CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/12
Paper 12 Non-calculator (Core)

Key messages

To succeed with this paper, candidates need to have completed the full Core syllabus, be able to apply formulae, clearly show all necessary workings and check their answers for suitability. As calculators are not permitted, it is vital that candidates carry out their calculations accurately. Candidates should be reminded of the need to read all questions carefully, focusing on key words and instructions.

General comments

This is the first examination paper for the new syllabus. Compared to previous sessions, this has an increase in number of marks and available time. So, when candidates prepare for this paper using previous papers, they should take this into consideration.

The questions that presented least difficulty were **Questions 1**, **7**, **9(a)**, **11(a)** and **12(b)**. Those that proved to be the most challenging were **Question 10(a)** measure an angle accurately, **Question 12(c)** the *n*th term of a sequence, **Question 14** show a result using indices and fractions, **Question 17** the equation of a line and **Question 20(a)** relative frequency.

In the majority of cases, it could be seen that candidates attempted virtually all questions.

Comments on specific questions

Question 1

Candidates did very well indeed with this opening multiple choice type question. Occasionally, in part **(d)** candidates gave 33 or 39 as the prime number.

Question 2

Many candidates were able to answer this question correctly. Candidates were better at rounding to the nearest 10 than dealing with decimal places or significant figures. Sometimes the answer to part **(a)** only had 1 significant figure or the number was moved around the decimal point but kept the same digits. In part **(b)**, again, the number was multiplied or divided by powers of 10.

Question 3

(a) Many candidates got the correct answer. The most often occurring wrong method gave 16 as candidates incorrectly inserted two pairs of brackets into the calculation to give $(5 + 3) \times (4 – 2)$. Also seen was another incorrect insertion of brackets to give $(5 + 3) \times 4 – 2 = 30$. Candidates must learn the correct order of operations, as it is used in all calculations, and not simply work left to right or add brackets which are not needed.

(b) Candidates performed better in this part of the question. A few gave $3 – 1 = 2$ for the numerator with $4 – 3 = 1$ as the denominator, leading to an answer of 2. Occasionally candidates inverted the second (or sometimes the first) fraction as if this was a division calculation.

Question 4

Here there was 1 mark for each correct answer. The answer of 16 was the one most likely to be correct. The 2 was occasionally given as –2 and the zero as 1.5 or left blank.

Question 5

(a) There were many correct answers here. Some candidates miscounted by missing lengths or going over the same ones twice. A few gave the perimeter (or half perimeter) of the rectangle that would surround the shape, 5 cm by 3 cm. A few added in internal lines and included these. Some did not add information to the diagram so it could not be ascertained what method was being used.

(b) Again, many were correct. There were other answers which occurred when candidates made arithmetic errors.

Question 6

Many candidates were awarded 1 mark for 2^3 calculated correctly. Sometimes the 3s were 'cancelled' to give 125 + 2 = 127. Some gave $8 \times 125 = 1000$ then cube rooted that – this would have been awarded 1 mark for the 8. Also seen was $5^3 + 2^3 = 7^3 = 343$.

Question 7

This whole question was very well done as stated in the general comments. In part **(b)**, there were occasional errors when 1 h 25 min was given as the answer. This may have been an attempt to deal with 1.25 hours.

Question 8

Here, there were two common errors. The most common type of errors were purely arithmetic slips or just the discount was given as the answer. Candidates must make sure they read the question carefully to see what is required, as some percentage questions do just ask for the amount of discount.

Question 9

(a) A very large majority were correct with the value for x.

(b) This was a little more complex than the previous part as x was on both sides of the equation. Most problems were to do with the signs as some wrote $-4 - 1 = -3$. Some wrote that $2x - x = 2x$.

Question 10

Candidates were much better at measuring the length of side *AC* than at measuring the angle *ABC.* For angle *ABC*, some were not accurate enough or used the incorrect scale on their protractor or measured the wrong angle of the triangle. Candidates need to know that if an angle is referred to as angle *ABC*, then this is the angle at the vertex at the middle letter, *B*.

Question 11

(a) A large majority were able to plot point *B* correctly. The most common errors were to plot at (2, 1) or at (–2, –1).

(b) Many were correct for the positioning of their point *B*. A small number gave the point (3, 2). This showed they were not familiar with the term midpoint.

(c) This was not well done. Candidates made errors quoting the gradient formula or, if doing this by counting, forgot that this line has a negative gradient.

Question 12

(a) Many answers were correct here. Some candidates did not know how to express the rule as they included an *n* in their description. A few made errors when subtracting and so gave an incorrect number to subtract. A few wrote, 'Add 13'.

(b) Candidates did well here, correctly giving the next two terms of the sequence.

(c) Finding the *n*th term was complex for many candidates. Many quoted the formula for the *n*th term correctly and then substituted for *a* and *d* incorrectly. This was more complex than some other sequences as it is descending.

