CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/11
Paper 11 (Core)

Key messages

To succeed with this paper, candidates need to have completed the full Core syllabus, be able to apply formulae and clearly show all necessary workings. Candidates are reminded of the need to read the questions carefully, focusing on key words and instructions. Candidates should check their answers for sense and accuracy.

General comments

Candidates should pay attention to how a question is phrased. Find, work out and solve indicate that calculations must be made to get to the answer, for example, **Question 14**, **18** and **20**. Write down is used when a numerical fact is needed or to show understanding of a mathematical term (**Questions 1** and **5**). Other command words used in this paper were complete, change, factorise and measure.

Workings are vital in 2-step problems, particularly those with no scaffolding such as **Questions 14**, **17** and **18**. Showing working enables candidates to access method marks in case their final answer is incorrect. Candidates must make sure that they do not make numerical errors especially in questions that are only worth one mark.

The questions that presented least difficulty were **Questions 2**, **3**, **4**, **7** and **Question15(a)**. Those that proved to be the most challenging were **Question 21** algebraic fractions, **Question 22(b)** and **(c)** using sets to solve a problem and interpreting set notation and **Question 23(b)** expressing a number with a negative index as a fraction. In general, candidates attempted the majority of questions.

Comments on Specific Questions

Question 1

This opening question was accessible to most candidates. There were some answers with the names of other polygons including hexagon, heptagon and hectogon. A few stated polygon, the general name for a shape rather than the particular mathematical name.

Question 2

This was the best attempted question on the paper.

Question 3

Very many got this correct. There were the occasional answers of red rather than white. The probability was not required, just the most likely colour of roses.

Question 4

Here, candidates needed to know how many millilitres there are in a litre to enable them to start the question. This conversion is more straightforward than that of cubic centimetres to litres. It was clear from some answers, that this conversion was not carried out correctly. Most could divide up the litre to three full glasses with 100 ml left over.

Question 5

Candidates were not so confident with this question. Answers seen were 7, 9 and 12. Also seen were 60 and 61 showing that those candidates were not certain of the meaning of the square root symbol.

Question 6

Some did only part of the calculation, 30 ÷ 5 = 6 or got as far as $\frac{90}{5}$ then made a slip when cancelling. It is a advised to do any cancelling first before multiplying, as it is easier to deal with smaller numbers. Others wrote the equation incorrectly as $\frac{3}{5} \div 30$.

Question 7

Candidates did well filling in the three values. The only one that was occasional wrong was the number of girls that choose swimming. This was given as 7 or 27 from making a slip with a carry figure.

Question 8

The occasional wrong answers include 55 (reading from the wrong end of the protractor) and other angles that were close but inaccurate. Other answers seemed to imply that some candidates did not have access to a protractor.

Question 9

Quite frequently candidates did have the same number in both boxes but that was likely to be 25 not 4. Sometimes the first box had a 4 but the second was 25. Candidates should have compared their percentage to the first fraction to see if their answer was reasonable.

Question 10

Many tried out different values to see if they gave the right answer for *x* but sometimes the workings became very confused making it hard for candidates to follow their own work.

Question 11

The most common answer here was 240 cents, which is the cost of twelve packets not the four packets the question asked for.

Question 12

Two approaches were seen here. Candidates could work out the result of each bracket and then multiply them, $-2 \times -3 = 6$ or multiply out the brackets as if was two brackets in algebra, 5 – 7 – 20 + 28 = 6. The first method is the quickest and simplest one. Those candidates who used the second method did get both marks for getting to 6 correctly.

Question 13

Many candidates found a correct fraction but if it was not in its lowest terms then full marks were not awarded. Cancelling can be done before or after the multiplication, but it is simpler to do it first. There were candidates who ‘cross multiplied’, i.e., 3×9 and 5×7. A few put the fractions over a common denominator of 63 as if they were going to add and then did not know what to do next. Also seen was $\frac{8}{16}$ which came from 'adding' the numerator figures and the denominator figures.

Question 14

Many calculated the amount of the reduction then either stopped or added it to the value of the car. This is a question where it might be helpful for candidates to underline the important phrase "reduced by 25 per cent".

Question 15

(a) This was answered well by many. A few drew the reflection of the curve in the x-axis or treated this as a transformation. Occasionally candidates drew a horizontal line at $y = 10$ or 12. Most lines of symmetry were ruled and in the correct place. Candidates should use the full grid to draw lines on graphs.

(b) Not as many got this correct in comparison to **part (a)**. Some, who drew the correct line, incorrectly named it as $y = 3$ or $y = 3x$.

Question 16

Here, candidates did not seem be to be confident of how to factorise as some tried to collect terms or solve this as if it were an equation.

Question 17

Some candidates may have not understood the phrase 'expected to arrive late'. Many candidates got as far as calculating 18 times and then stopped. Some subtracted 0.9 or 0.1 from 20 giving answers such as 19.1 or 19.9

Question 18

This question which uses algebra in a geometry context was generally well handled. First candidates needed to set up an equation based on the sum of angles in a triangle and then solve it. A few candidates used 90 or 360 as the sum of the angles. Some appear to think that $3x$ and x were the same whilst others ignored the angle at the bottom left as their equation was $180 = 20 + 3x$.

Question 19

Many candidates did well here, showing at least one correct 3-part ratio.

Question 20

There were not too many clear, well laid out workings for this question. Many candidates appeared to not know how to start this question and left workings scattered over the working area. Some left each answer in terms of the other variable so showed no attempt to eliminate one of the variables.

Question 21

A good number of candidates knew to turn these fractions into sixths but when it came to combining them, they made errors. Although they then occasionally went on to combine the numerator into one term. Sometimes, the denominator disappeared.

Question 22

(a) When using a Venn diagram to solve problems like these, the question must be read carefully. Many candidates omitted the final stage of the question, which was placing the 6 outside the circles to make up to the 112 books on the bookshelf, and therefore found **part (b)** more difficult.

(b) Due to an issue with this question, a discussion took place at the examiners' meeting before marking began. The examiners considered the impact on candidates in the light of answers seen. Changes to the marking approach for this question were agreed to ensure that no candidates were disadvantaged by the issue. The question paper has been amended prior to publication on the School Support Hub.

The original intention of the question was to state the number of elements in $(P \cup F)'$ which is 6. Some candidates had already worked this out in the previous part and selected 6 from the diagram. An alternative approach seen was to calculate 84 + 59 – 37 – 112.

(c) Many candidates did not get this right, maybe as they overlooked the ‘not’ symbol.

Question 23

(a) Many gave the correct value, –2, as their answer. Other answers include, –8, (the most common), 2 (minus signs not considered) or 9^2 or 9^{-2}.

(b) Some of the candidates who got the index correct in **part (a)** could not translate it into a fraction. Conversely, a few who got **part (a)** wrong were correct with their interpretation of 9^{-2} as a fraction. This was the question that most candidates did not answer.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/12
Paper 12 (Core)

Key messages

Candidates need to be careful to read the question in detail and answer as indicated. Candidates need to include sufficient working in order to gain method marks if their final answer is incorrect.

On a non-calculator paper, candidates are recommended to use exact fractions rather than conversions to inaccurate decimals.

General comments

Most candidates attempted all the questions and so appeared to have sufficient time to complete the paper.

There were many good and excellent scripts seen. There were several reasonably straightforward questions, giving all candidates the opportunity to show what they had learnt, and some which provided more of a challenge.

More work was needed to consolidate candidates' understanding of unit conversion in **Question 4**, using set notation in **Question 16**, percentage increase in **Question 20**, and reflection when the line of reflection is given as an equation as indicated in **Question 18**.

Comments on specific questions

Question 1

Candidates did reasonably well with this opening question. The most common error was to convert only $\frac{1}{2}$ year to months.

Question 2

Candidates did very well with this question. Only a handful of candidates gave 0.1 as an answer when they confused percentages with decimals.

Question 3

This is a familiar question and candidates generally performed well and often gained both marks. Those who did not score both marks commonly got one mark for 4×20. The incorrect answers included the $35 for five days which showed that the candidates did not read the question carefully.

Question 4

More than half the candidates were correct with their conversions from kilograms to grams. Others had a wrong conversion factor as answers such as 570 or 5700 were seen.

Question 5

(a) Many candidates knew how to work out the range and gave the correct answers. Some wrote $13-7$ on the answer line, others had an arithmetic error e.g. $13-7$ or $7-13$ then wrote 5 on the answer line.

(b) While most candidates gave the correct working out with the correct answer, others showed that they were confusing the two averages when they were clearly trying to find the middle number.

Question 6

(a) Nearly all candidates answered this part correctly.

(b) More candidates found the correct probability because they used the original information and wrote the answer as a fraction.

Question 7

Many candidates scored full marks. The common error was 10 when candidates tried to multiply ‘ $5-$ ’ by ‘ -2 ’.

Question 8

Most candidates scored at least one mark here for calculating trying to find $\frac{1}{4}$ of 120. The less able candidates picked up the method mark for showing $\frac{90}{360}\times 120$ or $\frac{120}{4}$.

Question 9

The majority of candidates answered this question correctly, demonstrating a very good understanding of enlarging a shape with an integer scale factor.

Question 10

Another well answered question, showing a very good understanding of powers and indices. Only a few candidates had an arithmetic slip or gave an answer of 12 from 2×6.

Question 11

Although this question did not provide a grid with the two points plotted, most candidates found the midpoint correctly.

Question 12

Better candidates found the diameter and divided by 2 to give the radius but many were confused between the circumference and the area of the circle. Others chose to work with π = 3.14, this made the question harder, candidates ended up spending some valuable time doing the arithmetic and some cases they just did not complete the question.

Question 13

An improvement in candidates understanding of function was noticed. Unlike previous exam sessions, the candidates attempted the question and almost three quarters succeeded in gaining the mark. The most common wrong answer was $\sqrt{2}$ when candidates used $\mathrm{f}(x)=5$ rather than working out $\mathrm{f}(5)$.

Question 14

Candidates found this question challenging and very few correct answers were seen. A number of candidates wrongly drew the image after a reflection in the *y*-axis. Others gained one mark from the drawing the reflection in $x=1$ or $y=k$.

Question 15

This is a familiar question and candidates generally performed well. Only a few confused the lowest common multiple (LCM) with the highest common factor (HCF) listing the common prime factors 2, 2, 3 and 2, 3, 5 or the multiples of 12 and 30 then gave 60 as their answer.

Question 16

This has been mentioned as one of the questions that candidates found challenging. The question is asking for the square numbers that are less than 20 but uses set notation. Most candidate missed out 1 from the square numbers and some included 25 and lots of candidates included 20 as a multiple of 4. Some candidates confused $A \cap B$ with $A \cup B$.

Question 17

The probability tree diagram question was meant to test the candidates understanding of probability with replacement. The first empty space was usually answered correctly for picking up the first blue. However, when candidates tried to answer the probability of picking the second ball, they still used 7 balls in the bag. The most common wrong answers were $\frac{4}{7}$ and $\frac{3}{7}$ for the second pick.

Question 18

The addition of algebraic fractions is a high-level topic, and it was certainly endorsed by this question. Some candidates initially took the correct steps required in manipulation of algebraic fractions but were not completely successful. Many scored a method mark only from setting up the correct fractions but were unable to successfully obtain the simplest form.

Question 19

This question was answered well and many candidates scored the mark. The most common error was to write 'right angle' rather than the value = 90°.

Question 20

Candidates appear to be familiar with percentage increase. However, only half of the candidates scored full marks. Many candidates knew that they had to find the difference between the new mass and the old mass but then tried to work out the percentage increase using the new mass with the common wrong working shown as $\frac{2}{7} \times 100$.

Question 21

In this question candidates had the correct approach and made reasonable attempts at expanding the two single brackets. Most candidates scored at least the method mark. The difficulty arose in the simplification. The most common errors were $7 - x$ or $x - 7$.

Question 22

Only a few candidates managed to write their answer correctly in standard form. The most common wrong answer was 2.74×10^{-5} .

Question 23

The number of marks for this question implies that the candidates needed to do some multiplication of the equations to have the same coefficients of *a* so they could then add the two equations and find the value of *b*. After an incorrect first value, many could correctly go on to find the second value by substitution and gained the special case mark.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/13
Paper 13 (Core)

Key messages

To succeed with this paper, candidates need to have completed the full Core syllabus, be able to apply formulae and clearly show all necessary workings. Candidates are reminded of the need to read the questions carefully, focusing on key words and instructions. Candidates should check their answers for sense and accuracy.

General comments

Candidates should pay attention to how a question is phrased. Find, work out and solve indicate that calculations need to be made to get to the answer. Other command words used in this paper were insert (brackets), change and describe (a transformation).

Workings are vital in 2-step problems, particularly for those with no scaffolding, such as **Questions 11**, **13** and **19(a)**. Showing workings enables candidates to access method marks in case their final answer is incorrect. Candidates must ensure that they do not make numerical errors especially in questions that are only worth one mark.

The questions that presented least difficulty were **Questions 2**, **5**, **8** and **20(a)**. Those that proved to be the most challenging were **Question 6** discrete and continuous data, **Question 14** external angles of a polygon, **Question 15** mean of group data, **Question 21** standard form and **Question 22** find a length using similarity. In general, candidates attempted the vast majority of questions.

Comments on specific questions

Question 1

This opening question was accessible to virtually all candidates. Occasionally, answers such as 40 or 0.4 or 0.25 were seen.

Question 2

Candidates did well here with only the occasional wrong answer of 1 or 3 seen.

Question 3

Candidates often find volume conversions conceptually most difficult. The wrong answers were mostly 0.04 or 400. It might help candidates to remember that there are 10 ml in a centilitre like there are 10 mm in a centimetre.

Question 4

Answers varied – these values were all seen: 270, 26 830, 26 900, 27 000 even 30 000. This indicated that some candidates did not recollect what to the nearest hundred meant as the last two answers were to the thousand and ten thousand respectively.

Question 5

Candidates did well here, working out the operation to be carried out. This was only worth one mark, so any arithmetic slip lost candidates the mark.

Question 6

In comparison to the last question, candidates did not do well here. Deciding whether data is continuous or discrete often causes difficulties.

Question 7

This question about finding the length of a line is much easier to understand for candidates that had sketched a graph. As the points are directly above one another, the length is the difference in the y-coordinates. Many candidates gave coordinates as their answer, often (6, 10) from adding the given coordinates.

Question 8

As stated before, candidates did well here even with the slight complication of the second term being missing. In general, candidates were much more likely to find the last term correctly rather than the second.

Question 9

Candidates had to realise from the text and diagram, that $90 = y + 60$ and then solve this equation or just to see that the missing part, y, must be 30 to make up to a right angle. Some measured the diagram despite the note saying that the diagram is not to scale. Some said 45, maybe as they thought the line XE was an angle bisector.

Question 10

This was well done by some candidates. Some were not confident in collecting like terms, so some lost an 'a' when collecting so $3a - a$ became just $3a$ or just 3. They were more confident with combining the b terms. A few thought this was the result of multiplying out two brackets. .

Question 11

This was the first real problem-solving question. Candidates had to form a strategy to find the height of a cuboid whereas it is much more familiar for a question to ask for the volume when all dimensions are given. A labelled diagram can help candidates decide what information they have and what they need to do.

Question 12

In this question the candidates handled the left-hand of the equation better than the right as it was maybe easier to see if there was a 5 already if the 3 + 2 was in brackets then that would equal 25. There was a lot of crossing out when candidates changed their minds about where the brackets should go. It is perfectly acceptable for candidates to try different places for the brackets in the space below the question and only add them to the equation once they were sure they had the right places.

Question 13

For many, this was a 2-stage calculation, first the discount must be calculated then that is taken from the original price of the coat. Some just give the discount, $5 and did not go on to complete the calculation. Some candidates took the 10 from 50 as if it was dollars not a percentage.

Question 14

There is no diagram for this question thus raising the difficulty level – this is another question where candidates should draw their own diagram. This question did say how many sides the polygon has, other questions might use the name instead. This is asking for the size of one exterior angle so those that went on to give the size of an interior angle did not get any marks. There were many candidates who did not attempt this question.

