found correctly.

(d) Most candidates started correctly by stating the extra time or the total time for the delayed journey but many lost the final mark for giving their answer correct to only 2 significant figures. There were a number of candidates who used 13.45 as their time instead of converting 13 h 45 min to a decimal number of hours.

(e) A small number of candidates either increased or decreased 441 by 5% rather than recognise 441 as 105% of the previous price.

Answers: **(a)** 0.3675 **(b)** 05 37 **(c)** 87.3 **(d)** 2.55 **(e)** 420

Question 3

(a) (i) This part was answered well.

(ii) Nearly all of the candidates gave the correct answer.

(iii) There were many wrong answers of 11 or 13 with candidates misinterpreting the set notation in this part.

(b) (i) This answer was almost always correct.

(ii) $\frac{12}{30}$ and $\frac{29}{30}$ were common wrong answers with many of the candidates unable to understand the requirements of the question.

(c) There were many correct answers. Of the candidates who went wrong, many used the complete set of candidates, giving denominators of 30 and 29, or correctly used an initial denominator of 17 but neglected to reduce it to 16 for the second candidate.

Answers: **(a)(i)** 10 **(ii)** 28 **(iii)** 20 **(b)(i)** $\frac{18}{30}$ **(ii)** $\frac{19}{30}$ **(c)** $\frac{42}{272}$

Question 4

As in the whole of the paper, candidates are reminded of the need for correct accuracy of answers. If values are exact, then the exact value should be given. So in part **(b)(i)** the only acceptable answer was (0, 0) and not, for example, (–0.0053, –0.0001): but when values are not exact, as in part **(g)(ii)**, then the answer must be given to 3 figure accuracy.

(a) The majority of sketches of f(x) were well drawn and indicated that the function had been typed in correctly with suitable ranges chosen for x and y.

(b) (i) and **(ii)** There were many correct co-ordinates, although a few candidates reversed the answers and some did not give exact values, suggesting the possible use of the trace function on the calculator instead of the maximum and minimum functions.

(c) Although there were many correct answers, many other candidates confused the range with the domain.

(d) Any integer between 1 and 7 was accepted here, but candidates who wrote $1 \leqslant k \leqslant 8$ did not gain the mark since this expression includes non-integer values.

(e) This was correctly answered by most of the candidates.

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(f) (i) A straight line, often ruled, was drawn by a large number of candidates and only a few incorrectly allowed the line to cross one or both parts of the curve of the original function.

(ii) Although the spelling was not always correct, a large number of candidates wrote the word asymptote, often embellishing it unnecessarily with words such as vertical or horizontal.

(g) (i) The sketch of the function g(x) was drawn reasonably well by many candidates.

(ii) Although many candidates recognised the value 2.48 (or sometimes 2.5) as being a solution, many did not include it in a statement involving x. The value 2 was much less frequently given. Some candidates attempted an algebraic solution instead of considering their sketches.

Answers: **(b)(i)** (0, 0) **(ii)** (4, 8) **(c)** $f(x) \leqslant 0, f(x) \geqslant 8$ **(d)** 1 or 2 or 3 or 4 or 5 or 6 or 7 **(e)** $x = 2$
(f)(ii) asymptote **(g)(ii)** $2 < x$ and $x < 2.48$

Question 5

(a) The correct answer was often given but a number of candidates ignored both the markings on the diagram and the statement below it and assumed that $AC = CB$.

(b) There were many good solutions to this part with a simple equation to find the value of x, followed by an equally simple division of 360 by the value of x to give the number of sides of the polygon. However, a number of candidates tried to use the formula for the sum of the interior angles, and although this approach did sometimes ultimately lead to the answer 36, it involved a great deal more work with greater scope for errors.

(c) (i) Most candidates obtained the correct answer.

(ii) This part was less well answered with some candidates assuming that AC was equal in length to EC.

(iii) There were more errors in this part with a variety of wrong answers.

Answers: **(a)** 68 **(b)** 36 **(c)(i)** 30° **(ii)** 70° **(iii)** 100°

Question 6

This question was generally well answered.

(a) (i) Many candidates gave the correct answer. The mark allowance of 2 indicated that more was required than just the answer and many candidates showed the products of the mid-values and the frequencies.

(ii) There were some excellent histograms drawn. A few candidates had the wrong frequency densities or misinterpreted the vertical scale and a very small number drew four columns of equal width.

(b) (i) The median was almost always found correctly from the diagram.

(ii) Most candidates found the inter-quartile range correctly.

(iii) This part was very well answered with nearly all candidates finding the correct answer.

Answers: **(a)(i)** 18.1 **(b)(i)** 22 **(ii)** 12 **(iii)** 10

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Question 7

(a) This part was very well answered with most candidates obtaining the right values for x and y. The methods used were either elimination or substitution; there were no attempts at solving these equations using a sketch.

(b) Many candidates correctly multiplied all the terms of the equation by 21 and most multiplied the brackets out correctly. Errors were made in then rearranging the terms to isolate x.

(c) (i) and **(ii)** Nearly all candidates wrote down the correct expressions for the number of newspapers and magazines that could be bought.

(iii) Most candidates wrote down a correct equation in x. There was some difficulty in dealing with the algebraic fractions but those candidates who managed this successfully went on to obtain the correct answer. Once again there was no evidence of any candidate attempting to solve this by sketching a suitable curve.

Answers: **(a)** $x = -2$, $y = 3$ **(b)** $\frac{13-21k}{11}$ **(c)(i)** $\frac{120}{x}$ **(ii)** $\frac{90}{x+0.4}$ **(iii)** 0.80

Question 8

(a) From the given data, candidates could only solve this using the cosine rule and the majority did this satisfactorily.

(b) In this part candidates were expected to use the sine rule and nearly all obtained the correct answer.

(c) A large number of candidates were able to find the area of the two triangles, but a great many had difficulty in converting their answer in square kilometres to an answer in square centimetres on the map using the correct scale. In the best solutions, candidates realised that 1 cm on the map represented 10 km and made this conversion before attempting to find the areas.

(d) (i) The right answer was often given.

(ii) There were many wrong answers here especially 275° and 95°.

Answers: **(a)** 131 **(b)** 190 **(c)** 240 **(d)(i)** 186° **(ii)** 265°

Question 9

(a) A number of candidates obtained the correct answer. Incorrect methods included using the volume of the cuboid container, trying to work in cubic metres and not converting seconds into hours and minutes.

(b) There were many correct answers to this part. Once again errors appeared when candidates tried to work in cubic metres. A number of candidates ignored the instruction to give their answer correct to 2 significant figures.

(c) All but a few candidates were able to give their answer to the previous part in standard form.

Answers: **(a)** 14 h 21 or 22 min **(b)** 440 000 **(c)** 4.4×10^5

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Question 10

(a) (i) Many candidates were able to write down the correct answer.

(ii) This part proved far more challenging with many candidates thinking that the vector $\overrightarrow{DE}$ is equal to $\overrightarrow{EC}+\overrightarrow{CD}$. A number also treated the point *E* as the midpoint of *CB* or left what would be a correct answer in unsimplified form.

(b) (i) Abler candidates found the correct answer easily, whereas the weaker candidates again found this part difficult.

(ii) Candidates could only gain this mark if their answer to part **(b)(i)** was consistent with the expected statement. Quite a few left this part unanswered or made statements about vectors rather than about the point *F*.

Answers: **(a)(i)** $\mathbf{r}+\mathbf{t}$ **(ii)** $\frac{1}{3}\mathbf{r}-\frac{1}{3}\mathbf{t}$ **(b)(i)** $\frac{1}{3}\mathbf{r}$ **(ii)** on *AB* extended

Question 11

(a) Most candidates wrote down the correct answer although some gave an answer still in terms of *x*.

(b) (i) The most common wrong answer in this part was to draw the curve $y = g(x) + 1$. Some drew the curve $y = g(x - 1)$.

(ii) Most candidates gained the mark for stating that the transformation was a translation and while many attempted to describe the translation in words, the better candidates simply wrote down the translation vector.

(c) (i) This part was well answered by most candidates.

(ii)(a) Many candidates attempted to draw the correct sketch and gained the mark if the intention was clear. A consistently common error was to draw a reflection of the given curve in the *y*-axis.

