MATHEMATICS

Paper 0581/11
Paper 11 (Core)

Key Message

To succeed in this paper candidates need to have completed full syllabus coverage, remember necessary formulae, show all necessary working clearly and use a suitable level of accuracy.

General comments

Candidates made good attempts at answering this paper. In those questions which carried more than one mark, workings needed to be shown in order to access the method marks if the final answer given was incorrect. Along with this entreaty for workings to be shown, candidates must check their work for sense and accuracy. In a similar way, candidates must take notice that if a question asks for the answer as a fraction, a decimal will not do. In one question there was an instruction to give the answer to the nearest dollar – this was not followed by many candidates.

The questions that presented least difficulty were 1, 2, 5, 6, 8 and 16. The questions that proved to be the most challenging were 4, 7 10, 13 and 19.

Some of the part questions towards the end of the paper were often left blank, which was not likely to be a time issue. The part questions over the whole paper that were the most often omitted were 12**(c)**, 16**(c)**, 18**(c)**, 19**(b)(ii)** and 19**(c)**.

Comments on specific questions

Question 1

This was a straightforward start to the paper where candidates were expected to find 55% of 1540. Some candidates misunderstood the question and did unnecessary work subtracting the correct answer of 847 from 1540 or finding 45% directly instead.

Answer: 847

Question 2

The most common wrong answer for **part (a)** was 2376. A few candidates reversed the last two digits to give 20367. However, the mark for **part (b)** was open to all if they correctly followed through their answer to **part (a)** – this was the only part question on the paper where all candidates gave an answer.

Answers: **(a)** 20376 **(b)** 20400

Question 3

This question was more challenging. Candidates had to understand the vocabulary as well as work out what type of symmetry was being referred to. Neither part was well answered. Often for **part (a)** candidates drew an isosceles triangle and so gave 1 line of symmetry and for **part (b)** 2 was the most popular wrong answer.

Answers: **(a)** 3 **(b)** 3

Question 4

Many knew the trapezium but were less sure about the parallelogram, many giving rhombus as their answer. Even some of the more able candidates appeared not to be familiar with the names of these basic shapes.

Answers: **(a)** Trapezium **(b)** Parallelogram

Question 5

This was a very straightforward ratio question when the value for only 1 part out of the total was required. The slight complication was that the amount of money needed was for Naomi, the second named, rather than Mark, the first named. Most incorrect answers were either $500 (Mark's amount of money), $120 (from 600 ÷ 5 rather than 600 ÷ 6) or both amounts given, ie, $500: $100 when candidates were expected to give the one answer.

Answer: 100

Question 6

This was another straightforward question so those that knew the formula for area of a circle gained both marks. Some candidates used the formula for the circumference of a circle. A few candidates squared pi as well as the radius.

Answers: 124

Question 7

Many candidates only obtained the mark for the figures 54. Only a small number gave the correct answer of 0.54 km, showing that many had problems converting from centimetres to kilometres. Some candidates attempted to divide 20000 by 2.7 instead of multiplying.

Answer: 0.54

Question 8

This question was generally well answered, **part (a)** better than **part (b).** Only occasionally did candidates write 4^{10} and/or 6^{9}. Sometimes 6 was given as the answer for **part (a).** It was not always the case that candidates got 2 or zero marks with many only successful with **part (a).** This question did not have the complexity of negative indices.

Answers: **(a)** 10 **(b)** 9

Question 9

Candidates found this question quite challenging, partly as they had to deal with two sections of the syllabus, angle facts and algebra. Many did not attempt it or had totally unrealistic responses for the size of the angle *x*. Only a few candidates put clear and correct expressions on the diagram. For some candidates maybe there was too much choice of where to add to the diagram to help them form an equation to solve. There were five straight lines (where the angles summed to 180°) that could have been used as well as two places where angles round a point would give the correct answer. A few thought that there was an angle of 90° made up by a 2*x* and *x* on the right of the diagram. Some were confused when their angle did not come out as a whole number. For a few, their error was in adding up the number of x's and so equating 7, 9 or 10*x* to 180. An answer given in degrees and minutes scored full marks

Answer: 22.5

Question 10

There were many correct responses to this question with about half of all candidate getting full marks showing their confidence with the topic and methods of solving simultaneous equations. However, some produced a value for x or y that was not a simple number but still went on to the end of their method. The answer to simultaneous equations will generally be simple values (both positive and negative) and candidates should recognise that if their values are of a complex kind then they are likely to have made errors. This is one situation where candidates can check their work (by the method of substituting their values into both equations).

Answers: (x =) 13 (y =) –9

Question 11

Those who could do subtraction of fractions usually got this correct. Some left their answer as $2 - \frac{5}{12}$ instead of a fraction, as required. In this question, one fraction was given in twelfths already so the $2\frac{1}{6}$ only needed to be converted to twelfths once the mixed number had been dealt with. There were various different ways candidates could gain the method marks depending on their approach. Candidates should be made aware that in questions when the paper says, 'without using a calculator', an answer with out workings scores zero marks. Zero marks were also awarded to those candidates who did the whole calculation in decimals and turned that back into fractions at the end.