Question 13

The factor that should be taken out of each term is $4x$. Some only took out x or the 4. In this situation, the bracket must be correct if a mark is to be awarded. It is not sufficient to factorise out just the 2, instead of the 4; it must be the largest number that is factorised out to be awarded a mark.

Question 14

There is a technique to approach 'show that' questions. Candidates must start with one side of the equals sign, process that and end up with what is on the other side. A few divided both sides by 18 which did not get awarded any marks. Some turned fractions (which are exact) into decimals (which are not) which is not an acceptable method. However, some candidates did set out the full process clearly.

Question 15

Candidates were more successful with the first Venn diagram than with the union diagram. Some said this second one was $P \cap Q$. Candidates must remember to use the correct names of the sets as a few gave their answer to the second diagram as $A \cup B$. A few incorrectly gave $n(A')$ and $n(P \cup Q)$.

Question 16

(a) A large majority gave the correct fraction. A few gave $\frac{4}{3}$ which is number of red marbles divided by number of blue marbles and not a probability as it is bigger than 1.

(b) Candidates needed to multiply their probability from part **(a)** by 140. A few candidates multiplied 4 (the number of red marbles) by 140 rather than the probability giving an answer of 560. If these candidates had thought about this answer they should have realised that it could not be correct. Some worked out the correct expected number and then divided this by the number of times; this cancels down to the probability so it is not the expected number.

Question 17

The equation of a line is an area of the syllabus that many candidates find difficult, in particular where a diagram is not given in the paper. Candidates may find it helpful to draw a diagram to aid them in visualising the situation; very few diagrams were seen. Here, the gradient is equal to that of the parallel line so only the place where the line *L* crosses the *y*-axis needs to be found. Sometimes candidates did not use the same gradient as in the original equation or used $-\frac{1}{3}$, the gradient of the normal to the given line.

Question 18

(a) The question requires that the mean point is plotted and then the line of best fit is drawn through it. Some candidates needed to be more careful in how they plotted the line of best fit as their line should follow the trend of the points and have approximately the same number of points on either side as well as going through the mean point. The line of best fit should not extend much beyond the area of the data, so the large number of candidates who forced their line to go through the origin, often from the top point, were not correct.

(b) In general, candidates were successful at using their line of best fit to estimate what Terry might have scored on his economics test.

Question 19

Candidates did better with part **(a)** than with part **(b)**. This question was not as straightforward as others on indices as the missing indices were within the calculation rather than part of the answer. Some gave 2 then 3 as their answers, showing they did not understand rules for indices.

Question 20

Many candidates find the expected number (see **Question 16**) and the relative frequency fairly complex ideas in probability.

(a) This was the question that the majority of candidates found difficult. Relative frequency is a probability found from doing an experiment many times. The greater the number of times the more accurate the probabilities are. Here, the spinner lands on a 4, 41 times out of 200, so the relative frequency is $\frac{41}{200}$. Many gave 41 as their answer. Others divided by the wrong number of spins as they added up the table incorrectly, even though the total number of spins is given in the question. Some used the frequency of another number instead of 4.

(b) This required candidates to work out the probability of a 1 or a 2. More candidates were successful with this, partly as the question used the word probability. A few gave $\frac{2}{5}$ which is true for a fair spinner but that is not the case here as the frequencies vary greatly. Similarly to the previous part, some gave only 69, the numerator.

Question 21

(a) Many candidates gained 2 of the 3 marks here, for rotation and the centre of rotation. Some gave the wrong angle. An enlargement, scale factor –1, with the origin as centre of enlargement is also correct and was awarded 3 marks. A good indication is that one piece of information is needed for each mark, so if a question has 3 marks available, the answer is most likely to be for a rotation or enlargement with the 2 other pieces of information. Some gave two transformations which is not correct as the question asks for the single transformation.

(b) Many answers were correct. Some candidates moved to a correct point and then did not remember which vertex they had moved and so drew the shape incorrectly. It is a good idea to put a cross on a vertex of the original shape and move that, then the others are easier to plot from the starting plot.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/22
Paper 22 Non-calculator (Extended)

Key messages

This examination was the first of the new syllabus and this paper now requires, on some questions, detailed responses as well as some short 'traditional' Paper 2 questions.

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

Candidates should check their working in each question to ensure that they have not made any careless numerical slips.

Candidates need to be able to describe transformations using correct mathematical terminology.

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 were able to complete the paper in the time allowed.

Some candidates lost marks through incorrect simplification of a correct expression.

Comments on specific questions

Question 1

Nearly all candidates scored this mark; the common incorrect answer was –5.

Question 2

This question was well answered with candidates correctly annotating the number line with an empty circle at –2 joining a solid circle at 3. A small number of candidates had the incorrect shading at the end points and a few did not draw a continuous line between –2 and 3.

Question 3

This question was correctly answered by the majority of candidates.