(ii)(b) As in part **(b)** the name of the transformation was usually given correctly, although the line $y = x$ was less often stated.

Answers: **(a)** 11 **(b)(ii)** translation $\begin{pmatrix}-1\\0\end{pmatrix}$ **(c)(i)** $\sqrt[3]{x}$ **(ii)(b)** reflection $y = x$

Question 12

A number of candidates assumed that the bowls were hemispheres and tried to answer this question using formulae involving π. As the shape of the bowls was not specified, the question could only be answered by considering their mathematical similarity. The candidates who realised this had very little difficulty in finding the required values.

(a) Among candidates using the correct method, errors arose when they used a truncated or incorrectly rounded value of their cube root of $\frac{108}{500}$.

(b) Again, candidates using the correct method only omitted to get the correct answer if they used a wrong answer from part **(a)** or used insufficiently accurate values in their calculations.

Answers: **(a)** 2.4 **(b)** 250

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INTERNATIONAL MATHEMATICS

Paper 0607/43
Paper 43 (Extended)

Key message

As all questions must be answered, it is important that candidates are prepared for the whole syllabus.

The level of accuracy required on graph questions is the same as the rest of the paper, unless otherwise stated. Many candidates seem to give less accurate answers in these situations.

Working should be shown in all but the shortest questions.

General comments

Almost all candidates were fully prepared for this examination and were able to complete the paper in the allotted time.

Working was usually clearly shown although a few candidates gave only answers to certain questions. Answers only may run the risk of losing marks. Candidates do have the responsibility to show their methods, especially in questions which carry several marks.

Apart from the graph questions, the level of accuracy was good and questions involving several parts rarely lost marks through premature approximations in the working.

Graph sketching and some applications continue to improve, although domain, range and inequalities continue to be a challenge to many candidates.

Topics which were well answered include percentages, compound interest, transformations, curve sketching with zeros, turning points and intersections, cosine and sine rules, histogram, mean value and drawing a cumulative frequency curve.

Topics found to be more challenging were the equation of a perpendicular line, areas of sectors and segments, ranges and inequalities from sketches of functions, similar areas and volumes, vector geometry, interpreting a cumulative frequency graph and a worded problem requiring the use of algebra.

Mixed responses were seen in questions on time and speed, probability and transformations of functions.

Comments on specific questions

Question 1

(a) This reverse percentage question was well answered. A few candidates need to connect the given amount with a percentage, which is not 100.

(b) (i) This compound interest question involving 3 years of different rates was generally well answered. A few candidates added the three rates (4 + 3 + 2 = 9) and calculated 9% of the principal.

(ii) The challenge of this part was to calculate the amount of each investment after 5 years. The new investment was usually correctly calculated. Many candidates compared this amount with the answer to part **(b)(i)**, overlooking the need to calculate the amount after 2 more years.

Answers: **(a)** $80000 **(b)(i)** $5463.12 **(ii)** $26.79

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Question 2

(a) The co-ordinates of the midpoint of a line was almost always correctly answered.

(b) The equation of the perpendicular to a given line and through the point found in part **(a)** proved to be much more challenging. The difficulties were finding a gradient, finding a perpendicular gradient and then using the correct co-ordinates in an equation.

(c) This part involved finding the points where two lines met the *y*-axis and then the distance between these two points. The challenges were to use simple proportion to see where the first line met the *y*-axis and to realise that the distance was simply the difference between the *y* co-ordinates. This question was often omitted or saw the use of long methods for only 2 marks. Pythagoras was often seen for this distance along the *y*-axis.

Answers: **(a)** (6, –1) **(b)** $y = \frac{3}{2}x - 10$ **(c)** 13

Question 3

(a) The full description of the single rotation was well answered.

(b) (i) The enlargement was quite well drawn although the scale factor of –2 was found to be challenging. A number of candidates drew the enlargement with a factor of $\frac{1}{2}$.

(ii) The description of the reverse of the transformation in part **(i)** was quite well answered, although the scale factor was again found to be challenging.

(c) This more demanding part required the drawing of a stretch with the object lying across the invariant line. Many candidates succeeded in drawing this correctly whilst others correctly placed two of the three vertices of the image.

Answers: **(a)** rotation, 90˚, (2, 1) **(b)(ii)** enlargement, scale factor $-\frac{1}{2}$, centre (3, 2)

Question 4

This question required candidates to find a region formed by the arcs of two circles.

The question was structured to lead candidates towards a suitable strategy and most candidates were able to earn marks in some parts.

(a) This required the calculation of an angle and to show that it rounded to a given value. The two challenges were, firstly, to realise that a simple trigonometric ratio was available and, secondly, to give an answer to an accuracy greater than that of the given value. Many candidates used the cosine or the sine rule, often successfully, but many overlooked the need for the more accurate answer.

(b) Most candidates were able to use the given value in part **(a)** to find the area of a sector. There were two radii in the stem of the question and a number of candidates chose the incorrect one.

(c) This part required the area of a sector of the other circle and the angle of the sector was found to be more complicated. Candidates who found the angle correctly usually gave a correct final answer.

(d) This calculation of the area of a triangle was more successfully answered with a range of methods seen.

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(e) This final part was to combine the answers to previous parts in order to find the required area between the two arcs. This proved to be extremely challenging and was the most discriminating question of the whole paper. There were some very good solutions from the stronger candidates whilst many could not combine areas correctly and many omitted this part.

Answers: **(a)** 36.869…° **(b)** 41.2 cm^2 **(c)** 23.2 cm^2 **(d)** 12.0 cm^2 **(e)** 14.9 or 15.0 cm^2

Question 5

The answers given in this question were often to fewer than 3 significant figures and candidates need to be aware that accurate values are necessary and are easily read from the graphics calculator.

(a) The sketch of the cubic function was almost always correct.

(b) Candidates clearly demonstrated their knowledge of zeros.

(c) The co-ordinates of the local minimum point were usually correctly found.

(d) (i) Many candidates found the x co-ordinates of the three points of intersection. Only a few gained full marks as a result of not adding a sketch of the new graph to the diagram for part **(a)**. As stated earlier, communication of methods is important and in this case a demonstration of intersecting graphs was required.

(ii) This part required the use of the answers to part **(i)** to solve an inequality. This was a challenging final part of the question with many candidates showing the need for more experience in this type of problem.

Answers: **(b)** –1.83, –0.657, 2.49 **(c)** (–1.29, –1.30) **(d) (i)** –2.71, 0.143, 2.57 **(ii)** $x < -2.71$, $0.143 < x < 2.57$

Question 6

(a) This question involved the calculation of a similar area. There were many correct answers, although a large number of candidates used the ratio of heights instead of the square of this ratio.

(b) This was a more discriminating question on similar figures. It involved the square root of a ratio of areas and then cubing it to find a volume. Many candidates were aware of the need for the cube of a ratio but only a few found the square root first. An alternative method seen, occasionally, was to find the height of the larger object and then cube the ratio of the known heights. A number of candidates involved the smallest object when its volume was not known.

Answers: $133\frac{1}{3}$ cm^2 **(b)** 2610 cm^3

Question 7

A number of candidates found this vector geometry quite challenging, especially the parts involving fractions of vectors.

(a) (i) Most candidates answered this straightforward part correctly.

(ii) This part required the addition of one vector to another. Many candidates gave the correct answer whilst many others found this concept difficult.

(iii) This vector was simply two thirds of the answer to part **(ii)**. A large number of candidates made the problem more complicated by using other routes which involved combining vectors.

(b) (i) This was found to be more straightforward with a reasonably simple combination of two vectors.

(ii) This part did involve choosing an appropriate route and then simplifying the vector expression. Success with this part was quite limited, with a large number of candidates overlooking the signs of vectors in opposite directions.

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(c) This required the interpretation of the answers to **(a)(iii)** and **(b)(ii)** and credit was only possible if these two answers were correct. The interpretation was that the two points were in fact the same point and the stronger candidates showed their ability in this situation. There were candidates who had answered all the parts of **(a)** and **(b)** correctly but found this interpretation too challenging, giving answers which often compared the vectors rather than the points.

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

Question 8

(a) This straightforward question involving angles was usually well answered.

(b) (i) The cosine rule was usually successfully applied.