Question 15

Candidates found this the most challenging question on the paper. Some candidates did understand the table but wrote out all the number of spots as a list, e.g. 0, 0, 2, 2, 7, 7, 7… and so made the calculation more time consuming and prone to error when they added the spots together. It is much simpler to use the table to get the 5 products, especially when a product is zero. In this question, the total number of ladybirds is given so there is no need for candidates to add up the frequencies.

Question 16

Many knew that the answer was negative. Candidates did not need to qualify the type with the strength. Also seen answers were descriptive words such as decreasing (the most common wrong answer) and translation as well as graphic, scatter plot and segment. Quite a few left this question blank.

Question 17

It is useful to check the number of marks for transformation questions. In general, if there are only 2 marks this means two pieces of information are needed so the transformation is a translation or a reflection. The vector must not be given as a pair of coordinates. Candidates must not mention two transformations as the question says, 'Describe fully the **single** transformation...' with single in bold.

Question 18

Many candidates gave the correct answer of 5. Some gave 195, the lowest common multiple, instead.

Question 19

(a) Many gave $\frac{1}{50}$ as the probability. There was no specified form for the answer, however, for **part (b)** the probability as a fraction is easier to calculate with.

(b) To find the expected number of defective rivets, candidates had to multiply their probability from **part (a)** by 10 000.

Question 20

(a) Candidates did well with this whole question, particularly with this part, considering its position in the paper.

(b) This questions requires the sum of the two numbers that show how many studied just maths or just science.

(c) This is slightly more involved in that candidates had to work out the value of x in the diagram. The x represents the number of people who studied neither subject. The number of people already included in the diagram was 33 so x was 17 students. Some did not include the three students who studied both subjects, so their answer was 20 – this did not get any marks as it is a wrong method.

Question 21

This was previously mentioned as a question that candidates found challenging. Candidates had issues with writing this number in standard form and some appeared to be converting the length in metres into millimetres or writing it as a fraction in its simplest form instead. Those who knew, in principle, what standard form looks like, made errors by not having a single number in front of the decimal point or missing out the minus sign in the exponent.

Question 22

Candidates found this the most challenging question on the paper as the scale factors involved are not integer values. There were some answers over 6 and sometimes as large as 12.

Question 23

Although many Candidates left this question blank, candidates usually gained a mark for a correct first step. Some candidates did not seem be to be confident on how to solve inequalities. Some did not know the form the answer should take and some did not deal with the minus sign correctly.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/21
Paper 21 (Extended)

Key message

Candidates should ensure that they concentrate on the detail of their work, particularly ensuring that they use notation accurately. They should also ensure that all working is shown as incorrect answers without working cannot be given credit, whereas partial credit can be awarded if a correct method is shown.

General comments

Candidates were generally well prepared for the paper and were able to demonstrate good understanding and knowledge across many of the topics tested. The standard of written work was generally good with many candidates clearly showing the methods they were using. Most candidates did not seem to have a problem with the time allowed to complete the paper and it was rare to find more than a few questions unanswered.

Candidates should be careful that they use notation correctly. Particular examples include: using the correct open or closed circles with a single straight line when representing inequalities on a number line (**Question 1**); not including a fraction line within a vector (**Question 2**); writing standard form correctly, and not as seen on a calculator (**Question 5(b)**); using set notation accurately (**Question 11(b)**) and using the correct inequality signs (**Question 15(b)**).

Comments on specific questions

Question 1

Many candidates answered this question with a clearly drawn line. Common errors included drawing two overlapping lines, drawing a line from –2 to +2, drawing two lines outwards from –2 and/or 3, omitting the line or the circles or having the filled and open circles at the wrong ends.

Question 2

Nearly all candidates answered this correctly. The most common errors were either slips with arithmetic or omission of the negative sign or only multiplying the top number by 4, or adding 4 to both numbers to give $\begin{pmatrix} 10 \\ 2 \end{pmatrix}$ or cancelling down to $\begin{pmatrix} 3 \\ -1 \end{pmatrix}$. A few candidates gave their answer incorrectly with a fraction line and some candidates worked out $4 \times \frac{6}{-2} = -12$.

Question 3

(a) Most candidates selected 29 as the prime number. The most common wrong answer was 39.

(b) Most candidates selected 27 as the cube number. The most common wrong answer was 25 and a few candidates wrote out the triangle numbers and gave 21.

Question 4

Most candidates factorised the given expression correctly. Common errors included $x^2(x-2)$, $x(x-2)$, $x(x-2)(x+1)$, $x(x-2)(x+2)$ and $x(x-1)(x+1)$.

Question 5

(a) Most candidates rounded the number correctly to 7.30. The most common errors included 7.3 without the zero, 7.30 000 with extra zeros, 7.29 truncated, 7.308 three non zero numbers and 7.298, rounded to 3 decimal places.

(b) Most candidates wrote the given number correctly in standard form. The most common errors included $3.06\times10^{+6}$, 306×10^{-8}, $3.06\div10^{6}$ or if copying direct from a calculator 3.06E – 6.

Question 6

(a) Almost all candidates solved this equation correctly. A few candidates gave $x=28-4=24$.

(b) Most candidates answered this correctly. The most efficient approach, used by a minority, was to divide by 3 as the first step, giving $a-6=8$ and complete from here. However, the most common approach was for candidates to first attempt to multiply the bracket out as $3a-18=24$ and complete from here. The latter method was often successful, but the arithmetic was harder and errors were seen when working out 18 + 24 and $\frac{42}{3}$. Algebraic errors included not multiplying both terms in the bracket by 3 or incorrectly isolating the $3a$ to $3a=24-18$. Candidates were expected to simplify $\frac{42}{3}$.

Question 7

(a) The majority of candidates answered this correctly. The most common error was $\frac{2}{18}$ because candidates had not read the question carefully and were considering both hats and scarfs.

(b) Whilst many candidates answered this question correctly there were many wrong methods seen, the most common being $2\times\frac{3}{10}\times\frac{4}{8}$, $\frac{3+4}{10+8}$, $\frac{3}{10}+\frac{4}{8}$, $\frac{4}{8}\times\frac{3}{7}$, $\frac{3}{18}\times\frac{4}{18}$ and $\frac{3}{18}\times\frac{4}{17}$.

Question 8

The majority of candidates answered this correctly. The most common wrong answers included -7, $\frac{1}{7}$, $\frac{1}{49}$, 2401 and 24.5.

Question 9

Many candidates answered this correctly. Candidates often attempted a factor tree and most were able to score one mark for finding 2, 3 and 5 as factors of 90. The most common errors included arithmetic errors when dividing, finding the factors but either leaving as a list, 2, 3, 3, 5, or summing $2+3+3+5$ or writing 3 rather than 3×3 in the product.

Question 10

Most candidates recognised that they needed to work out $\sqrt{2^2+6^2}$ and many reached $\sqrt{40}$. Whilst many of these candidates went on to simplify this correctly, incorrect answers such $4\sqrt{10}$ and $10\sqrt{2}$ were commonly seen. Less successful candidates attempted to find the magnitude using a range of attempts such as $6+2$, 6^2-2^2, $(6+2)^2$ and $\begin{pmatrix}1\\3\end{pmatrix}$ were seen.

Question 11

(a) Most candidates shaded the correct regions. The most common error was to shade the intersection of *P* and *Q* rather than their union.

(b) A fair number of candidates described the region accurately using set notation. However, a very common error was to use the union rather than the intersection symbol, namely $R' \cup S$.

(c) A good proportion of candidates found the correct number of elements. However, it was not uncommon for candidates to select the correct region, but then to give the answer 1, thinking this was one element rather than representing 7 elements.

Question 12

(a) A good number of candidates answered this correctly. Those not scoring full marks frequently scored one mark for correctly identifying angle *DBC* (or angle *BDC*) as 32°. Common errors included assuming triangle *ACD* to be isosceles with two 74° base angles and/or assuming angle *CAD* = angle *ADB* = 32° (isosceles triangle) or assuming *BC* is parallel to *AD* and using alternate angles or assuming angle $ACD = 90$. In addition, some candidates made arithmetic slips.

(b) This part was answered correctly more often than **part (a)**. There were two key approaches to this question. The most popular method was via angle *OCE* = 90° and using the isosceles triangle *OAC*. The equally good alternative was using the alternate segment theorem to give angle *CBA* = 42° and then angle at the centre is twice the angle at the circumference. Errors seen included slips with arithmetic, using angle *OCA* = 42° or *AOC* = 90° or 42° or 48° or assuming AO and EC are parallel and incorrectly having angle *OAC* = 42° or using the angle at the centre is half the angle at the circumference.

Question 13

(a) Many candidates demonstrated accurate surd manipulation combining the three numbers correctly. Some candidates correctly arrived at $5\sqrt{3}-4\sqrt{3}+2\sqrt{3}$ but did not collect these together correctly.

(b) Many candidates recognised that they needed to multiply by $\frac{\sqrt{3}-5}{\sqrt{3}-5}$ and they successfully simplified to the correct answer. Others scored one mark because they made errors simplifying the denominator with $(\sqrt{3}+5)(\sqrt{3}-5)$ commonly seen simplified to $3-5$ or $3+25$ or +22.

Question 14

A minority of candidates answered this question fully, demonstrating that they recognised the need to expand the brackets and equate coefficients. Many other candidates reached $x^2-14x+c = x^2+2dx+d^2$, to score one mark. Without using 'equating coefficients' many candidates then carried out a lot of algebraic manipulation and square rooting to find *c* in terms of *d* and *x* and then *d* in terms of *c* and *x*. In a few cases they then gave $d = 7$ rather than, $d = -7$. Candidates starting with the incorrect expansion of the bracket as x^2+d^2 were not successful in gaining marks. Less common approaches included candidates recognising that the left-hand side could be written as $(x-7)^2+k$, but not many were able to complete the question from here and candidates who started by square rooting both sides of the equation rarely made any progress.

Question 15

(a) Many candidates were able to factorise the expression correctly. Other candidates scored one mark for a two-bracket factorisation which multiplied out to $6x^2$ and either $-7x$ or –3. Although not the method intended, some candidates solved $6x^2 - 7x - 3 = 0$ using the quadratic formula to find its roots and used this information to help them successfully factorise the expression, but others incorrectly gave the answer $(x-1.5)\left(x+\frac{1}{3}\right)$. A common incorrect answer was $x(6x-7)-3$
Candidates are recommended to multiply out their answer to check it is the same as the given expression.

(b) Only a small proportion of candidates scored full marks on this question. These candidates usually demonstrated a clear visualisation of where the quadratic cut the number line with a sketch to show where it would be above or below the *x*-axis. It was rare for candidates to connect this part to the previous part with some restarting with the quadratic formula to find $-\frac{1}{3}$ and $\frac{3}{2}$. For full marks, candidates were expected to simplify their values rather than leave them as $\frac{18}{12}$ and $\frac{-4}{12}$. A small number of candidates missed out on scoring full marks because they included the word 'or' rather than 'and' when writing the inequalities separately. A common misconception was to assume that because the given quadratic was less than zero, *x* should be less than both $-\frac{1}{3}$ and $\frac{3}{2}$ with a final answer of $< -\frac{1}{3}$, $x < \frac{3}{2}$ or even $-\frac{1}{3} > x < \frac{2}{3}$ being frequently seen. Other candidates attempted to rearrange the quadratic for *x* giving answers in terms of *x*, such as $x < \sqrt{\frac{7x+3}{6}}$ or $x < \frac{3}{6x-7}$ and did not score.

Question 16

A number of candidates found the correct value for *p*, correctly using the two log rules $a\log b = \log b^a$ and $\log c - \log d = \log\frac{c}{d}$. Other candidates scored one mark for demonstrating correct use of one log rule, usually 2log3 = $\log 3^2$. Some candidates made an attempt to use logs, with a variety of errors seen, such as $3^2 = 6$, 2log3 = log6, 2log3 = $\log 2^3$, log9 – log2 = log7, 2log3 – log2 = $2\log\frac{3}{2}$, $\log 9 - \log 2 = \frac{\log 9}{\log 2}$, *p* = log4.5 or cancelling out the word log so log9 – log2 = log*p* became 9 – 2 = *p*.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/22
Paper 22 (Extended)

Key message

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

Candidates should check their working in each question to ensure that they have not made any numerical slips, especially on decimal calculations. Candidates need to be familiar with changing units in area and volume calculations, see **Question 4**. Candidates need to recall and use the fact log 10 = 1.

General comments

Candidates were generally well prepared for the paper and were able to demonstrate good understanding and knowledge across many of the topics tested. The standard of written work was generally good with many candidates clearly showing the methods they were using.

Candidates did not seem to have a problem with the time allowed to complete the paper and it was rare to find more than a few questions unanswered. Candidates lost marks through numerical slips and others lost marks through incorrect simplification of a correct answer.

Comments on specific questions

Question 1

Although the majority of candidates scored this mark, a significant number of candidates were unable to deal with the place value of their answer with answers of 0.9 and 0.009 being regularly seen.

Question 2

(a) This part was correctly answered by virtually all candidates.

(b) The majority of candidates scored both marks. The main error occurred with candidates who used 18 or 27 as their common denominator correctly but failed to simplify their answer.

Question 3

This question was correctly answered by virtually all the candidates.

Question 4

This question proved to be challenging for most candidates. Many candidates simply divided by 100.

Question 5

Many candidates gave the correct answer. Candidates clearly have a good understanding of indices.

Question 6

Incorrect answers occurred where candidates found the correct answer on the diagram but then failed to identify the correct angle.

Question 7

This question was a good discriminator. Some candidate struggled to work out the total distance correctly with many incorrect answers of 19 seen. Candidates who correctly found distance and time, had difficulties with the calculation of $\frac{13}{1.25}$. Candidates are strongly recommended to use fractions on this non-calculator paper, as questions are set to test their mathematics and, in this case, $13\times\frac{4}{5}=\frac{52}{5}$ was far easier to deal with.

Question 8

The common slip on this question was failing to find the mean of the two extra numbers with 40 being a common answer.

Question 9

This question was well answered although candidates sometimes made the question more difficult for themselves by eliminating *x*, which required two multiplications. Candidates who used the substitution method were more successful if they rearranged the second equation to make *y* the subject.

There was evidence that some candidates did check their answers which is pleasing and should be encouraged.

Question 10

There were many perfect solutions to this question. Some candidates made numerical slips when finding *'c'*. Unfortunately, some candidates 'predicted the question' and found the equation of the perpendicular bisector of *AB*.

Question 11

Candidates who factorised the expression were more successful, as candidates who used the quadratic formula were more prone to slips, probably due to the negative coefficients of *b* and *c*.

Question 12

This question proved to be a good discriminator. A surprising number of candidates failed to realise that this was a right-angled triangle. Candidates who drew a sketch were more successful. A few candidates who started the question correctly gave their answer as $\sin\left(\frac{3}{5}\right)$.

Question 13

(a) Nearly all candidates scored full marks on this part.

(b) Although many candidates scored this mark, some candidates gave the answer as $\frac{0.1}{0.4}$.

Question 14

Many candidates realising that the question related to modulus gave answers of 6 and –6. Other candidates substituted ± 15 for *x*, giving answers of 33 and –27.

Question 15

There were many excellent solutions to this tricky question. All the possible approaches were seen, with an equal degree of success. A minority of candidates failed to read the question carefully and thought that the question was ‘without replacement’.

Question 16

This question showed that virtually all candidates have a good understanding of the rules of logs. The stumbling block for the question was the realisation that ‘1’ needed to be replaced by $\log 10$. Some candidates spoiled a perfect solution by giving their answer as $\log 5$.

Question 17

(a) Answered well by most candidates.

(b) Answered well by most candidates.

(c) Many candidates did not realise the significance of the first two parts in answering **part (c)**, with a significant number of candidates leaving their answer as $\sqrt{9} - \sqrt{4}$.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/23
Paper 23 (Extended)

Key message

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

Candidates should check their working in each question to ensure that they have not made any numerical slips, especially on decimal calculations.