Question 4

Nearly all candidates gave the correct answer of 7.

Question 5

Many candidates gave the correct answer, with the common mistake being giving the vector in the wrong direction.

Question 6

(a) Most candidates were able to give the multiples of 3, but struggled to identify the set of triangle numbers. A significant number of candidates gave the answer as 3, 4, 5 as the lengths of a right-angled triangle.

(b) Candidates who might have lost a mark in the first part were able to score this mark as they were able to identify the intersection of their two sets in part **(a)**.

Question 7

The majority of candidates drew a factor tree and then wrote the product of prime factors correctly.

Question 8

The majority of candidates scored at least one mark by correctly rounding three of the numbers to one significant figure. Candidates who rounded all four numbers correctly, in general, went on to give the correct answer of 200.

The major error seen was to round 0.5461 to 1.

Question 9

(a) This part was executed very well with candidates using a variety of approaches. If candidates rearranged the first equation to $x = 4y - 7$ and then substituted into the second equation, this avoided dealing with fractions.

(b) Although many candidates knew that the lines were perpendicular, they did not always give the gradients of both lines but merely quoted a generalised statement.

Candidates were expected to give the gradient of the two lines and then show that the product of -4 and $\frac{1}{4}$ is equal to -1, hence the lines are perpendicular.

Question 10

Candidates did well on all parts of this simple probability question.

Question 11

This quite challenging question was very well attempted.

Nearly all candidates scored at least one mark by finding the second differences as 4, and many scored both marks.

Question 12

It was good to see there were only a few candidates who ignored the instruction to describe a **single** transformation.

(a) (i) Most candidates recognised the transformation as a reflection. The common error was to give the line of reflection incorrectly as $x = 1$.

(ii) Candidates did recognise that the transformation was an enlargement and gave the correct centre but the major error was to give a positive scale factor.

(b) Almost all candidates drew the correct image, neatly and ruled.

Question 13

This question was a good test of candidates' ability to find the equations of lines given diagrammatically.

Candidates who correctly identified the equations of the three straight lines were usually successful in stating the correct inequalities.

There was a significant number of candidates who, after finding $x = 5$, could not make any progress on the slanting lines.

Question 14

(a) This part was well answered, the popular incorrect answer was 0.025. Candidates could approach this part by considering $\frac{1}{2} \times \frac{1}{2}$ which would reassure them of the place value.

(b) The majority of candidates were able to cube root 64 correctly and then multiply by 9.

(c) There were many excellent attempts to this tricky question.

It was impressive to see that most candidates were able to rewrite 16^n as 2^{4n}, set up the equation $4n = n - 1$ and solve to find the correct solution of $-\frac{1}{3}$.

Question 15

This was done exceptionally well by nearly all candidates.

Question 16

This question was attempted by most candidates, but not well executed by many of them.

Candidates needed to identify the four surfaces of the solid and add together their areas. Care needed to be taken with using the correct formula for the area of a semi-circle and the circumference, which needed to be halved to find the area of the curved surface. Some candidates gave the area of the base as 12.

Question 17

Most candidates started by finding the gradient of the line, and then substituted this with one of the given points into $y = mx + c$.

It was then very common for candidates to struggle to rearrange this equation into the correct form where a, b and k were integers.

Question 18

(a) Most candidates attempted a correct first step of squaring both sides before adding b.

(b) Good algebraic manipulation was seen in this question.

Most candidates were able to clear the fraction correctly, rearrange to isolate terms in p, factorise and divide to make p the subject. There were some sign errors but nearly all candidates showed good working to score some method marks.

Question 19

This proved to be a difficult question for many candidates.

Candidates did not recognise that the height of the small cone was $\frac{2}{5}h$. Candidates who tried to use a volume scale factor often gave a ratio of $8:27$ as their final answer rather than using $\left(\frac{2}{5}\right)^3 : 1-\left(\frac{2}{5}\right)^3$ and then simplifying to $8:117$.

Question 20

Most candidates were able to calculate the probability of blue and blue without replacement giving an answer of $\frac{6}{72}$**,** which did not have to be simplified to score full marks.

Question 21

(a) The manipulation of surds were used correctly in most cases. The most difficult part appeared to be rewriting $3\sqrt{12}$ as $6\sqrt{3}$ whereas it was more common to see $\sqrt{48}$ or $\sqrt{75}$ correctly converted to a multiple of $\sqrt{3}$.

An issue that appeared in a significant number of candidates' scripts was not using BIDMAS correctly and calculating $6\sqrt{3}-\left(4\sqrt{3}+5\sqrt{3}\right)$ to get an incorrect answer of $-3\sqrt{3}$.

(b) This part was well attempted by many candidates, starting by correctly multiplying top and bottom by $\sqrt{5}+\sqrt{2}$, and then cancelling the resulting expression by 3.

Question 22

This proved to be a demanding question.