(ii) This part asked for a bearing and required another calculation in the triangle. Some candidates used the sine rule and some used the cosine rule again. Many were successful in finding an angle in the triangle. Using their angle to deduce the bearing was found to be more demanding. Bearings seem to continue to be a difficult topic for many candidates.

(c) (i) This required the calculation of the times of three journeys and then finding the total time. There were many good answers, with a few losing the accuracy to the nearest minute. A few candidates divided the total distance by the sum of the three speeds.

(ii) This part required candidates to find the overall average speed and most did correctly divide the total distance by their answer to part **(i)**. A few found the average of the speeds.

Answers: **(b)(i)** 54.5 km **(ii)** 333° **(c)(i)** 12 hours 24 minutes **(ii)** 18.5 km/h

Question 9

(a) This required the completion of a probability tree for selecting two balls from a bag containing balls of three different colours. Almost all candidates completed this tree successfully.

(b) (i) The probability of two balls being a given colour was very well answered.

(ii) The probability of the two balls having different colours was also well answered, often by finding the sum of six products. A simpler method was to subtract two products, one of which had already been worked out, from 1.

(c) The final part asking for the probability that the second ball was a particular colour was also generally well answered.

Answers: **(b)(i)** $\frac{6}{72}$ **(ii)** $\frac{46}{72}$ **(c)** $\frac{5}{9}$

Question 10

(a) The frequencies from a given histogram were usually correctly calculated.

(b) The estimate of the mean from the frequency table was also well answered. A large number of candidates used a long method rather than the facility available on the graphics calculator, resulting in quite an amount of work for only 2 marks.

(c) The cumulative frequencies from the frequency table were found to be straightforward.

(d) The cumulative frequency curve was usually correctly drawn.

(e) Candidates found the interpretations and comparisons of two frequency curves more challenging.

(i) Many candidates gave the correct answer for the larger median whilst many thought that the answer would be the first median reading from left to right.

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(ii) There were some very good answers comparing the inter-quartile ranges. A number of candidates appeared to be less confident with this question and a number did not find the correct quartiles. It is important that candidates can not only carry out statistics calculations or draw graphs but also interpret results.

(f) This required candidates to read a frequency for a given value and this was generally successfully answered. There were a few inaccurate answers, apparently from misreading the scales.

Answers: **(a)** 10, 30, 22 **(b)** 56.7 cm **(c)** 14, 30, 60, 82 **(e)(i)** B **(ii)** B by values in the range 6 to 10 **(f)** 18

Question 11

(a) The sketch of a given function was very well completed by almost all candidates.

(b) The range of the function for a given domain was found to be much more challenging to the majority of candidates. The appropriate values of f(x) were seen quite frequently but the inequalities for the range were less successfully stated.

(c) (i) The asymptotes were often correctly stated with the two vertical ones proving to be more accessible. Many candidates gave the horizontal asymptote 1 or 2 units below the correct one.

(ii) Most candidates appeared to understand that f(x + k) gave a translation of k units to the left. There were a few who were confused between f(x + k) and f(x) + k. Many of the candidates did give the correct translations of their asymptotes seen in part **(i)**.

Answers: **(b)** $f(x) \leqslant -\frac{2}{3}$ **(c)(i)** $x = -2$, $x = 2$, $y = 2$ **(c)(ii)** $x = -5$, $x = -1$, $y = 2$

Question 12

(a) The algebraic expression for the area of a rectangle proved to be much more challenging than expected. Many candidates demonstrated the need for more practice with this type of problem.

(b) As the area was given in part **(i)**, candidates were able to apply it in this part and solved the resulting quadratic equation. Many chose to use the formula, possibly because of the need to find a suitable domain and range on the graphics calculator.

(c) The maximum area of the field was successfully found by those who did use the graphics calculator. Other candidates usually omitted this part.

(d) This worded problem required candidates to find the area of a circle with a given circumference and was generally well answered. A few candidates had difficulty in realising that the 100 metres was the circumference rather than the diameter.

Answers: **(b)** 11.8 m or 38.2 m **(c)** 1250 m^2 **(d)** 796 m^2

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INTERNATIONAL MATHEMATICS

Paper 0607/51
Paper 51 (Core)

Key Messages

Candidates are well-advised not only to read the questions carefully but also to use the examples to check their understanding. For example, **Question 2(b)** says 3 on each small cube, so an answer of 1 for later cubes does not follow.

The task should be seen as a whole and answers should show coherence. In this respect, checking back is worthwhile. For instance, any patterns observed in the table in **Question 4** should correspond to previously found answers.

General Comments

The large majority of candidates were able to understand the three-dimensional nature of the situation. There were, however, several candidates who had not understood that the crosses were put on the small cubes **after** the large cube had been made. The communication marks that were gained were fewer than last year, with a significant number not showing their working in reaching the numerical answer in **Question 5(c)**.

Comments on Specific Questions

Question 1

(a) Nearly all candidates were successful with this question.

Answer: 8

(b) Candidates were expected to realise that the three other faces of every small cube were hidden inside the large cube. Most candidates were able to express such ideas correctly. A number of candidates implied that, for three dimensions, what one sees on a two-dimensional diagram will only be three sides. This did not receive credit.

(c) Most candidates correctly determined the number of crosses on the outside of a 2 by 2 by 2 cube.

A frequent incorrect answer was 48, indicating that candidates assumed there were crosses on each side of every small cube.

Answer: 24

Question 2

(a) Candidates were generally successful with this question. The main errors were those in counting, a method used when a candidate was unaware that the answer could be calculated.

Answer: 27

(b) Candidates, who did not consider the orientation of the diagram or who thought that the crosses only covered what they could see, only saw one cube with three crosses. This was a fundamental misunderstanding and cost candidates several marks in subsequent parts.

Answer: 8

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(c) Two methods are apparent here and candidates had the opportunity to check their answer.

The easier method was to notice that each face of the large cube had one small cube with only one cross on it, giving 6 cubes in total.

To check this answer candidates could take their answer to part **(a)**, the total number of cubes and then subtract the numbers of cubes with 3 crosses (their answer to part **(b)**), 2 crosses (given in the question) and no crosses (given in the question).

Candidates, who had not understood that the crosses were marked on after the large cube was made, had difficulty here.

Answer: 6

Question 3

(a) The 4 by 4 by 4 cube was drawn very accurately using the isometric dot grid by nearly all of the candidates. Candidates who strayed from the grid points and drew shapes that did not appear cubical received partial credit.

(b) (i) Those who were unsuccessful in the similar **Question 2(b)** were unsuccessful here. A common incorrect answer was 1, being the only cube where the three crosses were seen on a diagram.

Answer: 8

(ii) This question was best answered by observing that there were 4 such cubes on each side of the large cube, so that the answer could be obtained by multiplying 4 by the number of faces, 6.

Those who only looked at what showed on the diagram gave 9 as their answer.

Answer: 24

Question 4

This question asked candidates to summarise their findings by completing a table. Organising the results in this way is a key stage in tackling an investigation, so candidates should be familiar with such an exercise. The blanks in the table could be found by counting crosses in diagrams and many candidates used the grid on page 6 of the question paper to draw relevant cubes.

Some candidates tackled the question without drawing the 5 by 5 by 5 cube, having felt they had spotted the necessary patterns.

Apart from the cells with an answer from a previous question, the most frequent correct cell was that with 125, the total number of cubes in a 5 by 5 by 5 cube.

Again candidates who had not understood correctly how the crosses were drawn could make little of this question.

Question 5

(a) This question led candidates through calculating the total number of crosses by considering each type of small cube. There was an opportunity to recover here since much of the necessary calculation was already in place in the question and several candidates, who were unsuccessful in **Question 4**, picked up marks here. Perhaps an opportunity was missed by such candidates in checking back and amending previous work.

A frequent error was to assume that, for the 3 by 3 by 3 cube, the number of cubes with 0, 1, 2, 3 crosses followed the sequence 1, 6, 12, 18.

(b) This question was well answered by the majority of candidates. Not all candidates made use of their answer here to check that their answer in part **(a)** made sense.

Answer: 9 54

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(c) Many candidates gave the correct answer here. Examiners looked for a method of how the result was found. There was a lack of communication in this respect by many candidates and this affected their communication mark overall.