Candidates need to recall and state the geometrical reasons for angles to be equal.

General comments

Although candidates were able to demonstrate good understanding and knowledge of algebra a significant number of candidates found this paper challenging.

The standard of written work was generally good with many candidates clearly showing the methods they were using.

Comments on specific questions

Question 1

(a) Many of the candidates did well on this question, however a significant number of candidates were unable to deal with the place value of their answer with an answer of 0.6 being regularly seen.

(b) The majority of candidates scored well on this question, but a significant number of candidates gave an answer of 300.

Question 2

(a) This part was correctly answered by the majority of candidates.

(b) The majority of candidates scored at least one mark by finding the mean of the eight numbers. Candidates were then unsure as to dealing with the extra information to find the 9^{th} number.

Question 3

The majority of candidates scored this mark. Mistakes occurred where candidates were unsure if the end points were to be included or not in their answer.

Question 4

(a) Nearly all candidates correctly identified 5 and 7 as factors. The question required candidates to write their answer as the product of prime factors.

(b) Candidates found this part tricky, although there were some correct answers. It was hoped that candidates would find the LCM of 70 and 175. Some candidates wrote out a list of times to find the first value that occurred in both lists. In some cases, careless arithmetic meant that a correct solution could not be found.

Question 5

Nearly all of the candidates gave the correct answer.

Question 6

The majority of candidates scored the first mark by dividing 360 by 15. Incorrect answers occurred where candidates then subtracted 24 from 180 to find an interior angle.

Question 7

(a) Nearly all candidates scored this mark.

(b) Many candidates made careless numerical slips when multiplying 25 by 12.

Question 8

The majority of candidates showed good algebraic skills. The common slip was failing to correctly find $-d$ as a factor.

Question 9

(a) Candidates found this question challenging as they were required to highlight angles that were equal and give a geometrical explanation as to why they were equal.

(b) Candidates were able to use the fact that there were similar triangles to make a good attempt at this part. There were some careless numerical errors following from a correct equation involving *EF.*

Question 10

(a) There were many correct solutions to this part.

(b) Candidates were all able to attempt this question with varying degrees of success. Candidates were required to find the gradient of a line perpendicular to *AC* and then substitute the coordinates of *C* into the general equation of a line.

Question 11

(a) Candidates needed to set up an equation that showed inverse proportionality and then to use the given information to find the constant of proportionality. Some candidates scored full marks.

(b) It was expected that candidates would use the result from **(a)** to solve this part. A number of candidates who were unsuccessful in the first part started again and correctly found the answer of 8.

Question 12

This question proved to be a good discriminator. Many candidates scored the first mark by correctly finding the vector **a – b**, but did not realise that the use of Pythagoras' theorem was needed to find the magnitude of the vector. Some candidates correctly found an answer of $\sqrt{208}$ but were unable to simplify this surd.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/31
Paper 31 (Core)

Key messages

In order to be able to answer all the questions, the candidates must have a graphical calculator and be familiar with using it. The candidates should be encouraged to show all their working out as many marks were lost when the working out was not written down and the final answer not given to an appropriate degree of accuracy. Candidates should be familiar with correct mathematical terminology. Candidates should practice answering ‘show that’ question and understand that they cannot work backwards in a ‘show that’ question. They should also realise that if the question states ‘write down’ then they do not have to work anything out. Teachers should ensure that they cover the full syllabus with their candidates.

General comments

It appeared that there was sufficient time to complete the paper as most candidates attempted all the questions. There was also a wide range of marks that indicated that the questions were at the correct standard for Core candidates.

Candidates should be careful when writing 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 and, if no working out is seen, then no marks will be awarded for answers given to 1 or 2 significant figures. When working out is shown and is correct then partial marks can be awarded. Candidates also need to read the questions carefully and answer what is asked in the question.

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

Comments on specific questions

Question 1

(a) Nearly all the candidates managed to write the number correctly in words.

(b) Here too, a high number of correct answers were seen. The most common wrong answer was 7.68 or 7.69 due to incorrect use of the calculator.

(c) Some candidates gave all 8 factors correctly, but many were only awarded 1 mark because they omitted some of the factors. If the candidate gave less than 4 factors then they did not receive any marks.

(d) Most candidates wrote 17 and a few wrote 19. Some candidates wrote 16 or 18 and others wrote a prime number that was less than 15.

(e) (i) This part was generally well answered. The most common error was to write 7832.94.

(ii) This part was also well answered with the common error being 7832.

(iii) This part was answered better than the other two parts with only a few candidates writing 7900 for their answer.

(f) Most candidates either put the correct symbols in the correct place or did not attempt the question at all.

(g) Several candidates tried to answer this using the compound interest formula. Some others forgot to divide by 100. Some candidates were awarded 1 mark for finding the simple interest for one year only or finding the correct answer but then added it to the principal amount.

Question 2

(a) Most candidates knew how to find the mode and gave the correct answer, but some wrote 9 instead of 2 which was the number of days and not the amount of rain.

(b) It was common to see the correct answer to this part, but some candidates wrote 0 days instead of 7 days.

(c) Working out the mean amount of rain was challenging for the majority of the candidates. Many just added up the frequencies and divided by 6.

(d) Many candidates managed to find the correct probability.

Question 3

(a) Many candidates could not name all three lines correctly. Many named the diameter and/or the tangent correctly but fewer could name the chord correctly.

(b) (i) Most candidates knew how to find the circumference of a circle, but some used 3.14 instead of the calculator value for pi and lost the final answer mark because their answer was not correct to 3 significant figures. Some others rounded incorrectly and wrote 26.3 instead of 26.4.

(ii) The same comment as above applies to the area of the circle but fewer candidates lost a mark due to incorrect rounding in this part.

(c) Only a handful of candidates knew how to calculate the area of the sector. The most common answer was $\frac{1}{2}\times 4.2\times 4$.

Question 4

(a) Nearly all candidates plotted the 2 points correctly.

(b) (i) Many candidates found the correct length for *AC*.

(ii) Not all candidates knew how to use Pythagoras' theorem. Some candidates did write $\sqrt{(2^2+4^2)}$ and were awarded a method mark. They then went on to give an answer of 4.5 which is not correct to 3 significant figures.

(c) Quite a number of candidates knew that the shape was a kite – but many other answers were given such as rhombus, parallelogram, square, diamond etc. and the spelling was very creative at times.

(d) Drawing the reflection of the shape in the line $y = 4$ was well attempted. Some candidates received 1 mark for reflecting in the line $y = 4.5$.

Question 5

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

(ii) This part was also well attempted with many candidates getting the correct answer. The most common wrong answer was 1. The candidates who had shown their working out received a method mark if their working out was correct.

(b) (i) There were many correct answers to the simplification.

(ii) This simplification proved more challenging than the previous part with various wrong or partially wrong answers which included ±11*a* and/or ±5*b.*

(c) (i) Many candidates found the correct answer. The most common mistake was to forget the negative sign before the 0.3 and give an answer of 7.8.

(ii) There were more correct answers to this than the previous part.

Question 6

(a) Nearly all the candidates completed the frequency table correctly.

(b) Finding how many more members chose tennis than badminton was also well answered.

(c) Writing down the probability was also well answered by nearly all the candidates.

(d) (i) The 'show that' problem proved challenging for many of the candidates. When they are asked to show that the sector angle for tennis is 132° then they cannot use 132° to show that this is equivalent to 11 members. They must start with the 11 members and show that the angle is 132°.

(ii) Not all candidates were careful when it came to drawing the pie chart. Many candidates could work out the other angles but did not always draw them accurately to within a range of ±2. Some forgot to label the sectors and others only drew the sector for tennis.

Question 7

(a) Most of the candidates managed to plot the points correctly.

(b) Many candidates knew that the regression was negative.

(c) (i) The majority of the candidates knew how to find the mean but lost the mark by writing 4.72 instead of 4.73.

(ii) The mean length of the song was better answered perhaps because no rounding was required on this answer.

(d) Few candidates managed to score both marks for drawing the line of best fit. Many of the lines were within tolerance but did not pass through the mean point. The candidates should be encouraged to plot the mean point and make sure that their line passes through it. Only a handful of candidates plotted the mean point.

Question 8

(a) More than half of the candidates managed to write the correct first three terms of the sequence. One common wrong answer was 7, 19, 39 where the candidate has multiplied by 2 before squaring and adding 3.

(b) (i) Nearly all candidates managed to find the next two terms of the sequence correctly.

(ii) Approximately half of the candidates knew how to find the *n*th term correctly.

(iii) Another 'show that' question which proved problematic for most of the candidates. Many candidates thought that just continuing the sequence without any comment was sufficient. A method mark was awarded for continuing the sequence correctly but, to receive both marks, the candidate had to make a suitable comment as to why the number –101 was not a term of the sequence.

Question 9

(a) Describing this transformation was not well answered. Many candidates wrote down two transformations in this part and so received 0 marks.

(b) More candidates were awarded a mark in this part for either stating that it was a translation or writing the correct vector of translation.

(c) Rotating the shape by 90° was not very well done. There was no common wrong answer here. Some candidates lost a mark for forgetting to add the 'tail' to the square.

Question 10

(a) Many candidates managed to write down the correct coordinates of where the graph crossed the *y*-axis.

(b) There were very few correct answers to this part with most of the candidates writing (–3, 0).

(c) Here too there were few fully correct answers seen. A few candidates lost a mark for writing –1.66 instead of –1.67. Other candidates did not understand what was meant by the local maximum and wrote (3, 16) as their answer.

(d) There were fewer rounding errors in this part but not very many candidates found the correct coordinates. Here too (–4, –12) was a common wrong answer.

(e) Many candidates managed to sketch the graph of $y = 8$ on the diagram.

(f) Most of the candidates did not realise that they had to use their calculator to find the intersection point of the two graphs. Many tried to 'solve' the equation using algebra.

Question 11

(a) Many candidates found the correct values for the angles.

(b) There were many correct answers. Some candidates tried to use Pythagoras' theorem. When the command is 'write down' there should be no working out necessary.

(c) Only a handful of candidates managed to find the area of the triangle correctly. Most of the candidates wrote $\frac{1}{2}\times 14\times 14 = 98$ for their answer.

(d) This part was also poorly completed with most of the candidates forgetting to multiply their answer to the previous part by 6 before multiplying by 5.

Question 12

(a) Finding the time that Ruben took to walk to the supermarket was well attempted. The main problem was that many candidates correctly found the time to be 15.6 minutes and then wrote their answer as 15 minutes and 6 seconds.

(b) In this 'show that' question again many candidates tried to use the 0.2 minutes to show this was 12 seconds. What they had to do was simply begin with the 12 seconds and write $\frac{12}{60} = 0.2$.

(c) Finding the average speed was not well answered. Many candidates did not use the information from the previous part and divided 1.3 by 5.12 rather than 5.2 and arrived at the wrong answer of 15.23 km/h

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/32
Paper 32 (Core)

Key messages

To succeed in this paper, it is essential for candidates to have completed the full syllabus coverage. Sufficient working must be shown, and full use made of all the functions of the graphics calculator that are listed in the syllabus.

General comments

The standard of work demonstrated on this paper was impressive; the majority of candidates were well prepared for the examination. Candidates found the paper accessible and were able to attempt all questions to show their knowledge of the syllabus content. All candidates had sufficient time to complete the paper.

Work was well presented, and candidates communicated clearly their approach to each question. Few topic areas caused problems. Work on Algebra continues to show improvement; candidates have a firm grasp of the conventions and procedures required. Calculators were used accurately and efficiently though it was clear that some did not have a graphical calculator, which is essential for this paper.

Comments on specific questions

Question 1

The whole of this question was answered well by most candidates. Though calculators were used appropriately in **parts (b)** and **(c)**, writing the answer in **part (c)** correct to two decimal places was not always done correctly. Some truncated their answer to two decimal places and others gave an answer to more than two decimal places.

Question 2

There were many fully correct answers to every part of this question. A small number of candidates tried, often unsuccessfully, to use formulas to work out the area and perimeter in **part (c)** instead of counting squares for the area and lengths for the perimeter. The main error in **part (d)** was for candidates to include one or both diagonals of the rectangle as lines of symmetry.

Question 3

(a) The majority of candidates were successful in answering all parts of **(a)**. A common error for some was to write $n + 4$ for the answer to **parts (a)(ii)** and **(a)(iii)**.

(b) Again, there were many fully correct answers here. Errors were, in **part (ii)** to give the values in Row 6 rather than Row 8 and in **part (iii)** to give $n - 2$ as the answer.

Question 4

(a) Most candidates recognised that the triangle was isosceles.

(b) Some candidates ignored the dashes on *PQ* and *PB* and assumed *PQ* and *QB* to be the equal length sides. Many found the value of *x* correctly.

(c) This was generally well answered though 72 was a common wrong answer.

(d) Here there were a lot of answers with no working, which suggests that candidates were possibly guessing. Some of the candidates gave 6 as the number of sides since that is what it seemed to be from the diagram. Candidates may need reminding that 'Not to scale' means that the diagram is not accurate.

Question 5

Every part of this question was done well by all candidates. There were very few errors in any of the parts.

Question 6

(a) (i) Here, many forgot to add 'pm' to their answer when not using 24 hour clock time.

(ii) There were a few careless answers in **part (ii)**. Common wrong answers were 3 h 5 min, 3 h 25 min or 3 h 35 min.

(b)(i) This was usually answered correctly.

(ii) There were mostly correct answers here, though some candidates just found the increase and did not go on to work out the new fare.

(c) Most knew to work out 'distance divided by time' to get the required speed but a number failed to convert 2 hours 15 minutes to 2.25 hours to use in the formula. Some incorrectly divided by 2.15 and others divided by 135.

Question 7

(a) Both sections of **part (a)** were answered very well with only a few candidates misreading the scale.

(b) (i) Many correctly found the gradient of the line. Most of these used the formula $\frac{y_2-y_1}{x_2-x_1}$. However, some then failed to get the correct value for *c* in their equation of the line.

(ii) In general, candidates did use their equation from **(b)(i)** to find the answer to **part (ii)**. However, a common error was to find the cost of 50 cards from the graph and then multiply by 2.

Question 8

There were many fully correct answers to every part of this question. Sketching was good and graphical calculators were used effectively. It was evident though that some candidates did not have a graphical calculator and many plotted points to find the shape of each graph, sometimes not very successfully.

(a) The correct shape for the quadratic curve was common but sometimes this did not pass through the origin.

(b) The line was often drawn correctly but some sketches were not straight.

(c) The two points of intersection were commonly found correctly.

Question 9

(a) and (b) Both of these parts were answered well. Again, a lot of fully correct answers to every part of this question. There has been a pleasing improvement in candidates' approach to algebra.

(c) Generally, this was answered well, although some candidates were getting a result of just one common factor.

(d) In **(d)(i)** an answer of x = 1 and in **(d)(ii)** an answer of x = 2 after a correct equation $4x = 2$ was a common error by candidates.

(e) A common error in **(e)(ii)** and **(iii)** was taking the square root first and then dividing by 6.

Question 10

(a) Generally, points were plotted correctly but some candidates misread the scale and made errors.

(b) Most knew that the trend of the points from top left to bottom right meant that the correlation was negative.

(c) Many candidates still do not realise that the line of best fit should pass through the point given by the mean of each set of data. Most lines correctly ran within the body of the data.

(d) It was clear to candidates what was required but again some read the scale incorrectly.

Question 11

(a) Many answered the question correctly, but some candidates used the 134 mm and the 54 mm to show that the angle was 68º. This is not what the question requires. They should have used the 54 mm and the 68º to lead to *BC* equalling 133.65 mm and thus showing that this value rounds to 134 when corrected to the nearest mm. A number of candidates used the 54 mm and the 68º with the wrong trigonometric ratio.

(b) Generally, this was answered well though there were errors occurring similar to those in **part (a)**. These included using the wrong trigonometric ratio and not giving answers to a reasonable degree of accuracy.

(c) Pythagoras' Theorem is well understood and can be applied by most candidates.