Answer: $1\frac{7}{12}$

Question 12

Part (a) was the most successful for candidates. The most common incorrect answer was 1738.2, but other incorrect roundings or truncations of the given number were seen. Some candidates changed the position of the decimal place. In **part (b)**, some candidates wrote out the number in words when the length of the answer line should have told them that a shorter length answer was expected. This could be a misunderstanding or a lack of knowledge about standard form. Other candidates gave 287×10^2 as their answer. This was one of the most straightforward questions on standard form as it did not involve negative indices. Although many candidates left **part (c)** blank, those that attempted it were more successful than in **part (b)**. Candidates were only asked for one bound not both, and lower bound is the easier concept to understand. Incorrect answers seen were 3.5, 6.0, 6.75 and 6.95.

Answers: **(a)** 1738.3 **(b)** 2.87×10^4 **(c)** 6.5

Question 13

Compound Interest is a more complex topic than Simple Interest. The use of the CI formula is unnecessary but some candidates tried to use it, many incorrectly. Some candidates who did get to the correct total amount of money forgot about the instruction to give their answer to the nearest dollar.

Answer: 3245

Question 14

Many candidates gave the correct time in **part (a)**. The most common incorrect answer was 07 01. Candidates had to realise their calculated time represented a time the next day as that is what they were told in the question. **Part (b)** solicited only half the number of correct answers as **part (a)** with the conversion of 10 hours 33 minutes to 10.55 being challenging for many candidates. Those candidates who knew the formula for average speed, and made the appropriate substitutions, managed to score some marks. Quite a few candidates only wrote down an incorrect answer and therefore could not score the method marks as there was nothing there to credit. It was pointed out in the general comments that workings can score marks when answers are wrong and candidates should take note of how many marks are available for each part of a question.

Answers: **(a)** 08 01 **(b)** 78.4

Question 15

Most candidates answered **part (a)(i)** correctly. However there were many and varied incorrect responses to **part (a)(ii)** including 3:09 pm or 1509. These two answers were 9 minutes (the previous answer) after the time Janine gets to the station. The two parts about the temperature table were better answered. **Part (b)(i)** was almost the best handled question on the paper with most candidates giving one of the two acceptable answers to the comparison for January. Slightly less well answered was **part (b)(ii)** when candidates had to make a comparison between cells in the table that were not next to one another.

Answers: **(a)(i)** 9 **(ii)** 15 03 **(b)(i)** 7 or -7 **(ii)** 17

Question 16

Part (a) was very well answered. For **part (b)**, the angle could be found without reference to the context of pie-charts. Candidates needed to compare the 16 people with 96° to get the relationship to find the number of people represented by 60°. The numbers given by candidates varied greatly and without working it was hard to identify specific errors. That part led into a question about the total number in the survey. If candidates followed through their answer to **part (b)**, they gained the mark, but again workings were few and far between. **Part (d)** could be done in two ways and a correct follow through of their previous answer scored the mark. The giving of marks on follow through is not a reason for candidates not to check their work. There was no need for candidates to simplify their fraction answer as that was not an instruction in this question.

Answers: **(a)** 84° **(b)** 10 **(c)** 60 **(d)** $\frac{16}{60}$

Question 17

Parts (a) and **(b)** were not as well answered as **parts (c)(i)** and **(ii)**. In **part (a)** some candidates gave the vector **BA** or reversed the *x* and *y* components. Again, for **part (b)**, candidates made the same errors as with **part (a)** but also some put point C at (–3, 1). Candidates in general handled the directed numbers well but there were some instances of only a single number in the vector brackets.

Answers: **(a)** $\begin{pmatrix} 6 \\ 2 \end{pmatrix}$ **(b)** C marked at (1, 2) **(c)(i)** $\begin{pmatrix} 4 \\ -3 \end{pmatrix}$ **(ii)** $\begin{pmatrix} -12 \\ 4 \end{pmatrix}$

Question 18

Many candidates started well with **part (a)** and then found the other two parts more demanding. A large number of candidates seem to have difficulty identifying angles denoted by three letters and this is often the cause for failure in these questions. There were some unrealistic responses to the angles in this question – even when drawn inside a circle, triangles do not have a sum of more than 180°. Candidates should realise that although the diagrams are not to scale, the sizes of angles are close to those stated or required. Again lack of working was evident even with the more able candidates. In **part (c)** many did not realise that triangle OCB was isosceles. It might help candidates if they write their answers to previous parts in the diagram.

Answers: **(a)** 66° **(b)** 114° **(c)** 33°

Question 19

Some candidates knew the answer to the number of aeroplanes Piet had but had difficulties answering with algebraic expressions. If candidates did manage to give the two expressions in **part (a)**, some forgot to add in the extra *x* for **part (b)**. This left candidates solving an equation that would not give a whole number answer. Some forgot that they were dealing with a real-life context giving the number of aeroplanes Piet had as 6.25 and 13.25 for Rob as seen from candidates who did not go back to check and correct their work.

Answers: **(a)(i)** $x + 7$ **(ii)** $3x$ **(b)(i)** $x + x + 7 + 3x = 32$ **(ii)** 5 **(c)** 12

MATHEMATICS

Paper 0581/12

Paper 12 (Core)

Key Message

To succeed in this paper candidates need to have completed full syllabus coverage, remember necessary formulae, show all necessary working clearly and use a suitable level of accuracy.

General comments

The paper was a fair test of basic skills at core level and there was a wide range of marks achieved by the candidates. There were no questions on the paper that could not be tackled by candidates who had been well prepared for the examination.

Many marks were lost by some candidates who did not take the time and care to read the questions in order to understand what type of answer was required. Also if they had looked at their responses in the light of what the questions asked they may have often found that they were unrealistic.