Answer: 96

Question 6

(a) This question required more sophisticated algebraic thinking in generalising the result and only the better candidates were successful. Several candidates gave numerical answers of cube numbers like 216 or 343.

Many candidates knew how to calculate the total number of small cubes for large cubes of side 2, 3, 4 and 5 but then few were able to take that a step further and suggest n^3 as a starting point for the correct answer.

Any clear demonstration that cube numbers were being used was given credit under communication.

Answer: $(n – 2)^3$

(b) This question was beyond nearly all candidates but credit could be gained for communication by taking the sequence 0, 6, 24, 54 and showing that the second differences were both 12. Candidates, who wrote $6(n – 2)^2$, the formula for the *n* by *n* by n cube, as well as those who wrote the formula for the *n*th term of the sequence, as suggested by the question, gained full credit.

Answer: $6(n – 1)^2$

(c) Several candidates were successful in finding the *n*th term of the linear sequence 0, 12, 24, 36 though this was dependent on them having the correct cells with 0 and 36 in the table in **Question 4**.

Again, candidates who gave $12(n – 2)$, the formula for the *n* by *n* by n cube, received full credit. There was a chance to gain credit for communication by showing that the differences were all 12 or that the formula required multiples of 12.

Answer: $12(n – 1)$

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INTERNATIONAL MATHEMATICS

Paper 0607/52
Paper 52 (Core)

Key Messages

Candidates are well-advised not only to read the questions carefully but also to use the examples to check their understanding. For example, **Question 2(b)** says 3 on each small cube, so an answer of 1 for later cubes does not follow.

The task should be seen as a whole and answers should show coherence. In this respect, checking back is worthwhile. For instance, any patterns observed in the table in **Question 4** should correspond to previously found answers.

General Comments

The large majority of candidates were able to understand the three-dimensional nature of the situation. There were, however, several candidates who had not understood that the crosses were put on the small cubes **after** the large cube had been made. The communication marks that were gained were fewer than last year, with a significant number not showing their working in reaching the numerical answer in **Question 5(c)**.

Comments on Specific Questions

Question 1

(a) Nearly all candidates were successful with this question.

Answer: 8

(b) Candidates were expected to realise that the three other faces of every small cube were hidden inside the large cube. Most candidates were able to express such ideas correctly. A number of candidates implied that, for three dimensions, what one sees on a two-dimensional diagram will only be three sides. This did not receive credit.

(c) Most candidates correctly determined the number of crosses on the outside of a 2 by 2 by 2 cube.

A frequent incorrect answer was 48, indicating that candidates assumed there were crosses on each side of every small cube.

Answer: 24

Question 2

(a) Candidates were generally successful with this question. The main errors were those in counting, a method used when a candidate was unaware that the answer could be calculated.

Answer: 27

(b) Candidates, who did not consider the orientation of the diagram or who thought that the crosses only covered what they could see, only saw one cube with three crosses. This was a fundamental misunderstanding and cost candidates several marks in subsequent parts.

Answer: 8

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(c) Two methods are apparent here and candidates had the opportunity to check their answer.

The easier method was to notice that each face of the large cube had one small cube with only one cross on it, giving 6 cubes in total.

To check this answer candidates could take their answer to part **(a)**, the total number of cubes and then subtract the numbers of cubes with 3 crosses (their answer to part **(b)**), 2 crosses (given in the question) and no crosses (given in the question).

Candidates, who had not understood that the crosses were marked on after the large cube was made, had difficulty here.

Answer: 6

Question 3

(a) The 4 by 4 by 4 cube was drawn very accurately using the isometric dot grid by nearly all of the candidates. Candidates who strayed from the grid points and drew shapes that did not appear cubical received partial credit.

(b) (i) Those who were unsuccessful in the similar **Question 2(b)** were unsuccessful here. A common incorrect answer was 1, being the only cube where the three crosses were seen on a diagram.

Answer: 8

(ii) This question was best answered by observing that there were 4 such cubes on each side of the large cube, so that the answer could be obtained by multiplying 4 by the number of faces, 6.

Those who only looked at what showed on the diagram gave 9 as their answer.

Answer: 24

Question 4

This question asked candidates to summarise their findings by completing a table. Organising the results in this way is a key stage in tackling an investigation, so candidates should be familiar with such an exercise. The blanks in the table could be found by counting crosses in diagrams and many candidates used the grid on page 6 of the question paper to draw relevant cubes.

Some candidates tackled the question without drawing the 5 by 5 by 5 cube, having felt they had spotted the necessary patterns.

Apart from the cells with an answer from a previous question, the most frequent correct cell was that with 125, the total number of cubes in a 5 by 5 by 5 cube.

Again candidates who had not understood correctly how the crosses were drawn could make little of this question.

Question 5

(a) This question led candidates through calculating the total number of crosses by considering each type of small cube. There was an opportunity to recover here since much of the necessary calculation was already in place in the question and several candidates, who were unsuccessful in **Question 4**, picked up marks here. Perhaps an opportunity was missed by such candidates in checking back and amending previous work.

A frequent error was to assume that, for the 3 by 3 by 3 cube, the number of cubes with 0, 1, 2, 3 crosses followed the sequence 1, 6, 12, 18.

(b) This question was well answered by the majority of candidates. Not all candidates made use of their answer here to check that their answer in part **(a)** made sense.

Answer: 9 54

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(c) Many candidates gave the correct answer here. Examiners looked for a method of how the result was found. There was a lack of communication in this respect by many candidates and this affected their communication mark overall.

Answer: 96

Question 6

(a) This question required more sophisticated algebraic thinking in generalising the result and only the better candidates were successful. Several candidates gave numerical answers of cube numbers like 216 or 343.

Many candidates knew how to calculate the total number of small cubes for large cubes of side 2, 3, 4 and 5 but then few were able to take that a step further and suggest n^3 as a starting point for the correct answer.

Any clear demonstration that cube numbers were being used was given credit under communication.

Answer: $(n – 2)^3$

(b) This question was beyond nearly all candidates but credit could be gained for communication by taking the sequence 0, 6, 24, 54 and showing that the second differences were both 12. Candidates, who wrote $6(n – 2)^2$, the formula for the *n* by *n* by n cube, as well as those who wrote the formula for the *n*th term of the sequence, as suggested by the question, gained full credit.

Answer: $6(n – 1)^2$

(c) Several candidates were successful in finding the *n*th term of the linear sequence 0, 12, 24, 36 though this was dependent on them having the correct cells with 0 and 36 in the table in **Question 4**.

Again, candidates who gave $12(n – 2)$, the formula for the *n* by *n* by n cube, received full credit. There was a chance to gain credit for communication by showing that the differences were all 12 or that the formula required multiples of 12.

Answer: $12(n – 1)$

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INTERNATIONAL MATHEMATICS

Paper 0607/53
Paper 53 (Core)

Key Messages

Candidates are well-advised not only to read the questions carefully but also to use the examples to check their understanding. For example, **Question 2(b)** says 3 on each small cube, so an answer of 1 for later cubes does not follow.

The task should be seen as a whole and answers should show coherence. In this respect, checking back is worthwhile. For instance, any patterns observed in the table in **Question 4** should correspond to previously found answers.

General Comments

The large majority of candidates were able to understand the three-dimensional nature of the situation. There were, however, several candidates who had not understood that the crosses were put on the small cubes **after** the large cube had been made. The communication marks that were gained were fewer than last year, with a significant number not showing their working in reaching the numerical answer in **Question 5(c)**.

Comments on Specific Questions

Question 1

(a) Nearly all candidates were successful with this question.

Answer: 8

(b) Candidates were expected to realise that the three other faces of every small cube were hidden inside the large cube. Most candidates were able to express such ideas correctly. A number of candidates implied that, for three dimensions, what one sees on a two-dimensional diagram will only be three sides. This did not receive credit.

(c) Most candidates correctly determined the number of crosses on the outside of a 2 by 2 by 2 cube.

A frequent incorrect answer was 48, indicating that candidates assumed there were crosses on each side of every small cube.

Answer: 24

Question 2

(a) Candidates were generally successful with this question. The main errors were those in counting, a method used when a candidate was unaware that the answer could be calculated.

Answer: 27

(b) Candidates, who did not consider the orientation of the diagram or who thought that the crosses only covered what they could see, only saw one cube with three crosses. This was a fundamental misunderstanding and cost candidates several marks in subsequent parts.