Question 12

(a) Many candidates did not know how to complete the table of cumulative frequency values. Some just transferred the frequency values, others put in mid-interval values and a few put in the lower interval value plus the frequency or the upper interval value minus the frequency.

(b) Those with a correct table often went on to produce good cumulative frequency curves.

(c) Though the method to find the median is generally known, to find the inter-quartile range is not, many weren't able to find this.

(d) Candidates could use their graph successfully to answer the question. Few misread the scale.

Question 13

(a) Both sections of this part were answered well. Some candidates did confuse surface area and volume. In **(a)(ii)** a few only found the area of one face of the cube.

(b) The majority of the candidates calculated $\dfrac{\text{volume of cuboid}}{\text{volume of cube}}$, an incorrect method. The question required candidates to work out how many cubes could fit along the length of the cuboid, how many could fit along the width and how many of them could fit along the height. The product of these three integer values gave the answer.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/33
Paper 33 (Core)

Key messages

To succeed in this paper, it is essential for candidates to have completed the full syllabus coverage. Sufficient working must be shown, and full use made of all the functions of the graphics calculator that are listed in the syllabus.

General comments

There were some encouraging performances on this paper. Candidates were quite well prepared and, in general, showed a sound understanding of the syllabus content. Presentation of work continues to improve though some candidates are still reluctant to show their working and just write down answers. An incorrect answer with no working scores zero whereas an incorrect answer with working shown may score some of the method marks available, Calculators were used with confidence, though it does appear that some do not have a graphical calculator, as the syllabus requires. Candidates had sufficient time to complete the paper.

Comments on specific questions

Question 1

(a) This was generally answered well though a few candidates used too many or too few zeros within the number.

(b) The fact that this was a mixed fraction confused many candidates. A common error was to write $8\frac{2}{5} = \frac{16}{5} = 3\frac{1}{5} = 3.2$.

(c) 16 was commonly identified as the square number required.

(d) In general, calculators were used appropriately here. Some candidates incorrectly truncated their answer to 5 significant figures and others counted the zero in front of the decimal point as a significant figure.

(e) Again, calculators were generally used correctly. However, some candidates truncated to 1 decimal place and others rounded their answer to 3 significant figures.

(f) This part was generally answered correctly.

Question 2

(a), (b) and (c) The first three parts of this question were answered well.

(d) Good attempts were made for this question although some candidates failed to reduce each answer to its simplest form.

(e) Again, some very good attempts were made on this question, but similar to **part (d)** a common error was not reducing each answer to its simplest form.

(f) In general, the bar chart was drawn well. A few candidates read the scale incorrectly and drew bars of the wrong height.

(g) Invariably, candidates arrived at the correct answer to this part.

Question 3

(a) Surprisingly, many candidates failed to count squares and lengths correctly to find the area and the perimeter of the shape. 9 was a popular wrong answer for the perimeter. Often, cm^2 was given as the units to both area and perimeter. A few mixed up area and perimeter.

(b) Many confused rotational symmetry with line symmetry and drew a shape with line symmetry.

(c) Some candidates correctly drew a shape with line symmetry even after doing the same for **part (a)**. Many managed to draw a line of symmetry on their diagram.

Question 4

(a) Candidates invariably wrote the coordinates correctly.

(b) Many thought the quadrilateral was a parallelogram and that the triangle was isosceles.

(c) Pythagoras' Theorem is well known. The lengths of the sides of the triangle were often given as 6 and 5 instead of 5 and 5.

(d) Correct attempts at trigonometry were few and far between. It appears that this aspect of the syllabus needs more attention.

(e) Candidates were able to reflect the shape in the y-axis. A small number reflected it in AD and others reflected in $y = x$.

Question 5

There were some excellent answers to all parts of this question.

(a) Some answers had '$T =$' missing or '+ 800' missing.

(b) A few candidates correctly worked out 324×2.50 but then forgot to add the 800.

(c) Similarly, a few forgot to subtract 800 before dividing by 2.50 .

Question 6

In all parts of this question, candidates had a problem reading the scale.

(a), (b) and (c) Many did not know how to tackle these questions, particularly **parts (b)** and **(c)**. Some were finding a half and a quarter of (130 + 105) on the horizontal axis to find the median and the lower quartile instead of finding a half and a quarter of (0 + 100) on the vertical axis.

(d) Many read up to the graph from the horizontal axis and across to the vertical axis. Few then subtracted their value from 100 to answer the question.

Question 7

(a) A lot of the answers to this part were spoiled by candidates using 30 days in a month and 4 weeks in a month. Some used perhaps a less straightforward method and worked out the cost per day for each payment type.

(b) Most correctly used 'distance divided by time' to find the speed, but often the time was not in the correct units or was converted incorrectly.

(c) In **part (i)**, most used 'speed multiplied by time' but again the 27 minutes was not converted into hours correctly. **Part (ii)** was found difficult by most candidates. A few multiplied by 1000 to change kilometres to metres but then struggled to know how to change the hours part to minutes.

Question 8

(a) The first two angles were found by many candidates. The third one proved to be less straightforward for some.

(b) and (c) Very few candidates knew how to tackle **parts (b)** and **(c)**. Rarely did they realise that it had to do with the area and the circumference of the circle.

Question 9

(a) Candidates knew how to solve linear equations.

(b) Many could factorise the expression though some only took one common factor.

(c) Candidates could also expand the brackets though some only multiplied the $2a$ by 4 and not the -5.

(d) Many candidates made a pleasing start to this question, rearranging the second equation for *b* and then substituting for *b* in the first equation or multiplying the second equation by 2 and adding the two equations. Unfortunately, after this first step the algebra was not good enough to complete the solution.

(e) Many fell into the trap of dividing the powers in **part (i)** and multiplying the powers in **part (ii)**.

(f) A few candidates showed pleasing work manipulating the algebraic fractions, most others struggled. For instance, in **part (i)**, many just added the numerators and added the denominators to get their answer.

Question 10

(a) For those with a graphical calculator, the sketch in **part (a)** was straightforward. It was evident, however, that a significant number of candidates did not have the use of a graphical calculator.

(b) Few knew what an asymptote was.

(c) Some found the coordinates of the local minimum but often the answer was not given to the required accuracy.

(d) The sketch of the straight line was done well. However, some lines were not straight.

(e) Candidates realised they were looking for the points of intersection of the two graphs but often the answers were not accurate enough.

Question 11

(a) Many successfully completed the tree diagram.

(b) Candidates knew which two branches were needed to answer the question. Combining the fractions involved was not done well. Many just added numerators and denominators.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/41
Paper 41 (Extended)

Key messages

Candidates should show sufficient working in order to gain method marks, this is particularly important where the final answer is incorrect.

The general instruction is that answers should be given correct to three significant figures unless the answer is exact or the questions states otherwise. A few candidates lost marks by not providing answers to the appropriate degree of accuracy.

Almost all candidates were familiar with the use of the graphics display calculator for curve sketching questions, but many did not use them for statistical questions or for solving equations.

General comments

The paper proved accessible to almost all the candidates. Whilst most candidates displayed knowledge of the use of a graphics display calculator, some still are plotting points when a sketch is required.

There was some impressive work from many candidates showing strengths in dealing with higher algebra and logarithms.

Most candidates showed all their working and set it out clearly. Time did not appear to be a problem for candidates as almost all answered every question.

Comments on specific questions

Question 1

(a) The vast majority of candidates counted squares rather than using the scale and so translated through $\begin{pmatrix} -1 \\ 1 \end{pmatrix}$ instead of $\begin{pmatrix} -2 \\ 2 \end{pmatrix}$.

(b) This was done better than **part (a)** although several candidates misread the scale. A few also reflected in $x = 0.5$.

(c) This was usually correct, however some candidates omitted either the centre or the angle. A few applied the reflection to their answer to **part (a)**.

(d) Many candidates found this difficult. Most gave a triangle half the size of the original.

Question 2

(a) (i) This was almost usually correct, although a few candidates misread the scale.

(ii) This was usually correct.

(iii) Most candidates found 70 per cent of 300 correctly but many read off at 210 rather than 90.

(b) Most candidates reached the correct answer. Some candidates found the mean of the frequencies whilst others also used the width of the interval rather than the midpoint.

(c) (i) Many candidates successfully used their graphics display calculator to find the correct equation but some did not give accuracy to 3 significant figures.

(ii) Most candidates gave 'positive' though a few said 'negative' or 'no correlation'. Many commented on the strength of correlation which was not required.

(iii) This was usually calculated correctly from their equation.

Question 3

(a) Most candidates clearly used their graphics display calculator to produce a satisfactory sketch though a few joined the branches at $x = 0$. There are still some candidates who are plotting points in order to sketch graphs.

(b) Most candidates gave the correct answer but $y = 0$ and $x \neq 0$ were fairly common.

(c) This was done well by many candidates who could use their graphics display calculator effectively. A few gave answers such as (–0.999, 1) not realising that the actual answer would be (–1, 1).

(d) Stronger candidates did this well although sometimes they did not give their answers to sufficient degree of accuracy. Some candidates could find the points of intersection but were unable to write the inequalities correctly. A small number of candidates tried unsuccessfully to use an algebraic approach.

Question 4

(a) This part was very well done.

(b) This too was very well done although a few divided 171 by 13 instead of 3.

(c) Most candidates were successful here. A few found the interest only and some used compound interest instead of simple interest.

(d) (i) This was almost always correct. However, a few candidates subtracted the principle so they gave the interest only.

(ii) This too was very well done. Both methods of trial and improvement and logarithms were very successful.

Question 5

(a) All candidates gained some success here. The numerical parts were usually correct although some made errors with the final answer. Most were able to give the *n*th term for the arithmetic series although $n + 4$ was sometimes seen. The quadratic sequence proved more difficult. Many candidates used the difference method to recognise that a quadratic sequence was required. Some however were unable to proceed to the correct quadratic.

(b) and (c) Stronger candidates were successful here.

(d) This was fairly well done. Some candidates, however, did not recognised the statement about replacement and so amended the probabilities.

(e) This part proved more challenging. Many worked with 30 tiles instead of 18 and/or assumed replacement.

Question 6

(a) Most candidates realised that angle *AOC* was 150˚. Many chose to calculate AC in order to find the area of triangle *OAC*. Others believed *AC* to be the diameter of the shaded minor segment.

(b) Some candidates successfully found either the arc length or the area of the major sector, but candidates then struggled to relate this to the correct property of the cone. Many candidates used the minor, rather than the major, sector. Some good solutions were occasionally spoiled by premature rounding.

Question 7

(a) Almost all candidates were successful here.

(b) (i) This part proved more difficult. Many candidates used the factor 64 instead of the $\sqrt[3]{64}$.

(ii) Many realised that the factor $\frac{18400}{2300}$ was required but most did not find the cube root. Some candidates did not include any calculations in their responses. However, there were some excellent responses from some stronger candidates.

Question 8

(a) There were a high proportion of correct answers. A few added the coordinates and some subtracted the squares

(b) This proved to be very difficult for the majority of candidates. Most knew the techniques needed to find the equation of a perpendicular line, but the stumbling block was in the calculation of the coordinates of the point R. Some tried long methods finding various lengths often using Pythagoras. Some used the midpoint or one of the end points. Candidates who drew diagrams appeared to better understand how to calculate the coordinates of R, sketching a diagram should always be encouraged where appropriate.

Question 9

(a) (i) This part was almost always correct.

(ii) Most candidates were able to write down the initial composite function, but many made sign errors in the simplification.

(iii) Most candidates were able to make the first step but a significant number of candidates made sign errors when reaching the final answer.

(iv) This was answered well by many candidates. Some candidates, however, did not know how to proceed and answers involving cubes and cube roots were quite common.

(b)(i) This proved challenging for most candidates. Various incorrect transformations of the curve were given.

(ii) This was also a challenging question for candidates.

Question 10

(a) Most candidates knew to invert and multiply the second fraction, but most were unable to complete the simplification successfully.

(b) Here, the initial steps in finding the common denominator were made correctly but the vast majority made sign errors in completing the simplification. There were also many candidates who decided to cancel an (x – 3) term. Correct answers were rarely seen.

(c) There were large numbers of fully correct solutions to this question. Most candidates substituted the correct values to find two initial equations. A few substituted –3 and 4 instead of 2 and 3. Those who simplified the equations fared better in solving the simultaneous equations. As with other questions, the most common errors were sign errors.

Question 11

(a) This proved to be challenging for the majority of candidates who did not recognise the necessity to calculate the length of the top side of the trapezium. The answer of 2.1 × 0.9 × 100 = 189 was seen frequently. A few unnecessarily found the sloping side of the trapezium, much better use could have been made of the diagram.

(b) Most candidates recognised the need to divide the capacity by the rate of flow but the conversion of units, particularly the litres, proved too difficult for all but the best. A few did get the time to be 19.8 hours but then could not convert to hours and minutes.

Question 12

(a) Most candidates were successful with this part. A few candidates had their calculator set to radians but, as the answer found was plausible, did not realise their error.

(b) Most candidates made progress with this question. The majority were able to successfully find the length *BD*. Most of these candidates also went on to use the sine rule but some were a little confused that a further calculation was necessary to obtain the required angle. There was some premature approximation which led to an inaccurate answer. The same calculator error involving radians was seen here and a few candidates also decided to use a sine in the cosine rule.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/42
Paper 42 (Extended)

Key message

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

Communication and suitable accuracy are also important aspects of this examination and candidates should be encouraged to show clear methods, full working and to give answers to 3 significant figures or to the required degree of accuracy specified in the question. Candidates are strongly advised not to round off during their working but to work at a minimum of 4 significant figures to avoid losing accuracy marks.

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

General comments

The candidates were very well prepared for this paper and there were many excellent scripts, showing all necessary working and a suitable level of accuracy. Candidates were able to attempt all the questions and to complete the paper in the allotted time. The overall standard of work was very good, and most candidates showed clear working together with appropriate rounding.

A few candidates needed more awareness of the need to show working, either when answers alone may not earn full marks or when a small error could lose marks in the absence of any method seen. This is particularly noticeable in ‘show that’ style questions when working to a given accuracy.

The sketching of graphs has continued to improve and there was more evidence of the use of a graphics calculator supported by working, this is in the spirit of the syllabus. There was however evidence of use of facilities in the calculator that are not listed in the syllabus. These facilities often lead to answers given by candidates without any working, and this must be seen as a high-risk strategy.

Topics on which questions were well answered include transformations, percentage increase/decrease, factorising, probability, scatter diagrams, linear and quadratic sequences, trigonometry, and curve sketching.

Challenging topics for the candidates were circle theorems with algebraic angle calculations, inequalities, bearings, geometric sequences, similar triangles and mensuration.

Question 1

(a) The majority of candidates scored both marks in this part, the most common error was to get the equation of the line wrong. The most common incorrect answers were $y = x$, $y = 1$, the y – axis or just the word axis. A few candidates did not realise it was a reflection and some gave combinations of transformations such as rotation followed by translation.

(b) Most responses gained both marks, the most common error was to have the right orientation and *almo*st in the right place, often just one square out, they knew what was required but they were not quite accurate enough. Those that were one square down were probably using the origin as the centre of rotation, very few rotated in the wrong direction.

(c) Many candidates may have rejected the answer of reflection again as this was the answer in **part (a)**. This led them to try to make any other transformation or even a combination of transformations fit their diagram, despite most having triangle *C* in the right place. Again, the equation of the line of reflection was often incorrect with the most common answers being $y = -x$, $y = x + 1$ and $y = -x + 1$ seen.

Question 2

(a) (i) The accuracy of plotting was very good, the occasional error seen was usually at $x = 5.5$. The most common mistake was not attempting the question, this implied they did not understand 'complete the scatter diagram' or they overlooked the instruction in the question.

(ii) Nearly always correct. The few wrong answers were varied and included non-linear, random, curve, irregular, negative, weak, increasing etc.

(b) The few errors that occurred were usually either finding the mean time (5.4) and not the mean mark. Others thought that time or mark were a frequency and multiplied mark by time and then divided.