Many candidates substituted the two points into $y = ax^2 + bx + c$ and found two correct equations but with 3 unknowns and then could not make any further progress.

Candidates needed to use the vertex of (1, 3) to set up the equation of $y = a(x - 1)^2 + 3$. Using this equation and substituting in (5, 2) resulted in finding $a = 2$.

Candidates could then put $y = 2(x - 1)^2 + 3$ into a simplified form for the quadratic equation.

Question 23

(a) Nearly all candidates were able to find $a = 3$, but finding b proved to be problematic with the popular wrong answer being $\frac{1}{2}$.

(b) There were many good attempts seen.

The majority of candidates were able to rearrange the equation to tan $x = \sqrt{3}$ and use their knowledge of special angles to identify $x = 60$.

Candidates then used the CAST diagram or sketches of the tan graph to identify the other angle of 240 in the required range.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/32
Paper 32 Calculator (Core)

Key messages

Candidates should be encouraged to show all their working out. Many marks were lost because working out was not written down and the answer given to only one or two significant figures.

Teachers should ensure that the candidates are familiar with command words and know how to answer 'show that' questions.

Candidates should have a graphic display calculator and ensure that they know how to carry out all the functions that are listed in the syllabus.

General comments

Candidates attempted all the questions, so it appeared as if they had sufficient time to complete the paper.

In general, candidates appeared to have a graphic display calculator and knew how to use it to draw graphs and find the maximum and intersection points accurately.

Candidates should be aware that, if no specific accuracy is asked for in the question, all answers should be given exactly or correct 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. When working out is shown and is correct, then partial marks can be awarded.

The candidates should be aware that if the question states 'Write down' then they do not have to work anything out. Candidates should practice how to answer 'Show that' questions. In these questions it is essential that all stages of working out are shown. Using the answer given in the 'show that' process is not a correct method and will be awarded no marks.

Candidates should be familiar with correct mathematical terminology.

Comments on specific questions

Question 1

The majority of candidates found the correct change. A few candidates worked out the cost for the 7 cans and then forgot to subtract their answer from $5 to find the change.

Question 2

Many candidates used their calculator correctly to find the correct answer to the calculation.

Question 3

There were many correct answers seen to this question. The most common error was to add –2.5 and 3.2 incorrectly. Some candidates who gave an incorrect answer were awarded a method mark for showing the substitution of the correct values into the equation.

Question 4

There were many correct answers seen. The most common error was giving the answer as 5 m rather than 50 m.

Question 5

(a) Most candidates found the correct value for the mean.

(b) Although the majority of the candidates completed the stem-and-leaf diagram correctly, some did not order the leaf part or else produced an incorrect key.

(c) Many candidates found the correct mode. Fewer found the correct median and even fewer the correct interquartile range.

Question 6

(a) All candidates wrote the correct fraction that was shaded.

(b) Most candidates managed to put the 3 numbers in order of size. However, in a minority of cases 0.4 came before 25%.

Question 7

(a) Nearly all candidates managed to correctly calculate how many Yen Suki had left.

(b) Most candidates were able to correctly convert their answer back into dollars.

Question 8

(a) The majority of candidates managed to simplify the expression correctly.

(b) Candidates found this part challenging. Most candidates managed to gain a method mark for having three of the four terms in the expansion correct and a sizeable minority gave a fully correct answer.

Question 9

A large majority of candidates found the correct number of packets of rice. Most of these also showed their working out clearly.

Question 10

Nearly all candidates found the correct ratio.

Question 11

Using the compound interest formula proved difficult for many of the candidates. A few tried to use the formula but put the 1 + 1.2 all over 100. A few used the simple interest formula.

Question 12

Some candidates managed to gain a method mark for setting out their work correctly but then did not find the final percentage correctly. A few found the difference in the prices but then did not know where to go from there.

Question 13

Most candidates managed to write the number in standard form. The most common mistake was to write 25.6×10^2.

Question 14

(a) Nearly all candidates could name the 3 shapes.

(b) Fewer candidates scored full marks. This was a 'show that' question and the most common mistake was not giving the answer to more than 2 decimal places before writing the answer. It was necessary to give an answer to at least 3 decimal places in order to show that it rounded to the given answer. A few candidates wrote $10^2 + 5^2$ rather than $10^2 – 5^2$.

(c) Most candidates found the area of the circle correctly. A few candidates used 3.14 for π and this resulted in an answer that was insufficiently accurate. Candidates need to use either the button on their calculator or 3.142. Most candidates worked out the area of the rectangle correctly. The most common mistake in finding the area of the triangle was to write $\frac{1}{2} \times 10 \times 10 = 50$.

Question 15

(a) Most candidates managed to show that *H* was 2.8.

(b) Not so many candidates found the correct answer for the volume of the trophy. Some were awarded partial marks for finding the volume of the cuboid or the pyramid correctly. The most common mistakes were to find the surface area of the cuboid or to use $\frac{1}{2}$ rather than $\frac{1}{3}$ for finding the volume of the pyramid.