An unusual feature of many scripts was the significant number where little or no attempt was made on the last two questions. Sometimes too much time is spent on certain questions, leaving not enough time to complete the paper, but usually lack of time is not a problem. It is important that candidates ensure they attempt all questions, in particular those towards the end of the paper with high marks, and some of those marks usually very straightforward to gain.

There is a gradual improvement in working shown but as always there is room for improvement from many candidates. All questions with more than 1 mark will have at least 1 mark for the working and it is in the interests of candidates to show this working. In particular, when a calculator is used the calculation to be performed should be written down as this not only ensures the method mark, but makes it less likely that an error is made on entering the data into the calculator. All working should be shown on the question paper in the space provided.

Sometimes candidates write a corrected number over an incorrect one, making it very difficult to recognise what is intended. Corrections should be made with a clear line through the incorrect and the intended response clearly shown. Clear figures and working steps are improving but are still not evident on all scripts.

Comments on specific questions

Question 1

Whilst many candidates gave the correct answer, showing an understanding of the terms ‘square number’ and ‘cube number’, a large minority gave an incorrect answer or left it blank. With only two square numbers between 50 and 100 the incorrect 81 was often chosen. Some perhaps realised the correct response but gave 8, 8^2 or 4 as the answer.

Answer. 64

Question 2

Most candidates either realised the properties of parallel lines or deduced that the angle required was the same as that given, even though the diagram was not to scale. As a result this question was well answered, although there were a number of responses of 128°.

Answer. 52

Question 3

This question was answered well, with very few candidates giving the unacceptable forms of probability. The common error in part **(a)** was to give $\frac{1}{10}$ and $\frac{2}{10}$ but not adding them to give the single fraction answer. While most candidates in part **(b)** appreciated that the letter E was absent from the word, some gave none or impossible when an actual value was required.

Answers: **(a)** $\frac{3}{10}$ **(b)** 0

Question 4

The question on upper and lower bounds still seems to be one that candidates find difficult. Candidates need first to realise that the answers must end in a '5' and then the number of decimal places needs to be one more than the accuracy stated in the question. Of those who made some progress, 58.34 for the upper bound was often seen.

Answer. $58.25 \leq d \leq 58.35$

Question 5

Candidates are generally providing better answers for this type of question than in the past, with most realising that since the answer was given in the question, a calculator was not going to help and full working should be shown. The vast majority knew that conversion to improper fractions was needed and showed this before the step of inverting and multiplying was shown. Unfortunately some went into decimals, which is never credited with the four rules questions on fractions. Showing correct cancelling or reducing a fraction to its simplest terms were the ways to complete the proof.

Question 6

Although some candidates did manage to select the correct value without working, the way forward on these questions is to change all to decimals. This question was a little different as it was not smallest or largest required but the one between two fractions. Consequently the question seemed to confuse many and some correctly evaluated $(0.8)^2$ but then didn't recognise it as the correct answer.

Answer. $(0.8)^2$

Question 7

Apart from the basic calculator process, two skills were tested here, namely rounding and changing to standard form. Many achieved one of these but found it difficult to cope with both. Common incorrect answers were 5508, 55.08×10^2 or 5.508×10^3. Others gave the correct figures 551 but with no, or an incorrect, attempt at standard form.

Answer. 5.51×10^3

Question 8

Many candidates gave several unnecessary calculations for this conversion and although a correct one could be seen, it often did not lead to the correct answer. The converted cost was often given as the answer.

Answer. Euros from correct working

Question 9

Whilst one of the marks was often gained in this question, not many candidates achieved full marks. The common response 4^{-24} gained no marks as the x was absent. x^{24} was often seen and at times the correct answer was spoilt by an erroneous attempt to convert it to a fraction.

Answer. $4x^{-24}$

Question 10

Many candidates were successful on this question, although some cases of over approximation led to an answer of 14. Some candidates seemed to be confused by the triangle having the right angle at the top, rather than the more usual between horizontal and vertical lines. As a result, many who realised Pythagoras' theorem was required simply squared and added. Trigonometry was attempted by some who usually did not achieve a correct answer.

Answer. 14.4

Question 11

Many candidates did achieve the correct answer or at least realised that the café was open for 15 hours on Saturday. A major problem in part **(a)** was working out the number of hours worked from 06 00 to 22 00 which was often 17 hours. The several stages involved in the question was often difficult for less able candidates.

In part **(b)** some candidates clearly achieved the correct answer by simply adding 4 (from 4%) to the former closing time of 13 00. However many candidates found this part difficult.

Answers: **(a)** 07 00 **(b)** 17 00

Question 12

Without a specific point *A* placed on the grid, few candidates made use of the facility. Many clearly did not know that the corresponding components simply needed to be added in part **(a)**. It was clear that many did not know or understand the topic of vectors and many did not respond to the question. In part **(b)** many did not appreciate that the components simply changed signs and it was common to see the components reversed.

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

Question 13

Whilst some candidates answered well, it was very common to find candidates who did not recognise the requirements of the three parts of this question. They need to understand that only part **(c)** requires the use of a calculator. Rounding to one significant figure was poorly done, often being interpreted as rounding to the nearest whole number. It is good practice before working out with a calculator to form an estimate of the order of the answer by means of an approximation and this was being tested formally in this question. Since many didn't seem familiar with this practice, they were confused by parts **(a)** and **(b)** meaning that they were uncertain what to do in part **(c)**. In this part many just simply entered the values as stated with no reference to order of operations. Many candidates lost the second mark in part **(c)**, which required the first decimal place figure of 0 to give a fully correct response.