Answer: 8

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(c) Two methods are apparent here and candidates had the opportunity to check their answer.

The easier method was to notice that each face of the large cube had one small cube with only one cross on it, giving 6 cubes in total.

To check this answer candidates could take their answer to part **(a)**, the total number of cubes and then subtract the numbers of cubes with 3 crosses (their answer to part **(b)**), 2 crosses (given in the question) and no crosses (given in the question).

Candidates, who had not understood that the crosses were marked on after the large cube was made, had difficulty here.

Answer: 6

Question 3

(a) The 4 by 4 by 4 cube was drawn very accurately using the isometric dot grid by nearly all of the candidates. Candidates who strayed from the grid points and drew shapes that did not appear cubical received partial credit.

(b) (i) Those who were unsuccessful in the similar **Question 2(b)** were unsuccessful here. A common incorrect answer was 1, being the only cube where the three crosses were seen on a diagram.

Answer: 8

(ii) This question was best answered by observing that there were 4 such cubes on each side of the large cube, so that the answer could be obtained by multiplying 4 by the number of faces, 6.

Those who only looked at what showed on the diagram gave 9 as their answer.

Answer: 24

Question 4

This question asked candidates to summarise their findings by completing a table. Organising the results in this way is a key stage in tackling an investigation, so candidates should be familiar with such an exercise. The blanks in the table could be found by counting crosses in diagrams and many candidates used the grid on page 6 of the question paper to draw relevant cubes.

Some candidates tackled the question without drawing the 5 by 5 by 5 cube, having felt they had spotted the necessary patterns.

Apart from the cells with an answer from a previous question, the most frequent correct cell was that with 125, the total number of cubes in a 5 by 5 by 5 cube.

Again candidates who had not understood correctly how the crosses were drawn could make little of this question.

Question 5

(a) This question led candidates through calculating the total number of crosses by considering each type of small cube. There was an opportunity to recover here since much of the necessary calculation was already in place in the question and several candidates, who were unsuccessful in **Question 4**, picked up marks here. Perhaps an opportunity was missed by such candidates in checking back and amending previous work.

A frequent error was to assume that, for the 3 by 3 by 3 cube, the number of cubes with 0, 1, 2, 3 crosses followed the sequence 1, 6, 12, 18.

(b) This question was well answered by the majority of candidates. Not all candidates made use of their answer here to check that their answer in part **(a)** made sense.

Answer: 9 54

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(c) Many candidates gave the correct answer here. Examiners looked for a method of how the result was found. There was a lack of communication in this respect by many candidates and this affected their communication mark overall.

Answer: 96

Question 6

(a) This question required more sophisticated algebraic thinking in generalising the result and only the better candidates were successful. Several candidates gave numerical answers of cube numbers like 216 or 343.

Many candidates knew how to calculate the total number of small cubes for large cubes of side 2, 3, 4 and 5 but then few were able to take that a step further and suggest n^3 as a starting point for the correct answer.

Any clear demonstration that cube numbers were being used was given credit under communication.

Answer: $(n – 2)^3$

(b) This question was beyond nearly all candidates but credit could be gained for communication by taking the sequence 0, 6, 24, 54 and showing that the second differences were both 12. Candidates, who wrote $6(n – 2)^2$, the formula for the *n* by *n* by n cube, as well as those who wrote the formula for the *n*th term of the sequence, as suggested by the question, gained full credit.

Answer: $6(n – 1)^2$

(c) Several candidates were successful in finding the *n*th term of the linear sequence 0, 12, 24, 36 though this was dependent on them having the correct cells with 0 and 36 in the table in **Question 4**.

Again, candidates who gave $12(n – 2)$, the formula for the *n* by *n* by n cube, received full credit. There was a chance to gain credit for communication by showing that the differences were all 12 or that the formula required multiples of 12.

Answer: $12(n – 1)$

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INTERNATIONAL MATHEMATICS

Paper 0607/61
Paper 61 (Extended)

Key Messages

To do well on this paper, candidates need to be able to follow instructions carefully and to adapt their mathematics to practical situations. The Investigation and Modelling sections each look at a whole situation and should be treated in this way. Candidates need to refer back to previous questions and answers when working through the paper if they wish to be successful in finding correct answers and completing the ends of each section successfully.

General Comments

In ***Section A*** candidates were required to read the introduction and follow the examples given about the marking of the crosses on the outside faces of the cube. This provided them with key information for several of the questions.

In ***Section B*** those candidates who thought clearly about the practical situation whilst relating it to the Mathematics did the best.

Comments on Specific Questions

Section A: Investigation

Question 1

(a) Most candidates were able to understand the information given about the cubes and the crosses drawn on them, and were able to answer this question correctly.

Answer: 8

(b) Candidates need to work on their worded explanations. Most had not understood that crosses were made on the outside faces of each small cube once the small cubes had been joined together and they said that the other crosses were hidden. This was acceptable when they added that they were not seen because they were inside the cube. Many candidates did not explain what they meant by 'hidden', so it was not clear if they meant because of the 2D drawing or because of the cubes sticking together. Others quite clearly said it was because of the drawing, which was incorrect.

Answer: Response implying some faces hidden within the large cube

(c) Most candidates, including those who had not been able to give a complete or proper explanation to part **(b)**, were able to count these correctly.

Answer: 24

Question 2

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

Answer: 27

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(b) A few candidates did not realise that this was only the corner cubes or could only see 1.

Answer: 8

(c) More candidates miscounted here; some only counting what they could see and many more missing out one or two from the bottom or the back.

Answer: 6

Question 3

Many candidates very sensibly used the dotty grid to draw at least the 4 by 4 by 4 cube to help them. Many also noticed patterns within the columns of numbers. There were very few mistakes in counting or calculation.

Answer:

Size of cube	Total number of small cubes	Number of small cubes with			
		0 crosses	1 cross	2 crosses	3 crosses
2 by 2 by 2	**8**	0	0	**0**	**8**
3 by 3 by 3	**27**	1	**6**	12	**8**
4 by 4 by 4	64	8	24	**24**	**8**
5 by 5 by 5	**125**	27	54	**36**	8

Question 4

(a) Most candidates were able to answer this question correctly. Some still did not count all of the crosses that they could not see and had fewer than 8 for the small cubes with 3 crosses on them.

Answer: 1 small cube with 0 crosses gives 0 crosses
6 small cubes with 1 cross gives 6 crosses
12 small cubes with 2 crosses gives **24** crosses
8 small cubes with 3 crosses gives **24** crosses
Total = **54** crosses

(b) This was very well answered. Candidates were now using only a part of the cube that they could see.

Answer: 9, 54

(c) Also well answered; helped by drawings on the dotty grid.

Answer: 96

(d) Candidates will always need practice to help them when moving from number into algebra. Although simplification was not required at this stage it was common practice here not to simplify this expression, leaving it in a form such as $n \times n \times 6$ or similar.

Answer: $6n^2$

Question 5

Most candidates achieved at least one mark for n^3 or for noticing that the sequence started with the size of cube 2 by 2 by 2 so this meant 2 needed to be subtracted in the general term. Most of those who had the fully correct answer reached it by recognising that the numbers were cubed rather than using the difference or an algebraic method.

Answer: $(n - 2)^3$

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Question 6

Many candidates did not realise that they could equate the two expressions to find the answer to this question. Algebra practice on such topics as multiplying out brackets is essential because even those who did equate their two expressions made mistakes in their algebra. Many used trialling but only did one or two trials and consequently did not reach the answer. There were many numerical as well as algebraic mistakes leading to answers of 'No' even when 8 was used in a trial.

Answer: Yes and n = 8 or 216 seen

Question 7

Candidates still need to be encouraged to look back to help them move forwards. Those who looked back to their table in **Question 3** easily found a simple sequence to use to give them the correct answer, either by using the difference method or incorporating their findings from **Question 5** and using the $n - 2$ initially. The most common error was an answer of $12n - 12$.

Answer: $12(n - 2)$

Question 8

(a) Working backwards to solve a problem always needs more practice. Few took their answer to **Question 5** and equated it to 64. Of those who did, only the best candidates took the cube root and most multiplied out their expression in n. Again, some got the correct answer by trialling.