Question 16

(a) Most candidates appeared to have a graphic display calculator and managed to sketch the parabola correctly.

(b) Similarly, in this part, the parabola was sketched correctly and the maximum point found.

(c) Some candidates omitted the negative sign before 1.57 and a few gave their answers to 3 significant figures incorrectly.

Question 17

(a) Only a minority of candidates were able to show that the angle was 120°. The majority just wrote $2 \times 60 = 120$ without indicating that angles *BAO* and *BCO* were 90°.

(b) Only a few candidates knew how to find the arc length.

(c) Many candidates did not use trigonometry to find the length of *AB* and, of those that did, some incorrectly used sine rather than tan. Some candidates thought it was 2×5.8.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/42
Paper 42 Calculator (Extended)

Key messages

Sufficient working should be shown so that method marks are obtainable even if the answer is wrong. When questions ask for a result to be shown, it is essential to put every step of the working in. Working out should be laid out in a logical order.

Answers should be given to the require degree of accuracy. In general, that is to at least 3 significant figures unless the question says otherwise.

General comments

The standard of work from the majority of candidates was very high, with low scores being rare. Most candidates' work was well set out, but a number laid out the work in a rather muddled fashion. Most candidates worked to a suitable degree of accuracy but again, a number lost accuracy through premature approximation.

Comments on specific questions

Question 1

(a) This was well done by most candidates, but a number omitted the lengths *x* and 3 which were not shown on the diagram. This meant that the answer 5*x* +11 was fairly common. A small number added up the perimeters of the two rectangles ignoring the fact that two sides of the rectangles were not part of the perimeter of the combined shape.

(b) This was very well done with the vast majority getting the correct answer. A few candidates added the two areas incorrectly.

Question 2

The majority of candidates reached the correct answer, but common errors were dividing 108 by 7 or 5 or 2 rather than by 3.

Question 3

Most answers were correct, but a few candidates were unable to give their answer as a mixed number.

Question 4

(a) This too was generally well done. However, a significant number wrote $\frac{1}{3}\begin{pmatrix}6\\12\end{pmatrix}$ as $\begin{pmatrix}6\\36\end{pmatrix}$ leading to an answer $\begin{pmatrix}1\\37\end{pmatrix}$.

(b) A fairly large number of candidates did not understand the modulus notation and gave vectors rather than the length of the vector. A number also used $5^2 - (-1)^2$ instead of $5^2 + (-1)^2$. A few candidates did not give a sufficiently accurate answer.

Question 5

Almost all candidates gave a correct answer.

Question 6

Almost all candidates gave a correct answer, although just a few gave 113°.

Question 7

Almost all candidates gave a correct answer.

Question 8

(a) Most candidates gave a satisfactory sketch.

(b) Marks across the whole range were seen. Most candidates clearly had sketched the correct parabola on their graphic display calculator, as evidenced by their answers, although many did not show the sketch. Many candidates, however, did not give their answers to the required 3 significant figures. Many also gave the incorrect inequality symbols and $-1.73 < x < 0.852$ was fairly common.

Question 9

(a) Almost all candidates plotted the four points correctly.

(b) The vast majority of candidates were clearly able to use their graphic display calculator to reach a correct regression equation but many lost accuracy in their answer. In particular, 0.46 was frequently seen rather than 0.459 or greater accuracy.

Question 10

There were many excellent responses to this question. The majority of candidates were able to write down a correct equation in x and most of those solved the equation correctly. The most common error was to write $\frac{\sum f}{6} = 2.3$.

Question 11

The vast majority of candidates reached the correct answer. Some very impressive work on logarithms was seen but also some used trial and improvement and a very small number used a graphical approach. Just a few left an answer of 22.7 rather than the requested number of whole years.

Question 12

(a) Here a fully worked response was necessary to show the required result. Almost all candidates showed the $41 \times 32 \times 25$ but a significant number did not show the ÷ 1000.

(b) (i) Most candidates gave the correct answer but some with unacceptable accuracy. When a problem arose, it was usually caused by an inability to deal with time correctly. Frequently 1 hour 30 mins was not converted to 1.5 hours correctly.

(ii) The same issues with time were seen here. Most candidates found the 16.4 hours but a number could not convert this to hours and minutes and/or a time of day.

Question 13

(a) This was almost always correct.

(b) There were many correct answers, but some candidates factorised and then omitted the factor 2 in their final answer. It was surprising to see the number of candidates who reached $4x^2 + 8x + 4 - 2$ but followed this up with $4x^2 + 8x - 2$ as their answer. There were many candidates who did not understand the notation and multiplied f(x) by g(x).

(c) This was usually correct and if an error was made it was usually a sign error. A few candidates did not understand the notation and gave $\frac{1}{4x-2}$.