Answers: **(a)** $\dfrac{80}{20 - 4 \times 4}$ **(b)** 20 **(c)** 14.0

Question 14

Part **(a)** was answered correctly by most candidates although some gave a list of even numbers. Given three factors were required between 2 and 18 seemed to help many who often struggle on deciding between factors and multiples. Again part **(b)** was made more straightforward by following on from part **(a)** resulting in a good response from candidates. Some did include one or more of 6, 9 and 18 showing a weakness in understanding of prime numbers. In part **(c)** some candidates who understood multiples lost the mark by not observing that the question specified multiples between 50 and 100. Others gave factors again but overall this was answered well.

Answers: **(a)** 3, 6, 9 **(b)** 2, 3 **(c)** 54, 72, 90

Question 15

This was generally well answered although some candidates added, rather than multiplied, to expand the first bracket. The more common error was made in the final term of $-4y$ instead of $+4y$. Most candidates gained 1 mark from a correct expansion of the first bracket or a correct resolution of the terms in x. Very few tried to simplify further a correct answer.

Part **(b)** was answered well with many correct responses seen. The errors were usually only partial factorisation or a slip in one of the terms. Once again, observing the word 'completely' and 2 marks for the question should indicate to candidates that there were 2 factors required.

Answers: **(a)** $2x - 11y$ **(b)** $3x(2x - 3y)$

Question 16

Most candidates realised that trigonometry was required for the solution but some chose cosine instead of sine. Unfortunately some lost a mark by presumably rounding 17.546 to 17.55 and then 17.6 to 3 significant figures. With just 17.6 seen only the method mark could be awarded.

Part **(b)** was not so well answered as candidates seem to find more problems in trigonometry questions that require an angle to be calculated. Many assumed that angle *ADC* was a right angle even though the diagram was not to scale and there was no symbol at the vertex *D*. Of those who used inverse tan there were some who did not use brackets to isolate the division, once again emphasising the importance of the correct use of the calculator, this time for the solution of trigonometry questions. Rounding to 2 significant figures, 20, was also seen, without a more accurate answer stated.

Answers: **(a)** 17.5 **(b)** 20.38 to 20.44

Question 17

The unfamiliarity of this style of question confused quite a number of candidates. Although many statements about the line *BC* were given, the only relevant one to all the information given in the question was that it was recognised as the diameter of the circle.

In part **(b)** many found the base angle 63° of the isosceles triangle but could not then continue to find the required angle. There still seems to be a problem for many candidates in defining an angle given by three letters. Since this occurs in many geometry questions, it is an important part of teaching the course.

Answers: **(b)** 27°

Question 18

This question required two standard constructions although the second was put in terms of the locus. Part **(a)(i)** was quite well answered but again the 3-figure notation for the angle caused many to bisect angle *A* rather than angle *B*. Arcs were usually seen but sometimes very faint.

In part **(a)(ii)** many joined point *C* to the midpoint of *AB*. Even though this part was defined by the locus, it was still a compass construction and not a protractor measurement which a number of candidates did. Two sets of arcs were required to define the correct construction. A vertical line from the midpoint of *AB* was also common.

The region to be shaded was a little difficult to define with such a small triangular part not included. However, those candidates who didn't gain the mark usually did not attempt it or did not qualify due to incorrect or missing parts of the constructions.

Question 19

Reading of grid scales and question stems were the reasons for most loss of marks on this question. While there were many fully correct responses there were also many candidates who left answers blank.

In part **(a)(i)** 10 was a common wrong answer, probably from counting the 5 lines rather than the 4 spaces. Again in the following part many could not correctly work out the subtraction of the two distances.

Many correct answers were seen although some completely misunderstood part **(b)** by assuming that Samantha's journey had to follow the same shape as Joel's even though the stem makes it clear that it only required a single line. 14 minutes later for her start time was also not observed by many candidates and there was a great variety of responses, although most managed to correctly position the other end of the line at the school. Although follow through marks were often awarded in the final three parts many put the time of the bus passing Samantha as before it reached the bus stop, which was not allowed. Many did gain the final mark, either for the correct value or from their own graph.

Answers: **(a)(i)** 8 **(ii)** 7.8 **(b)(ii)** 07 38 to 07 40 **(iii)** 5.8 to 6.4 **(iv)** 17 to 19

MATHEMATICS

Paper 0581/21
Paper 21 (Extended)

Key Message

To succeed in this paper candidates need to have completed full syllabus coverage, remember necessary formulae, show all necessary working clearly and use a suitable level of accuracy.

General comments

The level of the paper was such that all candidates were able to demonstrate their knowledge and ability. There was no evidence at all that candidates were short of time, as almost all attempted the last few questions. Candidates are showing evidence of good work in percentages, standard form, simultaneous equations and working with average speed. Candidates particularly struggled this year with the two questions related to volume and area scale factors, namely **Question 6** on similar shapes and **Question 13b** on using the scale on the map. They also found the two 'show that' questions quite challenging, namely **Questions 16a** and **18b**. Not showing clear working and in some cases any working at all remains a concern this year, although there is evidence that this is improving. More candidates were giving their answers to the correct degree of accuracy than in previous years, although this was still an issue with some candidates. Candidates need to read the general rubric carefully at the start. They also need to make sure that they have noted the accuracy requirements of particular questions in their checks at the end of the paper.