(c) (i) The main error was being slightly out of range probably caused by not taking enough care in entering numbers into the calculator or by rounding to 2 significant figures. A few candidates unsuccessfully tried to calculate the gradient first and then find the equation of the line by co-ordinate geometry.

(ii) The least well answered section in this question. A number of candidates seemed unable to understand the question thinking 'units' meant the numerical value of their regression line. Answers like mark, time, hours, mark/time were not uncommon, m as a shorthand for marks was not allowed.

(d) Both parts were well answered with either the correct answer or the follow through (FT) seen. The main error was arithmetic, there were a few more errors in **part (ii)** due to the extra step of rearranging after substituting for $y = 36$.

Question 3

(a) This was well answered by the majority of candidates. The most common approach here was to use the circle theorem 'angle at centre is twice the angle at the circumference' so that the answer could be written down with no working, however some did halve the angle. Some candidates used the isosceles triangle *ODA* and most were able to proceed to the correct answer from here. However, some candidates did not simplify their expression, which the question specifically mentions. Other less successful responses saw some candidates resorting to quite extreme methods to obtain the result, it was rare to see a correct solution from these more complex methods. Common incorrect attempts saw the alternate segment theorem being wrongly applied or attempts to use the cyclic quadrilateral *ABCD*. Some candidates used the isosceles triangle *AOB*, some others incorrectly assumed that the quadrilateral *ADCQ* was cyclic.

(b) This part was more of a discriminator, although most candidates did manage to find the correct answer. Most applied the angle sum property for a quadrilateral, but many candidates lost unnecessary marks here through missing brackets or poor form. It was very common to see the answer $360 - 90 - x - 2x - 60 = 210 - 3x$ when it was clear that they knew how to find the required angle. It was less common to see a solution on the diagram, but it was important to see that many candidates labelled the right-angles correctly on their diagram picking up the available marks. Some candidates persevered with complex expressions from **part (a)** and had a correct answer. It was unusual to see the correct factorised answer, but there were also some instances of candidates dividing their given answer by 3 to obtain $110 - x$.

(c) Correct responses were less common here. Once again missing brackets cost a significant proportion of candidates the available marks. It was reasonably common to see e.g. $180 - 90 - (180 - 330 - 3x) = 240 + 3x$ or following on from an incorrect **(b)** e.g.

$180-90-(180-330+3x)=240+3x$ etc. Labelling angle C as 90 degrees for the B1 was less common in this part. Some candidates seemed to misread the question 'find in terms of x' and proceeded to attempt to work out specific values of the requested angles.

Question 4

(a) Most responses scored full marks in this part, those who did not usually scored 2 marks for the inverted V shape and symmetry on the y – axis, losing a mark for their graph not passing through the point (0, 4). A few candidates drew a straight line without a modulus. The graph was mostly neatly drawn without feathering or very thick lines, most candidates used a ruler to draw the straight line, although a small number drew it freehand.

(b) Most responses were able to score the mark for this question, whilst some candidates gave the answer 2 with another value, the most common error being 2 and 0.

(c) Most responses scored full marks in this part, those who did not usually scored 1 mark for the shape with the common error being for the graph not passing through the origin. Some candidates got the wrong curvature for the outer branches or used a ruler to draw them.

(d) Most responses gained the mark for this question, those who did not usually give the answer $y = 0$ or recopied the equation from the question, $y = 0.25x^2$. Also, a few candidates gave the answer y – axis and not the equation as stated in the question.

(e) Generally, only the more able candidates scored both marks here. The most common error was rounding off too early, either giving ± 1.65 or ± 1.67 for their final answer. There were also candidates who were able to score 1 mark for giving the answer 1.66 paired with an incorrect value, often 0. Very few instances of final answers in surd form seen.

(f) Most responses were able to score the mark in this part subject to scoring at least B2 in **(a)** and B1 in **(c)**. The most common error was those who shaded the entire area above the quadratic curve or the entire region below the inverted V.

Question 5

(a) (i) The two most popular methods to do this were **(i)** $\left(\frac{1240}{5}\right)\times 3$ and **(ii)** $\left(\frac{1240}{5}\right)\times 12$ (2976) followed by $\left(\frac{2976}{12}\right)\times 3$. In most incorrect cases the usual error was not to show the division by 5.

(ii) The most common single mark was given for 992. Candidates who got 558 as well usually went on to score all 3 marks Setting up an equation involving fractions was a very popular approach i.e. $\frac{774}{(992-x)}=\frac{4}{3}$.

(b) (i) Most candidates adopted the direct route and multiplied 92 × 0.8, fewer found 20 per cent and then subtracted. Several simplified written methods i.e. 92 × (1 – 20 per cent) were seen and this usually led to the correct answer, however for those who did see this through to the correct answer lost the method mark because of this calculator notation. This incorrect notation for methods was often evident throughout the rest of this question.

(ii) A trickier part as the candidates had to divide by 0.8, many common incorrect answers of 158.40 and 105.6 seen. This part was also affected by improperly written methods.

(c) (i) A small minority incorrectly found 18 per cent of 1240 and then 18 per cent of that answer, misinterpreting the question. Candidates who managed the reductions in one step rather than finding 18 per cent first and then subtracting usually fared better as there were fewer steps to make an error.

(ii) Candidates appear to have become more familiar with this type of question which asks for the number of times it takes for a percentage increase or decrease to reach a certain value. Different methods were seen and many candidates earned full marks. The use of logarithms was probably the most popular method although the graphical approach was seen more often than in previous years.

Question 6

(a) Usually answered very well and most showed the midpoints in their working somewhere, this gained a method mark if they later slipped up with their calculation.

(b) Nearly all correct.

(c) Most plotted correct points with surprisingly few plotting at the midpoints rather than the endpoints of the groups. Unfortunately, many thought the shape of the curve was wrong and did not join up some of their correct plots. Those that used a ruler generally produced a better result. It was disappointing how many feathered lines are still seen, rather than the candidate erasing, and improving for a good curve.

(d) (i) Mostly all correct.

(ii) Good answers with most managing at least the follow through for a correct upper or lower quartile seen for their curve. Very few candidates gave either quartile as a final answer.

(e) If the curve was not drawn accurately, their reading of 22 was often at 20 leading to an answer of 75 per cent.

Question 7

(a) (i) This part was usually correct, with some errors resulting from candidates not appreciating the true definition of a bearing. Of the many incorrect responses seen, rarely was a North line drawn at *A*. Some candidates misinterpreted the bearing as angle *BAC* + 28 degrees.

(ii) This part was not answered as well, although candidates who annotated their diagram seemed to have more success in this question. Of the many correct responses, it was common to see parallel lines being drawn so that the required angle could be simply written down.

(b) This part proved very accessible for the majority of candidates, with many correct solutions seen. The most common errors in this part were calculation errors when evaluating a correctly obtained expression for the length of *AB* via Pythagoras, it was rare to see errors in rounding/accuracy.

(c) This was also successfully attempted by the majority of candidates. However, some candidates assumed that angle *D* was 28 degrees and obtained an answer of 420 from use of the sine rule or by inspection of an isosceles triangle. It was disappointing to see a small minority of candidates unable to use a calculator correctly when using the cosine rule. There were several responses where candidates had e.g.
$CD^2 = 420^2 + 750^2 - 2\times420\times750\times\cos 28 = 738900 - 630000\cos 28 = 108900\cos 28$ etc. or similar. Often, candidates were attempting to simplify numerically before calculating the required length on their calculator, when their numerical expression could be typed into their calculator unsimplified.

(d) Many candidates were able to calculate the required area, with numerous correct responses seen. There were some errors with poor numerical simplification, as noted above, or some transcription errors with e.g. ‘750’ being replaced with ‘720’.

(e) This part proved to be the most challenging for candidates, but there were still many fully correct solutions seen. The most common method here was to apply the sine rule to triangle *ACD* to find angle *D* or angle *C*. Candidates who calculated angle *D* appeared to be more successful in interpreting the diagram to find the correct bearing. There were many solutions where candidates calculated angle *C* or angle *D* correctly, but they could not interpret the diagram correctly to find the required bearing. In some rare cases candidates used a calculated angle *BAC* (51. 866..) and applied to triangle *BAD* so that they could use cosine rule to find the side *BD* (919. 571..) and then used the cosine rule again to find angle *BCD*. Several candidates incorrectly assumed that angle *D* was 28 degrees.

Question 8

(a) Very few incorrect answers although several candidates misread **U** as the set of integers from 1 to 20, thereby scoring no marks in the first two parts.

(b) This was completed well unless values 1 – 20 were used. Another common mistake was not entering the 10 and 14 in the rectangle, some responses had $\frac{16}{20}$ the wrong way round with $\frac{15}{18}$.

(c) Most selected the correct region and gained the mark, many on follow through.

(d) The notation was not always fully understood with candidates either listing the elements or adding them together, however they had generally chosen the correct region even when making these errors.

Question 9

(a) This linear sequence question was extremely well answered with almost all candidates scoring full marks. A small number of candidates gave the term-to-term rule instead of the *n*th term.

(b) This exponential sequence was found to be much more challenging with the important aspect of the alternating sign. Almost all candidates earned one mark by giving the correct next term. The *n*th term was often a negative expression rather than an alternating sign expression. For example, a common answer was $64 \div 2^{n-1}$ instead of $64 \div (-2)^{n-1}$. Some candidates found a polynomial expression from a regression function on their calculator. This is not on the syllabus and the polynomial depends on which terms of the exponential sequence are used so there is not a definite polynomial answer. A small number of candidates gave the term-to-term rule instead of the *n*th term.

(c) This sequence where second common differences were usually found was more successfully answered. Many candidates gave the correct next term and the correct quadratic expression. Those who gave a quadratic answer or correct second differences earned one method mark.

Question 10

(a) Most responses gained full marks for this part, those who did not were usually able to score the mark for the substitution, only a few candidates give the final answer of 84.

(b) The majority of responses got both marks here, those who did not were usually able to score for not giving the fully simplified form of the final answer, usually the x was not cancelled. Common mistakes included candidates cross multiplying the numerator and denominator whilst others added the numerators and denominators together.

(c) (i) This was a well answered part with most responses gaining full marks, those who did not usually did not factorise out all the common factors. A few candidates left the incorrect remainder after correctly factorising $5b$ from the expression.

(ii) This was also a well answered with many responses gaining both marks, those who did not usually did not factorise all the common factors.

(iii) Most candidates scored full marks here, the common error being where candidates did not perform the factorisation by grouping but attempted to factor out one common factor from 3 or 4 terms. There were also candidates who gave the incorrect sign after factorising the negative term from the expression.

(d) This was a discriminating part in which only the more able candidates scored full marks. Many made an error when trying to eliminate the fraction by directly multiplying the left-hand side of the equation by $(a + 2)$ but forgetting to do the same to the '1'. Also, many others did not put $(a + 2)$ in a bracket when multiplying out, leading to the wrong expansion of the bracket in the following steps. Other candidates did not gather all the terms in x to one side before factorising the x, others did not factorise the x before dividing the equation with the algebraic coefficient of x.

(e) Most candidates scored at least one mark for this part by giving answers showing $\frac{1}{2}$ or 0.5. – 2 was rarely seen apart from those responses which scored full marks, many getting the answer directly with the aid of a graphical calculator.

Question 11

This question was the most challenging and discriminating part of the paper. Candidates who answered this question successfully were those who gained very high scores overall.

(a) This expression for the volume of a pyramid was generally well answered. Many candidates gave the best answer of $27h$ but a surprising number of candidates gave their final answer of $\frac{1}{3}\times 81h$. This answer was accepted but did make subsequent parts more difficult.

(b) This part required a correct statement of ratios from the two similar triangles. It was quite well answered but the 'show that' aspect of the question led some candidates into writing an expression that led to the given answer, omitting the use of similar triangles.

(c) (i) This part required writing an expression for a volume of water which was the difference of two pyramid's volumes. This was usually correctly done only by those candidates with a correct answer to **part (a)**, follow through was allowed but rarely seen.

(ii) This part also required the volume of water but was a single pyramid with the challenge being to give a correct height. There were some good answers from the stronger candidates. A large number of candidates gave a difference in a similar way to **part (i)** indicating a difficulty in interpreting the given diagrams.

(iii) This was a very challenging part requiring candidates to use their answers to earlier parts to create an equation putting two expressions for the volume of water equal to each other. It also required another expression using similar triangles. There were some very good solutions from the stronger candidates. There were many candidates who started with the given equation, thinking that they only had to deal with the algebra there. There were also many candidates who did not attempt this part.

(iv) Only the minority scored full marks whilst many responses scored the mark for giving both the positive and the negative roots as final answers. Only a few candidates showed a quadratic/cubic sketch earning a method mark.

Question 12

(a) (i) Mostly all correct although a few candidates did not give a numerical answer but just the word impossible earning no credit. $\frac{1}{12}$ was seen a few times for those either not understanding or not seeing the 'without replacement' instruction. $\frac{0}{12}$ was rarely seen but was allowed the mark.

(ii) In this part and then again in **(iii)** the denominators of 11, 10 and 9 were often seen, possibly an addition error. Also, in both **(ii)** and **(iii)** the 'with replacement' method was often used as 12 was regularly seen in all 3 denominators. Most answers were given in the simplest form of $\frac{7}{44}$ but equivalent fractions were seen along with the occasional decimal or percentage answers.

(iii) In addition to similar errors mentioned in **(ii)** the most common error was not realising that there were 3 possible combinations of their 3-term product, many scoring a single method mark for $\frac{7}{55}$.

(b) The correct answer or follow through was usually seen. The 2 most common errors were giving the answer as a probability e.g. $\frac{420}{2640}$, not as an expected frequency. Others were unable to multiply the fraction correctly, multiplying both the numerator and denominator by 2640.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/43
Paper 43 (Extended)

Key messages

To do well in this paper, candidates need to be familiar with all aspects of the syllabus. Candidates require the ability to interpret situations mathematically and problem solve with unstructured questions.

Work should be clearly and concisely expressed with intermediate values written to at least four significant figures and only the final answer rounded to the appropriate degree of accuracy. Working steps should use correct mathematical forms, for example 1 + 10 per cent is not accepted and should be written as $1+\frac{10}{100}$.

Candidates should show full working to ensure that method marks are considered where answers are incorrect.

Candidates should be familiar with the appropriate use of the graphics calculator and should be discouraged from using functions not listed in the syllabus. Candidates are reminded that, in most situations, good sketches from the graphics calculator are accepted for method marks.

General comments

The paper proved to be quite challenging for candidates and this was reflected in the responses to some questions. Candidates appeared to have sufficient time to complete the paper and any omissions were due to lack of familiarity with the topic or difficulty with the question rather than lack of time. The presentation in most cases was very good with methods clearly shown.

Most candidates followed the rubric instructions but there continue to be a number of candidates of all abilities losing unnecessary accuracy marks by either making premature approximations in the middle of a calculation or by not giving answers correct to the required degree of accuracy.

The topics that caused most difficulty were harder probability involving different arrangements, manipulative algebra involving fractions, three dimensional trigonometry, bearings as part of a trigonometry question, some aspects of functions and use of exact values in geometry and mensuration.

The topics where candidates were most successful were problems involving percentages, mean and cumulative frequency, linear and simultaneous equations, substitution in algebraic expression and sketching and interpreting graphs..

Comments on specific questions

Question 1

(a) This straightforward compound interest question was well answered.

(b) Calculating the rate of simple interest from a given principle amount proved to be more challenging. Some candidates treated the amount as the interest, and some treated the interest as compound. It is important to realise that expressions such as 1 + 1.6 per cent do not earn method marks until they are written as $1+\frac{1.6}{100}$.

(c) Although finding the number of years of compound interest investment is a high grade topic, candidates have become familiar with this situation and there were many fully successful responses.

Some candidates used logarithms, some used trials and a few used the graphics calculator. When using trials candidates should try to show their calculations in an orderly way and to find the number of years just before the required target and the number of years just after the target. The use of logarithms is the most efficient method and the stronger candidates showed their work in a very tidy manner. The use of the graphics calculator is also efficient but there is the challenge of finding a suitable domain and range in order to draw a sketch that can earn the method marks.