Answer: 216

(b) As in part **(a)** the best candidates equated their answer to **Question 7** to 60 to find n and used this answer in the expression given in **Question 6**. Some stopped when they had found their value for n and many used trialling again.

Answer: 150

Communication

The communication shown in this investigation could have been better. Candidates should be encouraged to explain or show how they are reaching answers even when they are able to write them down without any working out. This applies to all questions except those that state "Write down …..". There were several opportunities to show communication, but only the communication in **Question 4(c)** was regularly seen.

Answer: In two of **4(c)**, **4(d)**, **5**, **7**, **8(a)** or **8(b)**

Section B: Modelling

This section required knowledge of volume and capacity. Formulae were given on the paper but the use of the sphere volume formula when the hemisphere was required was common.

The ability to correctly convert metric units, in this case between litres and cubic metres, was crucial.

Question 1

(a) Candidates should know that a 'show that' question means every step should be written out because the answer is given. Many candidates did not divide by two until they realised the answer they had worked out was incorrect.

Answer: $\frac{1}{2} \times \frac{4}{3} \times \pi \times 3^3$

(b) A straightforward 'show that' question to make sure that candidates were aware that radius and depth were going to be the same for the cylinder, like the hemisphere.

Answer: $\pi \times d^2 \times d$

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(c) Many candidates felt they had to do more than was necessary. Since the volume of the hemisphere was given in part **(a)** it was only necessary here to show that the volume of the cylinder was 27π and that this is, of course, larger than 18π. Some candidates took several steps going back to the original formulae and calculating the decimal answers.

(d) Many candidates found this difficult to resolve because they did not start with the correct formulae. Some used $\frac{4}{3}$ rather than $\frac{2}{3}$ and changed the numerator at the end. Some used r^2 instead of r^3 and made the cube root of r^3 to be r. With questions like these, basic algebraic steps should be practised as well as how to get started.

Question 2

(a) Candidates need to be able to convert between units and in this case specifically between litres and cm^3 or m^3. Many candidates were able to get as far as 13 500 litres but could not successfully convert this to m^3 for the final mark.

Answer: 13.5

(b) Candidates need to be able to write what they can do numerically, as in part **(a)**, into an algebraic form. Candidates should also be able to simplify their answer; although it was not necessary in this case, the attempts at simplification showed that this is still an area of algebra that, for many, needs more practice. As in part **(a)** a common error was the inability to convert litres to m^3.

Answer: $W = 0.05FL$

(c) (i) Many candidates substituted correctly into their model found in part **(b)** and many correctly rounded down to give a whole number of fish. Candidates should be aware of the practicalities associated with models and when it is necessary to round to whole numbers and whether or not to follow the rules for rounding.

Answer: 16

(ii) Again, candidates were able to substitute correctly. As before the error of using $\frac{4}{3}$ for the hemisphere was quite common.

Answer: 2.12

(iii) A further substitution question, this part was well answered, relying only on the formula as given in **Question 1(b)** with the value of 20 given here for the volume.

Answer: 1.85

Question 3

(a) Candidates should have as much practice on all other solids as they do on the cylinder. Candidates performed better on all questions relating to the cylindrical pond than they did on the questions about the hemispherical pond. Candidates also need to understand the terminology 'in terms of' to avoid writing a formula the wrong way round. Some answers were written as 'r =' and although correct in themselves, did not gain the mark for this question which asked for answers in the form of 'd ='.

Answer: $d = \frac{20}{\pi r^2}$

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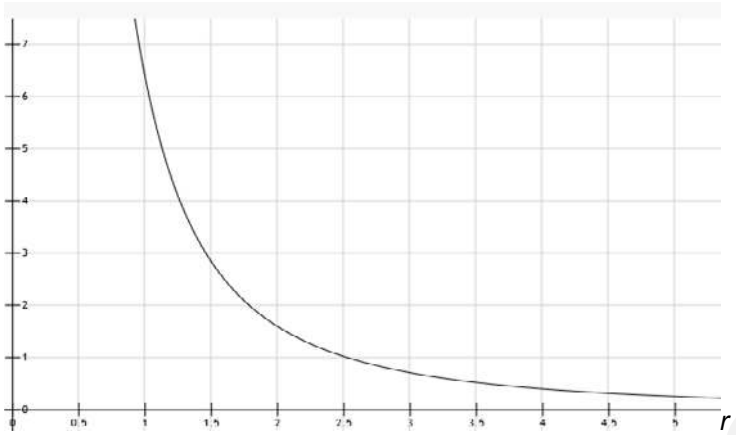
(b) Candidates who had completed part **(a)** successfully, even those with *r* in terms of *d*, were able to do a good sketch of the model.

Answer: *d*



(c) Some candidates traced their graphs back for values of $r < 1$. Some realised that a depth of over 6 m when the radius was 1 m indicated that the pond was already getting too deep. The steep negative gradient of the curve at this point should also have indicated this fact. Many candidates did not refer to their graph and missed this point.

Answer: Too deep

(d) Candidates recovered here and correctly substituted to find the radius from their model in part **(a)**.

Answer: 2.52

Question 4

(a) Few candidates realised that this meant that the depth would be greater. Many candidates put 30 cm into a model that was in metres. Those candidates who had a model in part **(b)** with *r* in terms of *d* found it very difficult to proceed here.

Answer: $d = \dfrac{20}{\pi r^2} + 0.3$

(b) Candidates were able to explain correctly their modification in part **(a)** so their understanding of transformations related to graphs was good; it is the relation of the graphs and models to the practical 'real-life' situation that still needs developing.

Answer: Translates up by 0.3

Communication

Good communication was seen on this part of the paper. Two opportunities taken out of five were asked for and it was quite common for it to be seen in four if not all five of these places.

Answer: In two of **2(a)**, **2(c)(i)**, **2(c)(ii)**, **2(c)(iii)** or **3(d)**

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INTERNATIONAL MATHEMATICS

Paper 0607/62
Paper 62 (Extended)

Key Messages

To do well on this paper, candidates need to be able to follow instructions carefully and to adapt their mathematics to practical situations. The Investigation and Modelling sections each look at a whole situation and should be treated in this way. Candidates need to refer back to previous questions and answers when working through the paper if they wish to be successful in finding correct answers and completing the ends of each section successfully.

General Comments

To score good marks in ***Section A*** it is often necessary to look for several solutions; for example, by testing or trialling all the points on the grid.

In ***Section B*** those candidates who can think clearly about the practical situation whilst relating it to the Mathematics, do the best.

Comments on Specific Questions

Section A: Investigation

Question 1

(a) Most candidates were able to follow the instructions about taxicab geometry given in the example, and to record the correct distances for CD and DE.

Answer: *CD* = 3, *DE* = 4

(b) Most candidates correctly showed the three shortest routes. Some added longer routes to their correct answers which was condoned in this question.

(c) Most candidates also showed four correct routes here. Often those who had shown the extra routes in part **(b)** also drew incorrect (longer) routes in this part. Some candidates put all the routes on one diagram, for which there was no penalty.

(d) (i) Most candidates correctly answered this question. Some routes included a corner which meant they were not the shortest. This could have been because none of the previous answers or the example were a straight line, so these candidates omitted to consider this possibility.

Answer:

or vertical.

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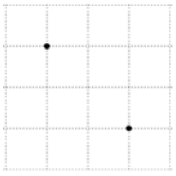
(d) (ii) This question was more demanding than the previous ones and not so well answered. Most candidates found two points that had a taxicab distance not equal to 6 with working showing six routes, having missed out some other routes that also existed.

Answer: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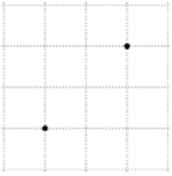


Question 2

(a) Many candidates found difficulty in transferring their knowledge about taxicab geometry to the co-ordinate grid, counting the unit lines and writing 1, 2, 3, … instead of writing the number of shortest routes.

Answer: 1 beside each destination on *x*- and *y*- axes

(b) Candidates had to explain that the shortest distances needed to be added. Many did not see this connection. Others showed adding by 1 + 2 = 3 but did not explain what the '1' and the '2' were representing.

Answer: Add both shortest routes

(c) Many candidates scored one mark, usually for getting the first row correct. Most of those who scored zero in part **(b)** also scored zero here. Few candidates recognised the sequences.