Comments on specific questions

Question 1

This was generally a well answered question by the majority of candidates. A small number of candidates misunderstood or misread the question and found the number of empty seats, so consequently the answer 693 was occasionally seen. Most candidates were able to correctly work with percentages.

Answer: 847

Question 2

This question proved to be a good discriminator. More candidates were successful with the $(A \cap B)'$ diagram as they were familiar with $(A \cap B)$ so shading the complement of that was more straightforward for them. A common error in the $A \cup B'$ diagram was to have the region $A \cap B$ unshaded. Diagrams were more clearly shaded compared to previous years with more candidates using pencil and making it clear which regions were shaded and which were not.

Question 3

This was generally well answered, particularly by those candidates who knew how to use the x power button on their calculator. There were a number who showed no working, keying it straight into the calculator, which is acceptable if they obtain the correct answer. If they did not obtain the correct answer there was no opportunity for a method mark by doing this. Showing working by completing the calculation in stages, for example writing $3 \div 1/16$ as an interim stage in their working, would ensure the maximum number of method marks were obtained in the event of keying something wrongly into the calculator. This would also prove to be a good check. There were a few candidates who misunderstood the indices and therefore $81^{0.25}$ was sometimes calculated as $81 \times 0.25 = 20.25$, although 4^{-2} was not very often seen as -8.

Answer: 48

Question 4

Candidates were more successful with part **(a)** than part **(b)** with the best working from those who wrote m + 2 = 12, and going on to solve this. A common wrong answer was 6, arising from the misconception that indices are multiplied. Part **(b)** proved to be more of a challenge for some, with a number of candidates not realising the key step of rewriting $\sqrt{6}$ as $6^{\frac{1}{2}}$. Some attempted to work in decimals.

Answers: **(a)** 10 **(b)** 5.5

Question 5

This was generally a well answered question with the majority of candidates correctly answering part **(a)**. Some candidates multiplied by 60 instead of calculating 24 x 60 x 60, therefore 1440 was a common wrong answer. Part **(b)** was generally answered well too. Some candidates used incorrect notation for standard form and therefore 864×10^2 was a common incorrect answer. A negative power was occasionally seen.

Answer: **(a)** 86400 **(b)** 8.64×10^4

Question 6

This question was a good discriminator. A small number of candidates realised that they needed to use the volume scale factor of 3^3. Unfortunately some of these then wrongly wrote $3^3 = 9$ so 36 was a common wrong answer (which also arose from those using the area scale factor of 3^2). Few candidates were able to work with the correct scale factor. The majority of candidates wrote the answer 12, using the length scale factor of 3.

Answer: 108

Question 7

Candidates generally did well on this question with the most success from those who either sketched a diagram to find the lengths 12 and 5 followed by Pythagoras' Theorem, or who used the formula $\sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$. There were a number of candidates who attempted to use an incorrect formula with the – and + signs being either incorrect or missing. Some candidates were unable to deal with the negative coordinates. A small number found the equation of *QR* or gradient of *QR*.

Answer: 13

Question 8

This question was generally well answered. The most successful candidates were those who rearranged leaving their answers as exact, i.e. $r = \sqrt[3]{\frac{1260 \times 3}{4\pi}}$. This way there was no opportunity for premature rounding. Some candidates struggled with rearranging, particularly dealing with the fraction $\frac{4}{3}$. The premature rounding problem that was most frequent was to divide by the rounded 1.33, which leads to a final answer of 6.71. Another frequent error was to square root instead of cube root. A few candidates were also seen to be subtracting values from 1260.

Answer: 6.70

Question 9

This was generally a well answered question with the majority of candidates correctly applying their knowledge of corresponding or alternate angles. Some candidates were able to correctly write the expression 2x + x + 5x = 180 then seemed unsure where to go from here and did not go on to simplify their expression to 8x = 180. The most common mistake was to make assumptions or to measure the angles, for example
5x = 90 followed by x = 18 was commonly seen. Candidates need to be aware of diagrams that say 'not to scale' as answers can never be gained by measuring.

Answer: 22.5

Question 10

This was generally a well answered question, with the most success coming from those using the elimination method. Many candidates realised they were only required to multiply one of the equations by a constant and they eliminated the y variable in the first stage of working. Some eliminated the x variable by multiplying both equations by a constant. The candidates who attempted to eliminate the x variable seemed less able to use consistent subtraction, having trouble dealing with the negative y coefficient in the second equation. A few candidates used the substitution method, some of them doing this well. The most common error when using the substitution method was to multiply out the brackets incorrectly. Therefore 2x - 3(30 - 3x) = 53 was often wrongly followed by 2x - 90 - 9x = 53.

Answer: x = 13 y = -9

Question 11

Upper and lower bounds remains a topic that candidates struggle with. However less errors were seen this year than previous years. There are still candidates who find the area or perimeter and then apply the bound to the answer. Part **(b)** proved more difficult with many candidates rounding their answer. In this case the lower bound is an exact answer and should be written in full. Candidates were generally showing their working therefore obtaining the method mark for identifying lower bounds even if they made errors in the calculations.

Answers: **(a)** 85.8 **(b)** 456.8625

Question 12

Most candidates successfully answered part **(a)**. Common incorrect answers seen were 7 01, 7 61, 8 01 p.m. or 20 01. Candidates should note that writing a.m. is not necessary in 24 hour clock (candidates were not penalised for doing this). In part **(b)** the majority of candidates used the correct formula for speed. Dealing with the time of 10 hours and 33 minutes proved more challenging with the usual problem of not being able to decimalise time occurring. Therefore a common wrong answer was: 827 ÷ 10.33 = 80.1 Another common incorrect answer was to divide 827 by the answer to **(a)** instead of 10.55. Reading the question more carefully would have helped here.