Question 2

(a) The calculation of the mean from a frequency table was well answered although many candidates carried out a lot of working on a topic where the graphics calculator is expected to be used. The number of marks should be a guide that not much working is expected to be seen. Mark schemes for these questions indicate that the partial mark is simply for showing the mid-value of each interval.

(b) Almost all candidates recognised the modal group.

(c) (i) This question required candidates to realise that they first had to work out the cumulative frequencies. Most candidates proved to be fully aware of this and that the horizontal coordinates were the upper boundaries of the intervals and not the mid-values. There were many excellent graphs, which was important not only for the 4 marks for the graph but also for the following parts.

(ii) The mean was almost always correct.

(iii) The interquartile range was also well answered.

(iv) Reading the cumulative frequency diagram to obtain a frequency value was also generally well answered.

Question 3

(a) The drawing of the enlargement was usually accurate. A few candidates used the origin as the centre of enlargement instead of the given coordinates.

(b) (i) Most candidates recognised the translation and gave the correct column vector. It should be noted that the only accepted equivalent to the column vector is a clear worded description.

(ii) Describing a stretch is much more challenging and this proved to be a discriminating question, especially finding the invariant line as it was not one of the axes. The stronger candidates usually gained at least two of the three marks.

(c) This part was more unusual as it described a combination of two transformations and candidates had to find a centre of rotation and a line of reflection. There were several possible answers and most possibilities using integer values were seen.

Question 4

(a) This straightforward linear equation was almost always correctly answered.

(b) This substitution question was also usually correctly answered. A few candidates overlooked the need to calculate 3 × 4.3 + 1 first or to use brackets around this calculation.

(c) This simultaneous equation question was generally well answered, with most successful answers coming from multiplying the equations to get the same coefficient of one of the variables. The candidates who used the rearranging and substituting method were less successful as they had to deal with equations with fractions.

(d) This division of algebraic fractions was found to be very challenging as expressions had to be factorised before simplification was possible. Most candidates showed that the division had to be changed to multiplying by the reciprocal. The difficulties of the question were to recognise the need to factorise and then to only cancel factors.

Question 5

(a) The sketch of the cubic was usually fully correct. Candidates should remember not to draw outside the given domain and try not to curl a curve back when the curvature is tending towards a straight line. Questions on this topic can only be successfully answered if candidates are fully experienced with their graphics calculators and that they obtain a correct sketch for other parts of the question.

(b) The coordinates of the local maximum point were usually correct. A few candidates gave their answers to one decimal place when they should have used the same accuracy as in other questions.

(c) The symmetry of the graph proved to be quite challenging, and this part was quite often unattempted. The other problem candidates faced was realising the difference between symmetry and transformations. 180° was not accepted as an equivalent to order 2.

(d) The zeros of the graph were usually correctly answered although the same comment as in **part (b)** about accuracy applies here. A few candidates confused the requirement of the question and gave coordinates of points on the *x*-axis instead of just the zeros.

(e) (i) The sketch of the quadratic was almost always correct.

(ii) Candidates seem to be fully familiar with connecting solutions to an equation with *x*-coordinates of points of intersection. Apart from the accuracy problem already described this part was well answered. As in earlier parts, correct sketches are the only way to obtain correct answers.

Question 6

(a) Most candidates gained partial marks by correctly using Pythagoras. A few weaker candidates struggled to cope with the three-dimensional aspect of the question. The accuracy of the answer also proved to be challenging and many candidates earned only three of the four marks by not reaching the required five figure answer. The most efficient way of reaching the exact answer of $4\sqrt{3}$ before changing to a decimal was seen occasionally.

(b) This part requiring the volume of a pyramid was another discriminating question as candidates had to find a strategy for finding the area of the triangular base and the vertical height of the pyramid. Various approaches were seen and there were many answers to the required accuracy. There were difficulties in using appropriate values but partial marks were available for both the area of the triangle and the height of the pyramid. A number of candidates did not attempt this part.

Question 7

(a) The shading of regions in the Venn diagrams brought mixed responses. The first one was generally successful but the second one was challenging as there was quite complicated set notation to understand.

(b) (i) This straightforward probability question was almost always correctly answered.

(ii) This part required very careful reading of the information in the question as a ball picked from one bag was put into one of two bags depending on colour. The probability was a single product of two fractions which most candidates recognised but success depended on understanding the context clearly.

(iii) This probability part required the sum of two products. Candidates were able to recognise this, and the main challenge was in the interpretation as described already.

Question 8

(a) The product of a speed and a time was almost always correctly carried out.

(b) This was a 'show that' calculation of an angle and candidates found this quite difficult probably because a good understanding of bearings was needed. Some candidates had some correct work on the given diagram but were unable to show all the working. The value of this angle was important for the next seven marks in **part (c)**.

(b) (i) The use of the cosine rule was found to be a straightforward calculation and was generally successful.

(ii) This was a very discriminating question involving use of the sine rule or the cosine rule together with finding a bearing. The question was often not attempted and many candidates only gained partial marks by finding an angle in the given triangle but were then unable to find the bearing. The stronger and successful candidates usually added to the diagram and north and south lines were especially helpful.

(d) This average speed question was found to be more challenging than anticipated. The total distances were already available and so only one time needed to be calculated. The common and most surprising error was to calculate the average of the speeds

Question 9

(a) (i) The evaluation of f(–4) was almost always correct.

(ii) The evaluation of f(g(3)) was more challenging but was usually correctly answered. A large number of candidates seem to prefer to find the algebraic expression for the compound function when rather than the simple evaluation of g(3) first. A few candidates worked out f(3) × g(3).

(iii) This was potentially an easy question but many candidates decided to find the actual inverse function and then substitute the given numerical value.

(iv) The comment for **part (iii)** is even more relevant here as many candidates were unable to find the inverse of h(x) = log$x$. Very few correct answers were seen when solving log$x$ = 2 would have been more accessible to many candidates.

(b) This part was also challenging as many candidates treated $(f(x))^{-1}$ as $f^{-1}(x)$. The candidates who fully understood the notation obtained a reasonably easy equation to solve.

(c) This part was found to be a more routine compound function question and there were many correct answers. A few candidates squared (2 – 3x + 1) instead of simplifying it to squaring (3 – 3x). There were also some errors in the expansions.

(d) This was another discriminating question involving logarithms and changing $p = \log q$ into $q = 10^p$. There were some good attempts from the stronger candidates as well as many no responses.

Question 10

(a) The comments apply to all five parts.

This question involved several angle properties of the circle. It was often very well answered with candidates showing a good knowledge of the properties, including the angle in an alternate segment property. Most candidates demonstrated the excellent strategy of completing all the angles in the diagram and then transferring them to the answer spaces. In this particular question no marks could be awarded for anything in the diagram as candidates had to identify angles represented in three letter form. A few candidates missed the fact that there were two angles in a semicircle and a few others treated opposite angles of the pentagon as though it was a cyclic quadrilateral.

(b) This question was challenging in so far that it used exact trigonometric values and multiples of π.

Partial marks were available for the area of a sector and the area of a triangle as well as using trigonometry to find a length. Fully correct answers were not often seen but those candidates who attempted the question usually earned one or more marks.

Question 11

(a) The simple algebraic fraction for a time in minutes to fill a tank was usually correctly answered.

(b) The writing of an equation with two algebraic fractions is a challenging topic and many candidates found this difficult. The equation to show was occasionally solved demonstrating that the information given in the question was proving too difficult to put into a correct equation.

(c) Solving the given equation was more accessible and many candidates succeeded in this part after not scoring in **part (b)**. Many candidates did not use the factors of the quadratic and used the formula or the graphics calculator. There were good solutions to this quadratic but they were often not used correctly to find an overall time to fill a tank.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/51
Paper 51 (Core)

Key messages

To do well on this paper candidates needed to read carefully to understand the information given, not only at the beginning on page 2 but also at the beginning of the other questions. Checking and rechecking that they were following the instructions was key. Also, reworking was essential to make sure they had not made any numerical errors.

General comments

The improved answers in **Question 2** compared to **Question 1** showed that many candidates had perhaps now realised what they needed to do, having settled into the investigation. Candidates often changed answers for the better, especially in the tables, as in **Questions 2b** and **4a**. This showed that these candidates did check back on either the information given or the accuracy of their answers or both.

Comments on specific questions

Question 1

Candidates who had read and understood the information on page 2 were able to gain good marks for this question. There were several ways in which the marks could be awarded for the table questions so even if errors were made in one part of a table, candidates could still score marks on other parts of the table. Candidates should be encouraged to study the information given carefully and not to rush into answering the questions.

(a) (i) Some candidates made the mistake of putting the next mass, 9, into bin 4 when there was still space in bin 1 (and even bin 3). The example showed that the mass of 6, following the first mass of 38, was placed in bin 1 because there was still enough space (22 kg). Candidates should be encouraged to keep looking back at the example to verify that what they are doing is correct.

(ii) The unused mass totalled the same if all the masses had been placed in the table, even if incorrectly. Most candidates found the correct answer and many also gained a mark for communicating their working.

(b) The majority of candidates managed to find the correct unused masses for their positions of the 5 items, even if they did not get the masses in the correct positions.

Question 2

The table in this question was answered well, often better than the tables in **Question 1**. Candidates should be encouraged to check back on earlier answers at stages throughout their paper.

(a) Candidates were able to write these masses in order, almost always in descending order.

(b) If candidates did not answer this question completely correctly, they did manage to place the first five masses in the correct places. Some were making mistakes in the unused masses which is why the answers to their rows were incorrect.

(c) Here was another chance to communicate working out to find this total unused mass. Many candidates took the opportunity to do this.

Question 3

This question was about the 'best solution'. Many candidates found the quickest way to find the best solution. Others created new tables which were not required.

(a) (i) The simplest solution was to divide 270 by 80 and since this came to 3.375 this meant that 4 bins was the best solution. Some candidates tried other methods, several of which earned them marks. Many candidates chose to use diagrams to illustrate this best solution. This method was perfectly acceptable.

(ii) Candidates were required to turn back to **Question 1(b)** to find and use the masses for this question. Those that did were mostly able to complete the question by dividing the total of 55 by 20. Again, there were several other methods that were acceptable for answering this question and most candidates were able to write down at least half of what was required for a particular method.

(b) This question moved to calculating the amount of unused masses. Again, there were several appropriate methods. Candidates should always be encouraged to write their thoughts down and not to leave the answer space blank.

Question 4

This question now introduced a new method that combined masses to the given total before continuing with Method 2.

(a) Most candidates understood that they needed to put masses together to total 40 kg with many finding the correct answers for the first two bins or the alternative correct answer using one bin. Fewer candidates used Method 2 to complete the question but put in the masses in the order of the list. The communication mark for listing the remaining four items in descending order was consequently not often awarded. The remaining part of this question was often attempted with many candidates finding the total of 132.

(b) This question required more thought as well as use of other basic skills such as percentages. Most candidates scored well on redistributing the mass of 12 and many were able to correctly communicate finding at least one of the unused percentages.

Question 5

The cost of the solution was invariably calculated correctly. Finding the best solution was also usually shown by using the table and rarely shown that it was the best solution by also dividing the total of 238 by 60 kg. Approximately the same number of candidates chose to use either Method 2 or Method 3 and usually placed the first 6 items in the correct places.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/52
Paper 52 (Core)

Key messages

Candidates should always be reminded to read the instructions carefully and show how they reached their answers. This will allow them to gain the communication marks, in addition to the answer or method marks. They should also be advised that looking for patterns, and physically writing down any they see, will enable them to not only answer the questions successfully, but gain communication marks as well.

General comments

Candidates had clearly read and understood the information given on page 2 and were able to complete at least **Questions 1** and **2** with ease, as well as **Question 3**.

Comments on specific questions

Question 1

(a) Most completed successfully both answers and gained communication marks as well.

(b) Again, most answered correctly.

Question 2

(a) Most answered correctly.

(b) Mostly correct.

(c) Most completed successfully, both answers and communication.

Question 3

(a) Most candidates continued to answer correctly.

(b) Mostly correct.

(c) Most completed successfully both answers and communication.

Question 4

(a) Most candidates achieved the numerical 5 by 5 answers and many achieved at least one of the algebraic expressions. Candidates should be encouraged to try to complete all empty cells – looking for patterns will often help.

(b) There were two common answers here, both of which implied that the candidates did not realise that the grid on page 2 'continues downwards' as it says in the information. The most common answer was 1000 when the candidates recognised it needed to be a square, so they worked on a 6 by 6 square, as shown. The other common incorrect answer was given by the candidates who also did not use the fact that it had to be a **square** window and took the whole 6 by 10 grid, as given at the start.

(c) The most popular method to try to solve this was to trial different sized windows. For full marks correct trials for a 6 by 6 and a 7 by 7 windows were needed.

Question 5

(a) Most candidates wrote down correct expressions and subsequently went on to simplify.

(b) There were some good attempts at the algebra that was required. Practice on multiplying out both a single term with a bracket and double brackets would be well worthwhile, as well as following up by combining terms.

Question 6

Candidates tried several different methods to solve this problem. Trial and improvement was popular and often resulted in the correct answer of a 4 by 4 window. Very few went back to adapting the algebraic expression from **Question 4(a)**.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/53
Paper 53 (Core)

Key messages

To do well on this paper candidates needed to be able to spot and use patterns to support the answers they calculated from their drawings. They also had to be good at substitution and be aware of the easiest method to find a variable and constant in a quadratic equation. They should know that going back to first principles and finding the *n*th term of a sequence is not always the simplest method. Candidates should also always try to use given data rather than data they have calculated themselves.

General comments

Those candidates who used differences in the tables to calculate values were often more successful than those who relied entirely on their drawings. Some also used their answers to recalculate previous answers. Substitution of two given values in a formula proved a quick and reliable method for finding a missing variable or constant.

Comments on specific questions

Question 1

Candidates followed the brief description given in the introduction and answered this question well.

(a) (i) Candidates drew the correct number of radii on each of the three circles and most of them labelled the regions.

(ii) The candidates completed this table correctly.

(b) It is essential that candidates understand the way to write formulas in that, 'a formula for *R* in terms of *n*' means the formula should begin with *R* = and then use *n*.

Question 2

This question was also well answered. Candidates again followed the instructions carefully.

(a) The table was completed correctly, most often with the aid of drawing diameters on the circle provided, for which a communication mark was available. Some candidates were able to complete the table correctly by following the pattern in the values for the number of regions. All candidates should be encouraged to use diagrams or to show how a pattern forms in order to communicate well.

(b) Candidates achieved a communication mark for writing a formula beginning with '*R* =' rather than writing an expression. As in **Question 1(b)** some candidates wrote a formula beginning '*n* ='.

Question 3

This question, using chords, was more complicated than the first two questions on radii and diameters but it was still answered well.

(a) The chords were already drawn for the candidates so careful counting meant most candidates found the correct number of regions.

(b) Again, a communication mark could have been earned by many for drawing five chords on the given circle. There was also the opportunity to earn this mark by showing the differences between the numbers of regions in the table.

(c) The formula was given with one coefficient to be found. Candidates could have improved their responses by realising that they did not need to go back to finding the *n*th term from first principles, using whichever method they may have learnt. By choosing one of the given pairs of values for *n* (number of chords) and *R* (number of regions) a straightforward substitution gave the answer to coefficient *b*. Many candidates did get the correct answer having used more time and work than they needed to.

Question 4

This question, by moving on to tangents, involved counting regions both inside and outside the circle.

(a) Most candidates realised the difference between the two diagrams and were able to explain using the correct vocabulary of 'parallel' or 'not intersecting'.

(b) (i) Most candidates found the correct number of regions here.

(ii) Some candidates were able to draw a fourth tangent that intersected the three already drawn. Care was needed to make sure that an actual tangent was drawn and that, if necessary, the pre-drawn tangents were extended so that all regions could be found. Being precise and careful led to correct answers.