Answer:

4	10	20	
3	6	10	15
2	3	4	5

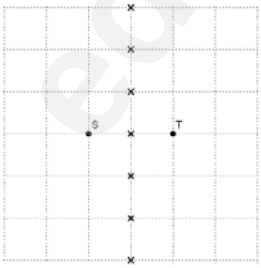
(d) This question was omitted by some candidates. Most who completed the taxicab distance were correct and some recovered from incorrect answers in part **(c)** to find the number of shortest routes.

Answer: 84, **9**

Question 3

(a) The majority of candidates spotted the 'line bisector' as the answer to this question.

Answer:



(b) Many candidates omitted this question and the correct answer was not seen very often.

Answer: 0

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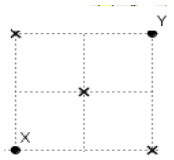
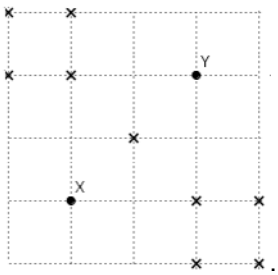
(c) (i) This question was well answered and because of the small number of possible points it was fairly easy for the candidates to see which ones gave equal distances to both *X* and *Y*.

Answer:



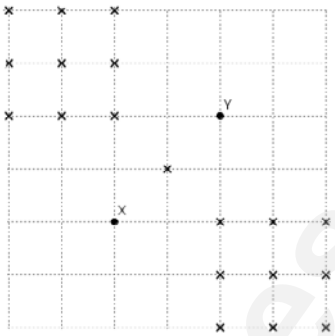
(ii) It is quite likely that many candidates assumed that the diagonal line in part **(c)(i)** and the 'bisector' in part **(a)** were leading to answers of further diagonal lines. Consequently they drew in points on the diagonal without checking any other places.

Answer:



(iii) The majority of candidates who answered part **(ii)** correctly made a good attempt at this question although it did not follow that they would all be correct. Most candidates who had plotted the diagonal in part **(ii)** now plotted the diagonal in this part.

Answer:



(iv) There were several different attempts at trying to work out this answer. 'n + 1' was the most common one seen following the diagonals in the previous parts. The mark was awarded for this answer if the leading diagonals were shown in all of parts **(i)**, **(ii)** and **(iii)**. Otherwise the correct answer was very rarely seen.

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

Communication

The communication shown in this investigation varied considerably. There were several different methods that could be used for either question but there was, in general, a lack of evidence of any of these methods being shown.

Answer: In one of **2(d)** or **3(c)(iv)**.

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Section B: Modelling

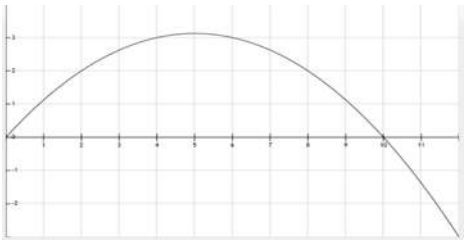
The ability to correctly interpret a graph and points on that graph was key to this modelling question.

Question 1

This question demanded the knowledge of how to use a graphical calculator to draw a graph and to find points on this graph. There were many candidates whose working showed that they were not using the graphing facility on the calculator and even though some had correct answers, time will have been an issue for them.

(a) (i) The sketch was drawn well by most candidates. Some went to great detail to plot points, many more than the two roots and the maximum. This implies either that they need to know how to use a graphical calculator or that they need to be advised of the difference between drawing and sketching.

Answer:



(ii) Most of those who had drawn the sketch in part **(i)** were able to interpret this question correctly. Again it was obvious that some candidates were working without a graphical calculator.

Answer: 10

(iii) Considerably fewer candidates were able to interpret this question, suggesting that there is still work to be done on using graphs in real-life situations. Some lost the mark by rounding to the nearest whole number or truncating their value to 3.1 or 3.12 without showing a more accurate result.

Answer: 3.125

(iv) Again, interpretation was an issue here for many candidates. There were also those who did not read the question carefully enough and who gave an answer of 3.

Answer: 1

(v) Some candidates recovered here and many were able to use symmetry rather than substituting values to interpret this question correctly, if they did not use the trace on their calculator.

Answer: 8

(b) This question, based on knowledge of the transformation of graphs, was not well answered. A common mistake was to replace y by 1.5. Many candidates did not modify the model but those who answered with '+ 1.5' seen were credited with the mark. More work on the translation of graphs and real life situations would be helpful to candidates.

Answer: $y = -\frac{1}{8}x^2 + \frac{5}{4}x + 1.5$

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Question 2

(a) The candidates were asked to write down three equations having been given three pairs of coordinates. Some did not realise that these could be easily obtained by substituting the given x and y values into the model given in **Question 1(a)** and tried to use the general equation of a quadratic. Others need to know that 'write down' means literally that and does not call for further working or solutions.

Answer: $0 = 0 + 0 + c$
$1.2 = 9a + 3b$
$0 = 25a + 5b$

(b) Almost all candidates who wrote down equations for part **(a)** were able to solve them. Some did this in part **(a)** and a very few used their calculator to give the solutions. Work on solving simultaneous equations is good, but more practice is needed in constructing equations, as in part **(a)**.

Answer: $a = -0.2$, $b = 1$, $c = 0$, $y = -0.2x^2 + x$

(c) Here, candidates were often unable to interpret the situation or to explain in enough detail. Candidates should be encouraged to be more specific and in particular to bring figures into their explanation. Some misinterpreted their own figures by answering 'No' with a correct value of the height of the ball as 1.2m or the correct greatest height of 1.25m.

Answer: Yes and 1.25 and maximum height or midpoint

Question 3

(a) (i) As always, reading the information in the question carefully should be stressed. The candidates then needed to look back at a previous question to find the three values that they needed to substitute into the general model. Two or three easy steps in simplification would then show them that they had interpreted all the information correctly.

(ii) Most candidates who understood to compare the information given in **Question 1(b)** to that given in **Question 3(a)(i)** were able to explain the difference; including candidates who had not succeeded in part **(i)**. Reading information carefully is very important because, as seen here, the answer did not rely on the candidate's previous answers. As in **Question 2(c)** candidates should be encouraged to use specific figures to support their explanation.

Answer: Statement involving origin (ground level) or 1.5

(b) (i) This question relied on substitution; being able to interpret the information given in this part of the question and substituting it into the model given in the stem of **Question 3**. More candidates were able to do this correctly than in **Question 3(a)(i)** which indicates that they are developing skills of resilience and learning to try every question even when they may have faltered earlier on.

Answer: $y = \dfrac{2x(x - 12)}{8(8 - 12)}$

(ii) Fewer candidates employed the use of symmetry here than in **Question 1(a)(v)** and many more omitted to answer this part. Candidates should be encouraged to look for alternative ways of finding an answer in modelling, where the practical situation may be just as helpful as the previous mathematics.

Answer: 4

(c) (i) This question was not well answered because it relied entirely on using symmetry with the practical situation. Candidates should be encouraged to look at the practical side of modelling as well as the mathematics involved.

Answer: 15 30

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(ii) This question relied more on mathematics and substitution than understanding and using symmetry and so was answered better than the previous part. Some candidates tried to use the general quadratic formula again but many followed through with the model of the general equation.

Answer:

$y = \frac{2.5x(x - 15)}{10(10 - 15)}$ or $y = \frac{2.5x(x - 15)}{5(5 - 15)}$

$y = \frac{2.5x(x - 30)}{10(10 - 30)}$ or $y = \frac{2.5x(x - 30)}{20(20 - 30)}$

(iii) The expectation was that candidates would use the symmetry of the situation and their answers to part **(c)(i)** to find x values which could then be substituted into their equations found in part **(ii)**. The thread of the use of symmetry to solve this practical situation was not commonly seen throughout this paper and resulted in many candidates omitting this question or not answering it correctly.

Answer: 2.81

Communication

Good communication was commonly seen in solving the simultaneous equations in **Question 2(b)**. It was much less frequently seen for the substitution in **Question 2(c)** and rarely seen in **Question 3(c)**, because this relied on explaining symmetry which many candidates had not grasped. Candidates should be encouraged to show every step of their working, as in the simultaneous equations, and to show how they obtain figures used in an explanation, as in the substitution required in 2**(c)**.