(d) Most candidates reached the answer 5 but many took a long route by finding $f^{-1}(5)$ and then f(1.75). Very few realised that, by definition of an inverse, $ff^{-1}(5) = 5$.

Question 14

(a) This part was answered very well.

(b) This part was answered less well. Many candidates were unsure as to which length was required. Some thought that *DB* was the required length and others that the length of the median was required. A few found the length of the bisector of angle *ADB*. Those that realised that the required length was the perpendicular distance from *D* to *AB* were usually successful with the trigonometry.

(c) Most realised the lengths required to work out the perimeter and many successfully reached the correct answer. Various methods were used to calculate the length of *BC*. Most used the sine rule or the cosine rule and some right-angle triangle trigonometry with the bisector of angle *BDC*. A few, having worked out the required lengths correctly, added the length *BD* in with the other four lengths. A small number of candidates worked with insufficient accuracy to give the final answer to the correct accuracy.

Question 15

(a) Most gave the correct answer, kite. However, a fairly substantial number gave wrong answers such as rhombus.

(b) Most candidates recognised that it was necessary to subtract the area of the triangle *OAC* from the area of the sector, but some only worked out the area of the sector. A number, however, regarded the shaded area as a semicircle with radius 4 or $\frac{1}{2}AC$.

(c) This was well answered by the more able candidates, but many candidates found incorrect lengths. The most common of these were finding the distance of *B* to *AC* or the length of *AB or CB.* Those finding the correct length often used complicated methods which led to success but often lost the final accuracy due to premature rounding in intermediate calculations. That said, many did use the efficient method of finding *OB* and subtracting 4.

Question 16

Most candidates reached the correct answer but a significant number gave $0.8 \times 3 = 2.4$.

Question 17

There were many correct solutions to this question. However, many candidates seemed to be more confident dealing with the algebraic indices rather than the purely numerical one. There were also a number of candidates who reached the correct answer and then either spoilt it or gave a less simplified one than they had already found.

Question 18

(a) There was much good work seen here with work clearly set out and all the required steps shown.

Putting the left-hand side over a common denominator and then eliminating fractions was more common than the more succinct method of multiplying both sides by $(2x - 5)(x + 1)$ as a first step.

Occasional errors and/or omissions, particularly of the zero, led to less than perfect solutions.

(b) Most candidates factorised correctly and reached the correct answers. A few ignored the instruction to use factorisation and used the formula. This was only given partial credit.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/52

Paper 52 Investigation (Core)

Key messages

Candidates should make use of space under a table to show how entries were calculated and gain credit for communication. For communication, candidates should also always show what they type into their calculator for working.

In 'Show that' questions, full reasons are necessary and short-cuts will often result in a loss of marks.

General comments

There were many good skills seen in trying out combinations of angles for polygons to fit around a point. In doing so it is advisable to organise the work on the page clearly. Reasoning that goes clockwise around the answer space is much harder to follow than that which starts top left and goes in columns. Overall, a good level of algebraic work was seen

Comments on specific questions

Question 1

Almost all candidates filled in the correct values about angles around a point. There were a few who gave 180° or did not complete one of the answer spaces.

Question 2

(a) The majority of candidates correctly showed six equilateral triangles making a hexagon. A few interpreted the question as requiring triangles fitting along an edge and so only drew two triangles.

(b) Most candidates showed three hexagons fitting together at a point. Some went further, without penalty, and drew a complete tiling of hexagons. A very small number only showed two hexagons meeting along an edge or at a point.

(c) The large majority of candidates showed the triangles and hexagons fitting around a point. A few candidates did not understand what was required.

Question 3

While most candidates gave the name octagon for the polygon, there were still some incorrect names seen.

Question 4

(a) Almost all candidates were successful in using the formula and substituting the correct number to find the size of the interior angle of an octagon.

(b) The majority of candidates correctly entered the angle sizes for two octagons and a square around a point. A few candidates did not understand 'The sum of angles at a point' and gave answers other than 360 for that.

Question 5

Finding the angles for polygons with 6, 9 and 18 sides was successfully done by most candidates. Many candidates would have improved their mark if they had shown how these angles were calculated. The space under the table and a total mark of 4 gave strong hints that more was expected than just the three numbers.

Question 6

(a) All candidates knew that a decagon had 10 sides.

(b) Almost all candidates knew that an equilateral triangle has angles of 60°.

(c) For full marks it was important to show the working required to calculate the remaining angle: an addition of two angles subtracted from 360 was expected. Some candidates preferred to write an equation in x and again it was still necessary to show the calculation to find x.

(d) A good number of candidates showed how to use the formula and find that their angle of 156° from the previous part gave a polygon with 15 sides. A communication mark was awarded for correctly substituting the angle that they had calculated in part **(c)** into the formula.