(c) The correct answer to **part (b)(i)** gave the candidates three consecutive numbers in the table to use for a pattern. Candidates should be encouraged to look for these patterns. In this case it might have helped some to realise they had made a mistake in **part (b)(ii)** and could go back and change their answer to fit the pattern, thereby also finding the correct answers for the table at the same time.

(d) Again, as in **Question 3(c)**, the formula was given with only the value of the coefficient of *b* to find. Some candidates continued to work from first principles when substitution of two given values from the table would have been much quicker.

Question 5

The meaning of a secant was explained at the beginning of this question as well as the particular information that was important to this question.

(a) Candidates need to read the information very carefully to make sure that their drawing follows all the instructions. There were three points to consider when drawing this third secant. Most candidates followed the first and third instructions although some drew their third secant intersecting where the first two were intersecting. Candidates should be encouraged to look for patterns even if there is a gap in the sequence given. Here the differences between the first and second, and then the fourth and fifth number of regions could have been calculated. Then the candidates could have completed the missing numbers of regions for three secants and compared it to the answer they had obtained by drawing and counting.

(b) This time the value of the constant *c* as well as the coefficient *b* needed to be found. Candidates who substituted in two pairs of values that were given were most often successful. They should be encouraged to use the data given when they can, rather than values they have found.

Question 6

Candidates had to draw together the information about the chords in **Question 3** and the tangents in question 4. Algebraic use of the formulas gave some candidates quick, correct answers.

(a) Some candidates used trials to find this answer. To improve their methods candidates should be encouraged to look back at previous answers and questions to see how they might use them to successfully answer further questions. Equating the two formulae produced a simple subtraction of terms to give the answer of 60.

(b) By means of using trials in **part (a)** rather than algebra, some candidates found the answer to this part when they were working on **part (a)**. A substitution of their number of lines into one of the formulae was good communication. Candidates should always show all their working-out.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/61
Paper 61 (Extended)

Key messages

In order to do well in this examination, candidates need to give clear and methodical answers to questions, showing enough method so that marks, particularly communication marks, can be awarded. Candidates are expected to use a graphic display calculator efficiently to draw and interpret graphs. This includes setting the scale on each axis so that the overall shape of a graph over the domain given is clear. Explanations, when required, need to be clear and not contradictory and based on the mathematics under consideration.

When candidates are asked to 'show that' a result is valid, they should produce a clear and accurate mathematical justification. When candidates are asked to show that a result is correct to a certain number of significant figures or decimal places, their penultimate step should always be to write down a value that has a greater accuracy, so that they are able to demonstrate the rounding and complete the question.

General comments

Many candidates presented their work neatly and with correct mathematical form, including the correct use of brackets, where needed. A good number of candidates scored well and found both **section A** and **section B** accessible. The latter questions in each section proved challenging for some, particularly **Questions 3**, **4, 6** and **7**.

The level of communication was generally good, although, in the investigation task, some good candidates omitted to communicate where it was possible. Communication was better in the modelling task and candidates seemed more comfortable in the early stages of the task. Methods stated needed to be detailed enough to communicate understanding to earn full credit. This could often be achieved using calculations in the investigation or sketches of graphs or equations, for example, in the modelling task. Any simple process that formed part of the solution should have been communicated.

Most candidates stated appropriate units. Occasionally, candidates stated units as part of the models used in the modelling task. This was condoned on this occasion but candidates should know when the statement of units are appropriate, rather than just stating them at every point. Freehand drawings of rectangles were accepted as diagrams although candidates are generally expected to use a ruler and pencil for these.

Comments on specific questions

Section A – *Investigation: Storage Bins*

Question 1

This question introduced candidates to the idea of packing items into storage bins using a process called Method 1. Items were packed into bins in the order in which they were listed without making any adjustments before packing them. Some candidates seemed to come back and make corrections to **Question 1** after starting **Question 2**, where adjustments were made before packing. Evidence of correcting all the methods in **Question 1** was seen many times, which was sensible.

(a) This was designed to be a simple introduction to the task and was well answered. Candidates needed to complete the packing of bins, given that some items had been prepacked for them. Candidates who followed the method correctly should have placed the first item, with mass 15, into bin 4. Candidates often placed the item with mass 27 first, this being the largest of the items remaining. This was incorrect for the method, as it did not follow the instruction given, and was only partially credited. Some candidates omitted to notice that the item with mass 9 could be placed in bin 1 and this was often misplaced in bin 3.

(b) A good number of fully correct responses were seen. Many other candidates were able to earn a mark for one correct row. Weaker responses, placing the items anywhere and showing the correct unused masses for the locations chosen, were also credited.

Question 2

In this question candidates needed to modify Method 1 to investigate whether ordering the masses of the items before packing them changed the amount of unused space. This process was defined as Method 2. Candidates were also introduced to the definition of *a best solution*.

(a) This part of the question was very well answered. The most common error was to write the values, in order, with the smallest first.

(b) Again, a good number of fully correct solutions were offered. Weaker responses were credited for placing the first five items correctly or for having two correct rows, which many did.

(c) This was the first part of the task that proved to be a real challenge. Candidates needed to consider the amount of space unused as a percentage of the total capacity of the bins used. Some good responses were seen. These responses were often detailed, neat and accurate, with a sensible comparison made. Candidates could earn a communication mark for stating a fraction from which they derived one of the percentages, or for similar evidence of method. A few candidates found the percentage of unused mass as a percentage of the total mass of the items. Candidates could be credited for communicating evidence of this, if seen. Further partial credit was also given in this case for the percentages found and a sensible comparison made. Other candidates included the unused bins in their totals of unused masses and/or included the unused bins in their total capacity of bins used. This often resulted in equal percentages. These candidates omitted to take note of the information given in the example at the start of the task. Communication was often omitted with values appearing without evidence of method or calculations being mislabelled as Method 1 when the values were clearly those of Method 2, or vice versa. Some candidates made no attempt at a comparison, which could have been credited if percentages were found. Other candidates looked at the percentages unused for each bin in each method. This could also gain partial credit, although it was much less likely, as it was more prone to error and missing method. Weaker responses were often poorly presented and difficult to follow.

(d) Here, candidates were introduced to the idea of *a best solution*. Some good responses were seen to this part. The most efficient methods were to find $\frac{270}{80} = 3.375$ or $80 \times 3 + 30 = 270$ which showed instantly that 3 bins were insufficient and 4 bins were needed. Some candidates only showed that 4 bins were able to hold the total mass and did not also show clearly that 3 bins were not enough. Other candidates did not read the information carefully enough and gave calculations and comments based on the percentage of unused space. Candidates did not always observe that *a best solution* was defined in this question, and it was expected that this definition would be carried forward through the remainder of the task.

(e) Method 1 was now modified in a different way. Candidates needed to make full bins and then apply Method 2. This process was called Method 3. Most candidates combined 21 and 19 and 30 and 10. Some coped with the full bins but then simply put the remaining items for the last 2 bins into the bins without ordering them, not following the instructions. Also many candidates omitted to show the ordered list for the remaining 4 items and so did not earn the communication mark available here. The idea of *a best solution* was totally forgotten or redefined by a significant proportion of candidates. These candidates now looked at Method 2 and Method 1 and compared the number of bins used with Method 3, or the percentages of unused space for Method 2 and Method 1 and compared those with Method 3. This usually meant using the percentages they had found in **Question 2(c)**, which was invalid as these were a different set of items. Redefining *a best solution* in this way was not accepted as its definition had clearly been stated. Candidates who only gave narrative descriptions of why this was a best solution may have done better if they had supported their narrative arguments with calculations. Arguments made without calculations or numerical evidence are rarely creditable.

Question 3

Candidates needed to solve a simple problem, finding the mass of two items that would result in Method 1 using fewer bins than Method 2. A good number earned one or both of the first two communication marks available for showing the use of Method 1 and Method 2 to pack the items whose masses were known. Many did not show sufficient evidence of method to earn the third communication mark available, which was for showing clear understanding that the masses of the two items either totalled 5 or had a total which was less than or equal to 5. A few good candidates stated a correct answer with very little supporting evidence. Many candidates were trying to work with much larger numbers and made the problem more difficult than it, in fact, was. A few candidates mislabelled Method 1 as Method 2 and/or vice versa. This was not credited for communication and these candidates needed to take more care with the presentation of their work. A few good candidates earned the third communication mark by only working with 1, 4 and 2, 3. Some chose 2, 3 showing that these values worked for one method without completing the solution by demonstrating the use of these values in the other method. Candidates whose approach was to use trials should be advised not to cross out work that does not lead to the correct solution as this then cannot be credited for communication. For trials, the trialling is part of the method.

Question 4

The problem was now expanded. As well as considering the mass of the items, candidates needed to consider how many items would fit, given the dimensions of the top of the bin and the items. This was Method 4.

(a) Most candidates divided the total area of the top of the bin by the area of one item, finding 4.5 and rounding down to 4. This gave the maximum possible number of items but was not sufficient to justify that 4 was actually the maximum that would fit in this case. A communication mark was available for showing that 4 was the actual number possible here. The simplest way to do that was to draw a simple diagram of rectangles showing how the 4 items would fit inside the bin. Whilst a sketch is sufficient, candidates are advised to make their sketch a reasonable interpretation of the problem and not, for example, add extra unnecessary lines or just use lines so that the outline of each item was not able to be determined.

(b) A good number of candidates were able to pack the bins correctly using the two criteria. The packing of the items in the correct bin was essential to the method here. Some candidates formed bins full of items first and so did not have to deal with the issue of a bin being full because of its mass. This was not accepted as the problem was then less complex. Candidates needed to follow the instructions given, correctly. Very few candidates justified the need to use 3 bins successfully. Again, narrative arguments without calculations were rarely clear enough to be credited for justification of *a best solution*. Some candidates ignored the maximum number of items per bin and incorrectly packed using masses only. Many candidates ignored the need to show that the solution was *a best solution*. Again, many candidates did a comparison either of the number of bins or unused percentages with Methods 1, 2 and 3.

Candidates could not be credited for the cost unless they had either placed all the items in the correct order in the correct bin or had shown 3 bins to be *a best solution*.

Section B - *Modelling: Half-Lives*

Question 5

Candidates considered models which find the mass remaining of a decaying chemical after a period of time.

(a) (i) Most candidates stated the correct mass remaining, 25 g. Not all candidates earned the communication mark available, although a good number did. A few of those using the model omitted to bracket the $\frac{1}{2}$, and were not credited as the form of the model was incorrect. Many candidates communicated by starting with 100 and clearly demonstrating the two steps of division by 2. This was accepted. Weaker responses offered the answer 50.

(ii) Some excellent graphs were drawn. Some candidates were very skilful, and the graphs drawn were neat and clear. Good use of the graphic display calculator was evident. A few candidates drew graphs of the correct shape, but which were not sufficiently close to the *y*-axis or touched the *t*-axis at some point in the domain $0 \leqslant t \leqslant 600$. Communication was awarded for having a *y*-intercept of 400. Weaker responses offered graphs that were linear or had ruled sections, for example. It may be the case that some of these candidates needed to adjust the view settings on the calculator to be able to see the graph correctly. Other candidates were clearly tabulating values and plotting points. This is not expected when the instruction is 'Sketch'. The resulting graphs were often a poor shape and not smooth.

(iii) A very good number of correct responses were seen. Some candidates made careless errors, miscopying figures and some used values other than 200, but which were close to 200. This was not condoned as 200 had been clearly stated as the mass remaining when $t = 100$ earlier in the question. The difference in values was not always shown and many candidates often stated a pair of values only. These candidates missed earning a communication mark for showing a correct method.

(iv) This was the most challenging part of **Question 5(a)**. A reasonable number of candidates earned all 3 marks available. Two communication marks were given for showing sufficient method. Many earned the first communication mark for a correct equation or a suitable sketch of appropriate graphs, although some simply stated they had used their graphic display calculator without any supporting graphical evidence. Many candidates earned a second communication mark for finding $t = 532$. Some candidates thought 532 was the number of half-lives and their solution stopped at that point. Other candidates solved the initial equation they had written down correctly to find 5.32, but omitted to show any method of solution and so lost the second communication mark, which was also able to be awarded for correct use of logarithms. Many candidates attempted to find the number of half-lives using trials. These were almost always unsuccessful. Using numerical methods to solve a problem that can be solved algebraically or graphically is not efficient. Candidates should be encouraged to solve equations graphically or algebraically and not numerically in the modelling task in particular. When forming the equation, weaker responses often showed incorrect use of the model with $10(t) = \ldots$ rather than $10 = \ldots$ Some weaker responses indicated that the number of half-lives was between 5 and 6 and estimated or tried to find the value using linear proportion or interpolation.

(b) (i) This part of the question was well answered with a good proportion of correct answers seen.

(ii) Very few candidates gave the required fraction. Some candidates stated a decimal value for $\frac{200}{1024}$ which they then rounded and divided by 200, this caused a rounding error that was not condoned. A few of those who did find $\frac{1}{1024}$ did not communicate any method and so lost the communication mark available for this. Most candidates substituted $t = 300$ into the model and found $\frac{25}{128}$, stating this as their answer. Communication was not always awarded for using the model, as candidates sometimes omitted brackets or used an incorrect value of *t*. A few candidates were credited for communication by stating that this value of *t* represented 10 half-lives.

(c) This part of the question was commonly well answered. The domain was often the main issue with $48 \leqslant t \leqslant 288$ or $0 \leqslant t \leqslant 6$ commonly stated. A few candidates omitted brackets in the model or wrote $\frac{1}{4}$ with a purely numerical power.

Question 6

Candidates now considered a new model to find the mass of the chemical remaining.

(a) (i) An explanation involving consideration that $3^0 = 1$ when $t = 0$ was required. This was rarely seen and, consequently, this part of the question was poorly answered. General statements such as 'anything to the power 0 is 1' or 'it is when $t = 0$', although reasonable, were not sufficient to be credited. Most explanations were too general and statements such as 'N_0 represents the original mass of the chemical' or 'No half-lives have happened at that point' or statements that $N_0 = 1$ were very common. None of these explanations were accepted.

(ii) Most candidates missed the obvious answer, $\frac{1}{2}N_0$ and stated expressions involving N_0, *k* and *t* or even *H*.

(iii) Candidates struggled with this part. Often N_0 was not evident in their calculations. Candidates often attempted to verify the result for a few numerical cases only or made no real attempt to answer.

(b) (i) Here candidates needed to understand the importance of the answer to the previous part of the question, state that $3^{10k} = \frac{1}{2}$ and use this to find *k* to a sufficient level of accuracy. In this question, 4 or more decimal places were required. Many candidates made a good start and used logarithms as instructed but did not show a more accurate decimal and so were penalised. Weaker responses showed no use of logarithms but instead verified that $3^{-0.63} \approx \frac{1}{2}$.

(ii) There were three communication marks available in this part of the question. Some excellent responses were seen with very good communication. Mostly this was achieved using logarithms, but appropriately detailed sketch-graphs were also credited and some good examples of this were seen. A few candidates used the wrong model. This was not accepted for the first three marks, as the model to be used was clear in the question. However, candidates who did this were able to earn the final communication mark for stating the unit of time. Some candidates attempted to make use of 3^{10k} again in this part and did not appreciate that they had just been given the value of *k* they needed to use here.

Some candidates used trials. Sometimes an acceptable answer was stated from these trials, as a wide range of values was credited. However, this approach was not accepted for communication marks. Some candidates tried to use some form of linear proportion or interpolation, rather than trials, with the model. Weaker candidates made no real progress beyond finding 10 per cent of 40 = 4 or made no attempt to answer.

Question 7

(a) This was the most challenging question in the task. Candidates needed to apply all the skills they had just practised with Chemical *D* to a model for Chemical *E* in order to find the half-life from the information given. A reasonable number of candidates used 49 and successfully formed the new model using 1.6 *k*. A few candidates misinterpreted the question and used 11, but these could still earn the three communication marks available. These communication marks could all be successfully earned using sketch-graphs and/or exponential equations and logarithms. The first key step was to find *k* and a reasonable number of candidates, who attempted a solution, did this well. A few candidates made premature approximation errors by rounding their working values too harshly. A few candidates incorrectly used the value of *k* for Chemical *D*. Again a few candidates used the wrong model which was not credited. Weaker responses found $\frac{30}{11} = 2.72$ or $\frac{30}{11} \times 1.6 =$ 4.36. Some candidates used the 4.36 in order to find *k* and then solved again to find the half-life as 4.36. This circular argument was not credited.