Answer: In one of **2(b)**, **2(c)** or **3(c)(i)**

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INTERNATIONAL MATHEMATICS

Paper 0607/63
Paper 63 (Extended)

Key Messages

To do well on this paper, candidates need to be able to follow instructions carefully and to adapt their mathematics to practical situations. The Investigation and Modelling sections each look at a whole situation and should be treated in this way. Candidates need to refer back to previous questions and answers when working through the paper if they wish to be successful in finding correct answers and completing the ends of each section successfully.

General Comments

To score good marks in ***Section A*** the candidates needed to be able to manipulate algebraic expressions correctly.

In ***Section B*** those candidates who paid attention to the detail, such as the inequality signs, and could relate the mathematics to the practical situation, achieved the highest marks.

Comments on Specific Questions

Section A: Investigation

Question 1

(a) (i) All the candidates were able to follow the information given about unit fractions and the instructions on their difference and product.

Answer: $\frac{1}{12}, \frac{1}{12}$

(ii) Most candidates were able to answer this question, although just a few gave both answers with the same numerator, expecting 5 – 3 to be 1 and not checking the answer on their calculator.

Answer: $\frac{2}{15}, \frac{1}{15}$

(iii) This was also very well answered with only a few candidates giving either a pair of fractions already given or fractions with denominators having a difference of 2.

(b) (i) Again, a very well answered question with just a very few answers of $\frac{1}{ab}$. Those candidates who gave both answers of $\frac{1}{15}$ for part **(ii)** were again expecting both answers in part **(b)** to be the same.

Answer: $\frac{b-a}{ab}$

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(ii) Most candidates gave the correct answer.

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

(c) Most candidates appeared not to know which fraction was smaller between, for example, $\frac{1}{5}$ and $\frac{1}{6}$, and gave the answer of $\frac{1}{n-1}$. Candidates should be able to order fractions just as they can order whole numbers and decimals.

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

Question 2

(a) (i) Again, most candidates calculated this sum correctly although just a few did not check their answer on a calculator. Candidates should always be encouraged to check their answers.

Answer: $\frac{12}{35}$

(ii) Most candidates understood the method explained in the example of **Question 2** and were able to use this to answer this part correctly. Incorrect answers to part **(i)** that did not produce a whole number for the hypotenuse were still given by some candidates for their answers.

Answer: 12, 35, 37

(iii) Most candidates calculated this sum correctly although again, just a few did not check their answer on a calculator.

Answer: $\frac{20}{99}$

(iv) This was the only question in this section that asked for an explanation, and it was not answered very well. Good candidates followed the pattern set up previously and calculated the hypotenuse using Pythagoras' theorem with 20 and 99. The very best candidates realised the significance of 101 as the answer being an integer and said so. A considerable number of candidates said yes because 101 was two more than 99; with no working to be seen it could only be surmised that they had found 101 by adding 2 to 99 and not by using Pythagoras' Theorem.

Answer: Yes and correct reason

(b) (i) This question was answered correctly by most candidates.

Answer: $\frac{p+q}{pq}$

(ii) Many candidates answered this question correctly although some wrote the two terms in the reverse order. The third term was written in already so this should have reminded the candidates which was the smaller term between $p + q$ and pq. Candidates should learn which is smaller algebraically as well as being able to do this with whole numbers, decimals and fractions (see **Question 1(c)**).

Answer: $p + q$, pq,

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(iii) Very few candidates achieved full marks for this question. Many received the first mark for using Pythagoras' theorem to equate the terms in part **(ii)** but a large majority of these lost the next marks because they multiplied $(pq)^2$ to give pq^2 instead of p^2q^2. Those who managed this second step successfully were also able to gain the third mark for a further correct line of working before the answer, which was given.

(iv) Only a few candidates achieved two marks for this last, testing, question. They found it difficult to see the connections between p and q without more support. Some candidates managed to find $q = p + 2$ and some of these gave the second answer as $p = q - 2$, presumably thinking that these were different.

Answer: $q = p + 2$
$q = p - 2$

Communication

The communication mark was usually achieved in this investigation in several of the opportunities, particularly the first three.

Answer: In two of **1(a)(i)**, **1(a)(ii)**, **2(a)(i)**, **2(a)(ii)** or **2(a)(iii)**.

Section B: Modelling

Question 1

(a) (i) Candidates found it difficult to explain the inequality in words and to relate it to the practical scenario that it represented. Most of the answers explained that the total mass had to be 80 tonnes or more but rarely did the explanation include the fact that maximums of 10 and 20 tonnes were allowed on each of the two aircraft.

Answer: Maximums of 10 and 20 and minimum in total of 80

(ii) This was answered very well. Candidates may have not been able to explain the inequalities in words but they were very capable of composing this inequality from the given information.

Answer: $5x + 7y \geqslant 35$

(iii) Most candidates were also able to put together this second inequality but many of them misunderstood the sentence about the flight time, and instead of using < for 'less than 24 hours' they used $\leqslant$ and so lost this mark.

Answer: $3x + 4y < 24$

(b) (i) A very common answer of 8 here followed on from the incorrect inequality using $\leqslant$ in part **(a)(iii)**. Candidates correctly put the inequalities from the previous two parts together but because their answer to part **(a)(iii)** was wrong both this answer and the next were incorrect.

Answer: 7

(ii) A very common answer of 6 here followed on again from the incorrect inequality in part **(a)(iii)**. A mark was awarded here for answers of 8 in part **(i)** and 6 in this part.

Answer: 5

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(c) Despite the error in part **(a)(iii)** candidates were very good at writing inequalities from words and very many candidates wrote the correct inequality here. Candidates need to know the difference between an expression and an equation because the x and y terms here were invariably written equal to something, making their correct expression into an equation. Where the expression was equated to a letter or to the word 'cost' it was condoned for the mark, but other equations did not score.

Answer: $40x + 65y$

Question 2

(a) Some candidates did achieve the full 5 marks for this question because previous incorrect answers were followed through on this diagram, and the region for the fifth mark was correctly identified. Many candidates achieved some marks for drawing lines correctly and the part of this question that needs some more work is deciding which side of each line needs to be shaded.

Answer: Correct lines and region

(b) Candidates should be encouraged to reflect on the practical side of the situation as very few of them did here. They should also be encouraged to write explanations in words, learning standard mathematical terms such as 'fractions' and 'integers', because some candidates were unable to express their thoughts clearly on the paper.

Answer: fractions

(c) Candidates need to learn how to use the inequalities that they can draw. Many candidates omitted this question and very few took the correct values from their correct diagram.

Answer: 6, 1, 305

Question 3

Following on from **Question 2(c)**, candidates need to learn how to read an inequality graph and to understand what it shows, and how they can use it for the practical situation it is linked to.

Answer: 3, 3, 10

Question 4

Again, work needs to be done on the relation of the written word to the practical situation. Here candidates needed to know that both the variables of time and cost should be identified. Many candidates used cost in their explanation but few included time as well.

Answer: Identify one solution using any valid comparison of time and cost

Question 5

(a) Many candidates managed to write at least one correct inequality. Candidates should again be advised about paying particular attention to the interpretation of the situation and the implication that this has on the inequality signs, both the direction and the inclusivity.

Answer: $5x + 7y + 4z \geqslant 35$
$10x + 20y + 8z \geqslant 80$
$3x + 4y + 2z < 24$
$0 \leqslant x \leqslant 7$
$0 \leqslant y \leqslant 5$
$0 \leqslant z \leqslant 11$

$40x + 65y + 50z$

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(b) Candidates should be commended for the fact that they attempted this last question even when they had not managed to achieve on some previous questions. Many candidates realised the difference in the situations, from a mathematical point of view. Candidates should be taught the correct mathematical vocabulary including such words as 'variable' and 'dimension' because many had difficulty explaining what they thought was the answer to this question.

Answer: The graph used in **Question 2** is 2-dimensional; the problem is 3-dimensional

Communication

The communication mark on this paper was for at least two valid trials in **Question 2(c)**. Candidates should be encouraged to show all their trials in an organised, systematic way so that they can easily be seen and read.

Answer: In **2(c)**

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