Answers: **(a)** 08 01 **(b)** 78.4

Question 13

In part **(a)** the majority of candidates realised that they needed to multiply 2.7 by the scale factor of 20000. The problems then arose from attempts to convert this to kilometres, the most frequent error being to only divide this answer by 1000 instead of 100000. Therefore 54 was a common incorrect answer. Part **(b)** proved to be more of a challenge with most candidates using the length scale factor in their calculations rather than the area scale factor. There were also additional problems with the conversion of m^2 to cm^2 here.

Answers: **(a)** 0.54 **(b)** 1.61

Question 14

This question was answered well by many candidates, with the most success coming from those who used the quadratic formula to solve the equation. Many had learned the formula correctly and read carefully the accuracy requirements in the question. Quite a few candidates left their answers in surd form i.e. $\frac{-3+\sqrt{57}}{4}$ and $\frac{-3-\sqrt{57}}{4}$ or to 1 or 3 decimal places. The question asks for answers to 2 decimal places. A number of candidates had problems dealing with the negatives and quite a few had not remembered the formula correctly or were confused between which coefficients were a, b or c. Very few candidates attempted to complete the square in order to solve the equation.

Answer: – 2.64, 1.14

Question 15

Candidates did well in part **(a)** generally taking all regions into account when calculating the value of x. 9 was a common incorrect answer arising from ignoring the 5 candidates who played no instruments at all. Part **(b)(i)** was generally well answered with most candidates demonstrating a clear understanding of Venn diagrams. Part **(b)(ii)** and part **(c)** were similarly well attempted with many candidates realising in part **(c)** that the denominator was no longer 36. However 8/36 was a common incorrect answer. There were a few candidates writing their probabilities as ratios, which are incorrect. Also not accepted is the notation '11 out of 36'. Probabilities must be written as fractions, percentages or decimals. If candidates write their probabilities as decimals or percentages they must be to 3 significant figures. Candidates are better off writing their probabilities as fractions in this case as they are then exact answers. Some candidates lost the marks due to rounding.

Answer: **(a)** 4 **(b)(i)** $\frac{12}{36}$ **(b)(ii)** $\frac{11}{36}$ **(c)** $\frac{8}{15}$

Question 16

This question was a challenge for many candidates. Part **(a)** was answered well by some with the most success coming from those who remembered to put brackets around the $\left(\frac{k}{2}\right)^2$. Since this is a 'show that' question we are looking for great accuracy in the working. Many candidates stated that k was the radius and therefore were unable to reach the stated formula. Many candidates were able to obtain one or two of the method marks from part **(b)**, particularly the dividing and square rooting mark. The greatest difficulty encountered was that many candidates were unable to deal with the fact that the k appeared more than once. Only a small number of candidates realised the first step is to factorise. A few candidates did this by subtracting 3.142 from 4 therefore obtaining 4A = 0.858k^2. They missed out on the first factorising mark since this is not exact. Then most went on to obtain the following two marks for correct division and square rooting. This method should not be encouraged as it does not solve the problem of rearranging if, for example, it had been a letter and not $-\pi$ in front of the second k^2.

Answers: **(b)** $k = \sqrt{\frac{4A}{(4-\pi)}}$

Question 17

In part **(a)** the majority of candidates had learned that a tangent meets a radius at right angles and successfully calculated angle *AOT*. There were a few who assumed that triangle *OBA* was equilateral and wrote that *AOT* was 60°. Whilst part **(b)** was answered well by many, the circle theorem that the angle on the circumference is half the angle at the centre is less well known. Part **(c)** was the least well answered of the three parts as many candidates either forgot that triangles *OAB* (or *OCB*) were isosceles. If they did remember many candidates wrote *OBA* as 66 assuming *OBA* and *BOA* were the equal angles. Another common incorrect method seen was to assume that *AB* bisected angle *OAT* and *OAB* was often written as 45°.

Answer: **(a)** 66° **(b)** 33° **(c)** 123°

Question 18

Candidates had more success in part **(a)** than part **(b)** with many able to successfully find the required vectors. A few candidates did not understand the concept of vectors and tried to square and add (as if a Pythagoras question). To have more success candidates need to be aware that the direction is vital to the sign of the vector since **q** + **r** and **r** – **q** were common incorrect answers. The best answers in part **(b)** were from those candidates who showed clearly a route from *M* to *X*. Those candidates showing direction arrows tended to make fewer errors with signs. Some simply halved their answer to **(a)(ii)** which wasn't showing that X is the midpoint of *MS*. For some candidates the ratio caused difficulty and QX was taken as 1/3 of *QR* rather than 1/4 of *QR*.