(b) Candidates who found the correct half-life in the previous part of the question were able to earn a final mark in this part by demonstrating that $60\left(\frac{1}{2}\right)^{\frac{1.6}{5.476...}} \approx 49$, or a similar argument. A small proportion of these candidates were able to show this correctly.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/62
Paper 62 (Extended)

Key messages

If the values found from a model do not match the given data exactly, this does not necessarily mean that the model is unsuitable.

An algebraic model should be written like a formula, with a subject and the correct variables.

If the entries in a table require a calculator to be used, candidates should show at least one example of the relevant calculation. Generally, whenever the calculator is used the calculation should be communicated.

General comments

Candidates often displayed strong algebraic skills, particularly in the expansion of brackets, and in using data points when solving simultaneous equations or finding the equation of a straight line.

Many candidates exhibited good problem-solving skills and there was much evidence of persistence in tackling the more challenging algebraic questions.

Efficient use of the statistical functions on the calculator was in evidence and nearly all candidates found a regression line correctly on their calculator.

Comments on specific questions

Section A – *Investigation: Opposite Corners*

Question 1

A very large majority of candidates answered this question correctly, with most of those clearly showing the calculation to find the opposite difference. The most common omission was the subtraction sign needed to communicate how the opposite difference was found.

Question 2

(a) Nearly all candidates found the corner squares in the given 3 by 3 window. A very small number assumed the grid was also 3 by 3.

(b) Almost all candidates in the relevant numbers and calculated the opposite difference of 160 in a 3 by 3 window.

(c) In this question candidates were asked to fill in some partially-completed 3 by 3 grids. As before, most did this correctly and for communication wrote out the necessary calculations to show how the opposite differences were calculated.

Question 3

(a) This question investigated the pattern that exists in the opposite differences with windows of different sizes. A large majority of candidates found the required numerical values in the table, but most did not show the calculation they had used. It is possible they guessed the pattern and worked backwards from a hint in the general expression on the last row. However, two given terms are not enough to continue a sequence, so multiplication and subtraction of numbers in a 4 by 4 or 5 by 5 window was required for communication. For the general result on the last row, a few candidates omitted one of the cells, even though each cell contained comparable expressions. This was often the first $(w - 1)^2$.

(b) In this question candidates had to think about the largest square window possible for a grid of width 10. The successful candidates substituted the 10 into the general expression that they had found in **part (a)**. The great majority of candidates overlooked the information that the grid continued downwards, also implied by dotted vertical lines below the grid. These candidates usually took a 6 by 6 square, which was the largest square that would fit on the part of the grid shown. This gave an answer of 1000. Some candidates took a 10 by 6 rectangle as the largest rectangle that would fit on that part of the grid.

Question 4

(a) This question introduced n in the first cell of a 2 by 2 window on a grid of width 7. Most candidates were successful in finding expressions for the other corners in terms of n. The most common error was to write $8n$ for the bottom left cell because 8 × 2 also gave the 16 seen in the grid in the question. A few candidates wrote only numbers in the cells.

(b) Candidates had to find the opposite product in terms of n and many showed algebraic proficiency in doing so. A common error was to write the subtraction of $n(n + 16)$ as $– n^2 + 16n$. There were a sizeable number of candidates who chose particular values for n or used a numerical 2 by 2 window, even though they were instructed to use algebraic expressions. These candidates gained no marks.

Question 5

For a grid of width g, candidates had more difficulty in finding the correct expressions, which were now a combination of two variables. Rather than adding $2g$ for the second row of the grid, several candidates added g or ng. The algebra too was more challenging, requiring care in multiplying out brackets. As in **Question 4(b)** several candidates did not have the necessary negative signs when expanding the subtracted bracket. However, many found appropriate expressions for the corners of the window and worked confidently through the necessary algebraic steps to obtain the result of $4g$.

Some candidates, noting from previous work that the opposite difference was a constant, chose to put 2 in the empty first cell. This approach resulted in easier algebraic work but was a valid approach and, if seen through successfully, gained all the marks.

Question 6

(a) Since the grid in the question was an illustration, candidates were not expected to write their answers within the small cells. In such an extended question candidates should arrange their work clearly and logically on the page. Some candidates wrote expressions in or near the cells but used different ones in their working.

This was the most challenging question on the paper. The algebra went a step further with n in the first cell, g for the width of the grid and x for one less than the size of the window. Only the best candidates were able to handle these three variables successfully and several candidates made no attempt at this question. Some reduced x to the number of cells seen along one side of the illustration and some took the size of the illustration as justification for $x = 2$ leading to expressions without x. With such expressions they could not arrive at an opposite difference of $4gx^2$. Many candidates wanted to use the result from **Question 3**, but that did not lead to the required answer. Some candidates offered a purely numerical response and did not score.

(b) This was a rather open-ended question where, using **part (a)**, candidates could write $4gx^2 = 144$ to help find all the possibilities for grids and windows. Even without managing **part (a)** candidates could still use the given result. Many candidates did not know where to start with this question. Some tried out various values for g and x and were able to gain a mark for implying one or two possibilities. The most successful candidates worked systematically by substituting x = 1, 2, 3, … into the equation. Clarity in doing so was rewarded with a communication mark. Others gained a communication mark for noticing that the equation could be usefully written as $gx^2 = 36$. The most frequent omission in the possibilities was $x = 1$ and $g = 36$. The answer $g = 1$ and $x = 6$ was often seen but that implied a window of width 7 on a grid of width 1. Very few candidates translated their values for x and g into answers in terms of the size of the grid and the size of the window.

Section B – *Modelling: Crickets and Temperature*

Question 7

(a) Candidates had little difficulty in writing down the mean values. Some candidates did not appear to use the statistical function on their graphic display calculator. Writing out additions was not required. A few rounded to 2 significant figures and so did not score the marks.

(b) The large majority of candidates plotted points accurately, that is, within half a small square of the exact position.

(c) Most candidates knew how to find the regression line on their calculator, but more candidates should have scored full marks than did. A common error was to round to two significant figures. With the data being given to two significant figures, statistical measures should normally have one more figure of accuracy. Another error was to write x and y from the calculator in the final model and another was to omit the subject N from the model.

(d) Some candidates incorrectly joined the points with line segments. Many candidates did not know that the regression line must pass through the mean point, but most drew a line passing close to the data points. A ruler of sufficient length was necessary to draw a good line.

(e) Finding when there were 170 chirps per minute could be done in either of two ways. Most chose to substitute 170 into their equation for the regression line. With an accurate ruled horizontal line at 170 on the graph, the answer could be read off the diagram or their calculator. Credit for communication was given for showing either of these methods.

(f) (i) Converting the data to Fahrenheit and chirps per 13 seconds was very well done. A few candidates did not give integer answers, as should have been clear from the table and from the statement above it. Most candidates only scored half marks because they did not communicate how they found the values in the table. To calculate the chirps in 13 seconds candidates would have used a calculator, in which case they should have been aware that communication of the calculation was required. One example for each conversion would have been sufficient.

(ii) A model to find the Fahrenheit temperature from the number of chirps in 13 seconds is to add 40. Candidates had to comment on the suitability of this model. Only the better candidates understood that a model is still suitable when the results are close, but not necessarily exact. Some candidates used percentage error as a guide as to whether the model was suitable.

Question 8

(a) In this question a quadratic model was offered as a better alternative and candidates had to use two given data points to find this model. A few did not use the given points. The common errors in working were arithmetical or, occasionally, unnecessary rounding. Using the rounded integer value for a gave an inaccurate value for b. While the final answers should have been integers, full accuracy should be kept in the calculator for the working.

Nearly all candidates correctly formed two equations and the large majority knew how to solve them simultaneously. The most efficient method of solution was to subtract the equations and rearrange to isolate a. Many candidates preferred rearranging one equation to give an expression for b in terms of a and then substituting it into the other equation. Others rearranged both equations to give two expressions for b which could then be equated. A very small number did this and sketched the graphs using the graphic display calculator.

Because an integer value of a in fact gave a model that was less good, tolerance was given to those who left a decimal in their final answer. However, models with 5 significant figures and improper fractions were considered inappropriate for the given data.

(b) It was expected that candidates would sketch the graph of their quadratic function passing close to the points that had been previously plotted. Owing to the rounding effects in writing the model, generous tolerance was given to candidates' sketches in this respect.

Some candidates drew a quadratic function that turned back on itself. Others drew one that was decreasing significantly at the start. Others drew a straight line, while there were a sizeable number who did not draw anything, perhaps because their incorrect model was beyond the given axes. All these cases could not receive credit.

(c) This question tested the understanding that a model will be suitable if its graph lies close to the data points. Only candidates with an appropriate model could gain this mark. Several candidates with an accurate model wrongly said it was unsuitable because it missed the data points.

Question 9

(a) (i) Candidates had to find a linear model for the data for another type of cricket by using two given data points. Most candidates managed this successfully by finding the gradient m and substituting it and one of the points into $y = mx + c$ to find c. Most showed the full method and received communication marks. The few, who only wrote down the answer, could score just one of the four marks. Answers written in terms of x and y, or omitting A =, could not be credited with the final mark. A few candidates left the coefficient of T as $\frac{1.15}{3.5}$, which is an unsatisfactory form. Some candidates wrote $c = 2.2$, thinking that this was the intercept on the vertical axis, not accounting for the graph starting at $x = 17$ rather than $x = 0$.

(ii) To change from a model for chirps per second to one for chirps per minute candidates had to multiply by 60. A change to the linear model was required so $N = 60A$ was insufficient as the original model was in terms of T. The most common error was to divide by 60.

(b) Over the course of the modelling task much data had been seen about the two types of cricket. From these and the models they had found, candidates had to draw comparisons, of which there were many possible. Comments about the rate of chirping or the range of temperatures at which crickets chirp were the most likely to gain credit.

Some comments were not precise enough. For instance, saying that one cricket chirped more than another was insufficient since it was the rate of chirping that was different. Candidates should practise giving general statements and not those that focus on only particular data items. A description of just the graphs was insufficient while successful candidates interpreted those graphs in the context of the chirping.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/63
Paper 63 (Extended)

Key messages

This paper awards marks specifically for clear and precise communication of mathematics. Therefore, it is essential to provide full reasons and steps in working to achieve full marks. This includes when candidates use their graphic display calculator to find the answer to a question, they must still communicate how they did their mathematics for example by including a sketch.

Candidates should always follow any instruction to use a previous part. Such instructions are intended to aid the candidate. In many cases, ignoring such an instruction will result in no credit being awarded.

General comments

The investigation was overall answered better than the modelling. Candidates need to be made aware that the investigation builds and therefore they need to remember and often use what they have discovered earlier on in the investigation in latter parts of ***Section A***.

Many questions in ***Section B*** were not attempted by many candidates, candidates need to practise the modelling questions and manage the use of time within the exam as the modelling is worth as many marks as the investigation. More practice of 'show that' type questions would be beneficial to candidates, especially where algebraic manipulation and substitution are required.

Comments on specific questions

Section A Investigation: Circles and Regions

Question 1

(a) This question required the candidates to work out the number of regions made when radii were added to the circle. All candidates were able to do this correctly.

(b) This question required a formula to be written for R in terms of n. The preferred response was $R = n$ and centres should encourage candidates to use widely accepted mathematical norms rather than $n = R$ or omitting the R.

Question 2

(a) The candidates had to find the number of regions when the number of diameters in the circle was increased. To get both marks, candidates needed to draw those diameters in the circle to communicate how they knew how many regions there were.

(b) This question required a formula to be written for R in terms of n. The preferred response was $R = 2n$ and centres should encourage candidates to use widely accepted mathematical norms rather than $2n = R$ or $n = \frac{R}{2}$ or omitting the R.

Question 3

(a) This question required the candidates to count the number of regions made by the chords. Nearly all candidates could do this correctly.

(b) This question required candidates to draw 5 chords and count the regions. Most did this correctly.

(c) Most candidates recognised that they were dealing with a quadratic number sequence. Three of the four marks available were for clear communication of how they reached their formula. This needed to be done in a logical manner with clear labelling of what their rows of numbers meant and therefore how they could use the information to progress to the next stage. For example, simple statements such as $a + b = 1$ communicate how you found the next value, rather than going from $a = 0.5$ straight to $b = 0.5$.

Question 4

(a) Candidates were required to give a reason why one pair of tangents did not create the maximum number of possible regions. This question was answered very well.

(b) This question required candidates to count the number of regions made by 3 tangents. Nearly all candidates counted correctly.

(c) This question required the drawing of a fourth tangent on the diagram. Candidates who applied what they had learned in **part (a)** got two marks for making sure that their tangent intersected all of the others and did not touch the circle at the same point as any of the other tangents.

(d) This question required candidates to substitute numbers from the table in **part (c)** into the given formula and solve for *b*. In this situation, candidates should always use given figures and not those they worked out in case they are wrong.

Question 5

(a) Successful candidates were able to apply all of the rules set out in **Question 5** to get the correct number of regions. It is important candidates read the information given carefully and carry it forward to other parts of the section where necessary.

(b) The intended method required for this question was to form two simultaneous equations and solve them. Candidates need practice in recognising when this would be an appropriate method to use and to gain confidence in accurate algebraic manipulation.

Question 6

This question required the solving of an equation. There also had to be communication of how the equation was solved, whether using the quadratic formula, trial and error or a graphic display calculator.

Question 7

(a) Two formulae needed to be subtracted and made equal to 60 and then solved for *n*. Many candidates did not attempt this.

(b) This question required the previous answer to be substituted into the correct formula.

Section B Modelling: Airport Runway

Question 8

(a) Candidates were required to work out the missing values in a table. Most candidates could do this correctly. To gain full marks, candidates needed to communicate what they were adding or subtracting.

(b) This question required candidates to sum a column of figures and subtract them from a given total. Written evidence of this method was required to gain full marks. Some candidates were able to do this.

Question 9

(a) This question required several simple calculations and those who had a good understanding of cumulative frequency did this well.

(b) This question required candidates to plot the four values they had calculated in **(a)** and join all the points on the graph with a smooth curve that started at the origin and passed through all points. Very few did this accurately enough.

(c) This question was answered well.

Question 10

(a) Some candidates did this correctly. Others needed to keep in mind the whole concept of the model and understand that p was the y coordinate and t the x coordinate.

(b) This was a challenging question for candidates, and it required them to divide their two equations from **part (a)** and then do some cancelling and manipulation of the powers.

(c) This question required algebraic manipulation of a given equation to show a solution of $a = 54$ correct to the nearest integer. Some candidates were able to solve the equation using their graphic display calculator, however, the answer had already been given, so this was not enough to show clear communication and showing a step after the original equation was necessary. It was also essential to show an intermediary answer that rounded to 54.

(d) Successful candidates were able to use information from **part (a)** and **part (c)** to solve for k and then write the completed model. Candidates should pay attention to what accuracy is required if it is specified, for example, to the nearest integer should not give an answer of 12.657.

(e) Recognition that candidates needed to substitute 50 into their model and solve for t was required for this question. If a graphic display calculator was used then the appropriate sketch should have been provided with a line at $p = 50$.

(f) There were too few answers to this question to comment.

(g) All candidates need to learn more about validity. The required response was one about at which values of t the model was close to the cumulative frequency curve.

Question 11

(a) Some candidates were able to find this value.

(b) Successful candidates had a good understanding of cumulative frequency.

(c) A few candidates were able to provide a reason that earned credit as to why a second runway should be built. The emphasis needed to be on the fact that approximately half of the planes arrived before the runway was clear and able to be used and therefore had to wait. It was not about how long the planes took to land but about how long the planes had to wait to start to land. Candidates should also make sure that they put yes as well as their reason, to make it clear what their decision is.