Question 7

The same comments apply here as in **Question 6(c)**. In addition, candidates had to find the number of sides of the remaining polygon. The correct final answer was usually seen although candidates could have improved their score by showing complete steps in their working.

Question 8

Again, the same comments regarding finding the angle in the remaining polygon still apply. But in this question there is no such remaining polygon possible and so candidates needed to explain why this was the case.

A popular method was to calculate the number of sides, as in previous examples, and note that the answer was not an integer.

Others made the observation that 117° was not an interior angle, without however giving a reason. The table offered an opportunity for clear communication why this was indeed so, but most candidates made no reference to it.

Question 9

Many candidates correctly calculated the angle of the remaining polygons by subtracting 60 from 360 and dividing by 2. This angle of 150 was then used in the formula to find the number of sides.

Other candidates assumed that the polygon had 12 sides and used a formula to calculate 150 and show that the angles of the three polygons totalled 360. This reverse approach was condoned. However some of these candidates then substituted the 150 into the formula and calculated 12, which was a circular argument.

Question 10

(a) Very few candidates were able to give satisfactory reasons as to why an equilateral triangle and a regular hexagon could not be two of the three polygons fitting around a point. Angles of 180° were seen, either for the sum of the interior angles, or better, for the remaining interior angle. Just stating that the remaining polygon does not have 180° angles was insufficient and reference to the fact that the shape was then a straight line was required.

(b) Candidates had more success in finding the correct number of sides for the third polygon when the second polygon had 9 sides rather than 8 sides. The same method as in **Question 7** was appropriate here and candidates who were successful with that question should have been successful here. Many candidates thought that writing the numbers in the table was sufficient for 5 marks and so did not show a method and gain the communication marks, which accounted for 3 of those marks.

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Question 11

There were many good answers seen showing how to find the three different ways of having a square and two polygons fit around a point. Some candidates wrongly assumed the two polygons had to be congruent while others assumed they had to be different. The question expected both cases.

CAMBRIDGE INTERNATIONAL MATHEMATICS

Paper 0607/62
Paper 62 Investigation & Modelling (Extended)

Key messages

To do well on this paper, candidates needed to write every line of their working particularly in questions that asked them to 'show that'. No step should be missed out nor should two steps be combined into one. Candidates should also be aware of how much follow through there is from one question to the next. Some candidates made it more difficult for themselves by ignoring a formula, model or expression that had been given or found in a previous question and going back to first principles to answer a question. This will also have influenced their timing for the paper.

General comments

Algebraic manipulation was generally good. Areas to look out for are when candidates combine two steps into one, when each separate step is required. See **Question 3**, for example, too often $180 - a = \frac{360}{n}$ was followed immediately by $n = \frac{360}{180 - a}$ instead of the intermediate line of $n\,(180 - a) = 360$. Using information from one question to answer another was key on this paper. For example, the formula for an interior angle was given in the stem of **Question 1**. It was prudent, therefore, to use it in **Question 1(a)** and to use the answer (given in **1(a)**) in part **(b)**. The same formula should have been used in **Question 2** and the rearrangement in **Question 3** could be used in **Question 4**.

Comments on specific questions

Investigation: Regular polygons

Question 1

(a) Most candidates knew that an octagon has 8 sides and were able to show the substitution of 8 for n in the formula given.

(b) Well versed on the requirements for 'show that' questions many used the formula to show that a square has an angle of 90, and then the majority combined this with two times 135 to total the 360 for a point. Occasional use of exterior angles of an octagon was seen. The working was usually clearly laid out.

Question 2

Three marks for three answers in the table could have led to complacency over showing communication. A large majority of candidates correctly assumed that the space below the table was for working out and most showed more than the minimum requirement for the communication mark.

Question 3

Every step needs to be written for a 'show that' question. There were only two clear steps to be taken and the first of isolating the *n* was invariably reached correctly, with some candidates taking three steps of working instead of one to get there. The second move was to multiply by *n* and this is where many candidates took a shortcut which cost them the second mark. These candidates multiplied by *n* and divided by (180 – *a*), the 'swap method', at the same time so the multiplication by *n* was not seen.

Question 4

This question was well answered with most candidates taking the sensible route to find the interior angle of polygon *C* by subtracting 144 + 60 from 360. They then used the rearranged formula from **Question 3** with *a* as 156, to calculate the number of sides to be 15.

Question 5

(a) Many candidates needed more space than was provided for this answer and used the blank page(s) or an additional answer book to continue their working. This was usually because they used many more than the 5 or 6 lines of working that was considered sufficient for the 3 marks. Having combined the terms and added them to equal 360 on the first line, candidates had a choice for the second step. Collecting the three numerical terms to equal 540 or factorising 180 out were the two most popular and acceptable next steps. Subtraction of the numerical values and a division (probably by 360) followed. Some candidates tried to use a common denominator of *pqr* either from the beginning or from part way through. Most of these ended without being able to reach the given equation.