Answer: **(a)(i)** – **r** + **q** **(ii)** ½ (3**q** – **r**)

Question 19

Part **(a)** was answered well by the majority of candidates with most realising that seconds was the required units and that the time on the graph was in minutes. In part **(b)** many candidates were able to obtain at least 2 of the 3 marks with most realising that they needed to work out the area under the lines. There were fewer candidates this year writing distance = speed x time, which is the incorrect method often seen. The problems that occurred were mainly to do with the scale. Therefore a common incorrect answer was 165 (arising from not converting the time into seconds). The candidates with the most success worked out the area of the trapezium. Those who split the area into two triangles and a rectangle were more likely to make an error somewhere in the calculation - the most common being calculating the rectangle area as 15 x 10 (x 60) instead of 15 x 8 (x 60). In part **(c)** many candidates realised the gradient was required. Again the scale proved a challenge for some, although they were still able to obtain the method mark, with the common incorrect answer of 7.5. A few candidates were using the rearranged formula $v = u + at$ equally well. Some candidates performed the calculation the wrong way round so 8 was a common incorrect answer. The most successful candidates read points a fair distance apart carefully from the graph i.e. the two points: (0,0) and (120 seconds,15). Some used intermediate values read off from the graph instead of 15 and 120 thereby introducing accuracy errors.

Answer: **(a)** 480 **(b)** 9900 **(c)** 0.125

Question 20

Nearly all candidates were successful in part **(a)(i)**. A small number of candidates misunderstood the question and attempted to solve g(x) = 6. Part **(a)(ii)** proved more challenging. The unsimplified $(2x)^3$ did not score the mark, since $(2x)^3$ in the working was frequently followed by $2x^3$ or 8x on the answer line. In part **(b)** the most success came from candidates who worked in stages. There are still quite a few candidates working out f(x) x g(x) instead of fg(x). There were also a few candidates who found gf(x). Some candidates obtained the first mark for the correct working: $(2x - 3)^3 = 125$ then they were unsure how to proceed. There were many attempts to multiply out the brackets with the incorrect $8x^3 - 27 = 125$ being commonly seen. Part **(c)** was well answered by a large number of candidates. Those who were most successful were the candidates who began with interchanging the x and y. There were occasional slips in the rearranging or the order of rearranging with two common incorrect answers being: $\frac{x-3}{2}$ or $\frac{x}{2}+3$. Candidates need to be careful how they write their algebraic fractions since it was common to see a diagonal dividing line instead of a horizontal one. When you see $x+3/2$ it is very difficult to distinguish whether this is the correct $\frac{x+3}{2}$ or the incorrect $x+\frac{3}{2}$. There are quite a number of candidates who misunderstood the notation $g^{-1}(x)$ and instead found $[g(x)]^{-1}$ or –1 x g(x).

Answers: **(a)(i)** 9 **(ii)** $8x^3$ **(b)** 4 **(c)** $\frac{x+3}{2}$

MATHEMATICS

Paper 0581/22
Paper 22 (Extended)

Key Message

To succeed in this paper candidates need to have completed full syllabus coverage, remember necessary formulae, show all necessary working clearly and use a suitable level of accuracy.

General Comments

The level of the paper was such that all candidates were able to demonstrate their knowledge and ability.

Questions 16b and **21a** proved to be good discriminators between the most able candidates. There was no evidence at all that candidates were short of time and very few candidates did not attempt all the questions.

Giving answers to the correct degree of accuracy continues to be a problem.

Comments on specific questions

Question 1

Whilst this question was generally well answered by nearly ¾ of the candidates, many candidates found the angle C instead of the angle A. Two significant answers were also common.

Answer: 53.1°

Question 2

Many candidates appeared unfamiliar with the term 'irrational'. Whilst most knew that π was irrational, they struggled to find the other number.

Answer: π, $\sqrt{3} + \sqrt{6}$

Question 3

This question was well answered by most candidates. Those that failed to score full marks often left out essential working. Candidates should be aware that steps must not be omitted when the answer is supplied.

Question 4

This was very well answered by most candidates. The main error was caused by rounding errors when converting to decimals.

Answer: $(0.8)^2$

Question 5

Almost all candidates knew what to do and carried out the method correctly. However some did not interpret their answer correctly and gave dollars as a result.

Answer: euros

Question 6

This question was very well answered, with almost all candidates scoring 1 or 2 marks. The loss of 1 mark was almost always due to not rounding to the required accuracy.

Answer: 3.322

Question 7

Most candidates knew what was required but some had difficulty reaching the final answer, either because they didn't subtract first or because they made errors in their arithmetic.

Answer: 1.85×10^4

Question 8

This question was more challenging for candidates. Most understood the basic process but seemed to not take note of the key words in the question …direct and square root. $p = kq^2$ and $p = \frac{k}{\sqrt{q}}$ were common incorrect starting points.

Answer: 16

Question 9

Problems involving upper and lower bounds continue to be difficult for candidates. Many wrote down bounds for the 1500 instead of the measurement. Others multiplied the numbers and then tried to find bounds for that value.

Answer: 1275 1425

Question 10

The majority of the candidates were successful on this question. What mistakes there were usually came from errors in arithmetic particularly for the Sunday hours where 6 was the common error.

Answers: **(a)** 07 00 **(b)** 17 00

Question 11

This was answered well with even the weakest candidates scoring marks on this question. The major problem that some candidates had was in moving the (a – b) term and ca – b = 4 was the common error.

Answer: $\frac{4 + bc}{c}$

Question 12

This question was very well answered with most candidates scoring full marks.

Answer: $x = 1$ $y = 0.2$

Question 13

This was generally well answered by most of the candidates. Part **(c)** was the least well answered part by the weaker candidates only.

Answer: **(a)** 72° **(b)** 36° **(c)** 54°

Question 14

This was one of the best answered questions on the paper, with part **(c)** presenting just a small problem to a few weaker candidates.