(b) (i) Values of 6 for *q* and *r* were frequently found.

(ii) Few examples were based on the information given, i.e., $p > 6$ and $q \geqslant p$ and $r \geqslant q$. Only those examples that used this information and reached a correct answer were acceptable. A popular correct answer was $\frac{1}{7}+\frac{1}{7}+\frac{1}{7}=\frac{3}{7}$. Popular incorrect answers were $\frac{1}{7}+\frac{1}{6}+\frac{1}{6}$ and $\frac{1}{q}+\frac{1}{r}=\frac{5}{14}$.

Question 6

(a) In this part there were many candidates who used the substitution of 3 for *p*, as given in the question, to show the equation to be correct. Candidates often showed the equivalence to two fractions with a common denominator, e.g., $\frac{3}{6}-\frac{2}{6}$, which although not required in this instance, showed a good understanding of the 'show that' instruction.

(b) This reason required an equation (e.g., $\frac{1}{q}=\frac{1}{6}-\frac{1}{r}$) to then be explained. Many candidates made various attempts at this explanation, most without the equation. They gave the impression that they knew what to do but did not have the skills to make this clear. The most successful gave examples of finding *r* when $q = 6$ and when $q = 7$ or 5.

(c) The table was completed correctly in many cases and the communication was also written by some of the candidates. Most of these gave a correct answer to their fraction subtraction which earned them the communication mark.

Question 7

Most candidates attempted this question and scored a minimum of B1 for one or two correct combinations of sides or angles. One mark for communication was also regularly awarded for $\frac{1}{q}+\frac{1}{r}=\frac{1}{4}$ seen when using the fraction method. Three marks was commonly awarded for this method with three correct answers. Those candidates who used angles usually stated the angles without showing the subtraction sums to find these answers and thus two marks was more often awarded.

Modelling: Street lights

Question 8

(a) With two marks for communication it was important that all stages of Pythagoras were seen. This included the numbers squared and subtracted and the square root. Most candidates remembered to double the radius to give the correct value for d.

(b) Candidates who transferred the new information to the diagram saw almost instantly that d was now 4 + 5. Others used Pythagoras again.

(c) This was well answered because most candidates realised that the greater the d distance the fewer lights were needed.

Question 9

(a) There was only one communication mark for Pythagoras this time and, like **Question 8(a)**, it was commonly awarded. The same few candidates as in **Question 8** omitted to show the square root and used implication for this step. Again, the radius was most often doubled.

(b) This was well answered with most candidates including the correct units.

Question 10

(a) Candidates were asked to draw a diagram as well as to label it. Although 'draw' normally implies accuracy, this was too difficult without the use of compasses. The diagram needed at least one right-angled triangle and then for full marks the two adjacent horizontal lines had to be separately labelled correctly. Many candidates put labels on the opposite sides of the path, not next to each other, or showed the total, as given, by a single arrowed line.

(b) The substitution of given values into the given model did not present a problem. Candidates should take care to extend the square root symbol over the whole of the sum, i.e., over the 6^2 as well as the 6.8^2. The most common error was to add $6.8^2 + 6^2$.

Question 11

(a) Several substitutions needed to be combined to reach this answer. x^2 needed to be replaced by $r^2 + h^2$, L replaced by 0.05 and the two equations put together, as well as the manipulation of $\frac{B}{0.05}$ to get $20B$. The first were quite commonly seen with some candidates showing all the steps to gain the final mark, whilst others skipped from $\frac{B}{0.05}$ to $20B$ without showing how this worked.
Candidates also need to think about how to set out their working clearly. These answers were often jumping across the page and back again or going round in circles which made them difficult to follow.

(b) In many cases the substitution of 10 and 6 clearly led to the correct answer. The most common error was to calculate 100 – 36 rather than 100 + 36 when rearranging the equation.

(c) Many correct answers were seen and further incorrect working after the correct answer was not marked. One quite common mistake was to replace the r^2 in $\sqrt{r^2 - w^2}$ by $\sqrt{20B - w^2}$ instead of $(20B - w^2)$. Another not so common error was to square all the square roots as separate terms, with or without squaring the d. Other candidates also wrote $\sqrt{(20B - w^2)}^2$ which, although accepted, is not good form.

Question 12

The communication marks for both the correct units and the substitution were frequently awarded. The correct answer was also reached by a good many candidates, with 61 gaining a B1 for many others. The inequality was seen very rarely. For the first mark several candidates preferred to go back to **Question 11(a)** and used $x^2 = \frac{3.5}{0.05}$ followed by $r^2 = x^2 - 3^2$. Some candidates, having made a good start, gave the impression that they did not know how to finish this question. A graphing method was used by some. Of those who drew the function of *d*, few used the calculator well enough to give an accurate maximum for *w*. Those who did the complicated rearrangement correctly to make *w* the subject managed to find the answer of 7.8.