Answers: **(a)** 84 **(b)** 15 **(c)** 6.28

Question 15

Large numbers of candidates scored full marks on this question. Those that did not, made one of three errors. Either the $(x + 1)^2$ was expanded incorrectly, they missed the sign change in the numerator or they cancelled inappropriately part way through their working.

Answer: $\dfrac{1-3x}{(x+1)(x+5)}$

Question 16

This question was challenging for many, with only the more able candidates being successful in part **(b)**. Part **(a)** was more often correct. Many candidates do not have a full understanding of the topic of vectors and did not appreciate that it is about direction as well as magnitude.

Answers: **(a)** ½**a** – ½**c** **(b)** ¾**a** + ¾**c**

Question 17

Most candidates could either deal with the numbers correctly or else the indices. Not many candidates got full marks for each part of this question.

Answers: **(a)** $4x^{-24}$ **(b)** $\dfrac{x^2}{16}$

Question 18

This was generally well answered by all but the weakest candidates. The most common error was to omit the negative sign on the gradient in part **(b)**.

Answers: **(a)** (6, 1½) **(b)** $y = -\dfrac{1}{5}x + 4$

Question 19

This was the best answered question on the paper with at least ¾ of the candidates scoring full marks on parts **(a)** and **(b)**. Loss of marks was almost entirely due to candidates making errors in simplifying their expressions.

Answers: **(a)** 8 **(b)** 4x – 9 **(c)** 2^{2x+2}

Question 20

Over half the candidates scored full marks on this question. Some candidates were clearly using ruler and/or protractor instead of compasses. Most of the remaining errors were due to bisecting an incorrect angle or side.

Question 21

Candidates found part **(a)** challenging, with many not being able to multiply these size matrices together. Some thought that part **(a)(ii)** was impossible. However, finding the inverse in part **(b)** was usually correct.

Answers: **(a)(i)** (0) **(ii)** $\begin{pmatrix} 12 & 18 \\ -8 & -12 \end{pmatrix}$ **(b)** $\begin{pmatrix} \frac{1}{2} & -\frac{1}{2} \\ -\frac{1}{2} & 1\frac{1}{2} \end{pmatrix}$

MATHEMATICS

Paper 0581/31
Paper 31 (Core)

Key Messages

To succeed in this paper candidates need to have completed full syllabus coverage, remember necessary formulae, show all necessary working clearly and use a suitable level of accuracy.

General comments

This paper gave candidates an opportunity to demonstrate their knowledge and application of mathematics. Most candidates were able to complete the paper in the allotted time, and many were able to make an attempt at most questions. Very few candidates omitted part or whole questions. The standard of presentation was generally good. There were occasions when candidates did not show clear workings and so did not gain the method marks available. Centres should continue to encourage candidates to show formulas used, substitutions made and calculations performed. Attention should be paid to the degree of accuracy required in each question and candidates should be encouraged to avoid premature rounding in workings. Candidates should also be encouraged to fully process calculations and to read questions again once they have reached a solution so that they provide the answer in the format being asked for and answer the question set. The use of the correct equipment should be emphasised.

Comments on specific questions

Question 1

This question was generally answered well by candidates of all abilities.

(a) Generally well answered, although many candidates gave the answer of 729.65 as they multiplied 500 by 1.4593. This was a common misunderstanding.

(b) Most candidates could calculate the cost correctly. Some made arithmetical errors, but gained one mark for correct workings. A few more able candidates tried to make the question more difficult by converting the figures in euros to dollars and working on those figures.

(c) This part proved more challenging. Many candidates took the 200 from 280 and therefore worked out the percentage saving.

(d) Well answered by candidates of all abilities.

(e) This was generally well answered with most candidates able to show that Helen was not tall enough. The more popular method was to multiply 50 by 2.54.

Answers: **(a)** 342.63 **(b)** 280 **(c)** 71.4 **(d)** 4.12

Question 2

This question provided challenge in testing the relationship between area and volume.

(a) Many candidates were correct with triangular prism or prism. Some "spoilt" their answer by stating "rectangular" prism.

(b) Some candidates were confused by the term perimeter and believed it involved more complicated calculations than measurement and addition. A common misconception was that the diagonal lines measured 4 giving an incorrect answer of 48.

(c) (i) Few candidates showed workings here, so if they were incorrect they did not earn method marks. A common incorrect answer was 7.

(ii) Many candidates started again here and multiplied 3 by 4 by 7 to reach the answer 84.

(d) Many candidates could take their answer from **(c)(ii)** and divide by 12 to reach either the correct answer or to reach 7 following from 84. It was unusual to see workings.

Answers: **(a)** (triangular) prism **(b)** 49.6 to 50.4 **(c)(i)** 6 **(c)(ii)** 42 **(d)** 3.5

Question 3

This algebra question was well attempted by many.

(a) (i) This was very well answered. A common error was to omit the "-"4 and therefore the answer given was 2.

(ii) Many candidates were able to substitute in the correct values but then were not able to process further. Some candidates thought that *m* was 19 and therefore reached the answer 52.

(b) This was well answered and showed many candidates were confident in expanding brackets. Most were able to get at least one term correct.

(c) Most candidates scored at least one mark by reaching a correct partial factorisation.

(d) Candidates demonstrated increased confidence in algebraic manipulation. Candidates who did not show all steps in their process may not have gained credit for a correct step by "leaping" straight from the question to their final (incorrect) answer. Those that showed all steps tended to earn at least one mark even if their final answer was not correct.

(e) This proved more challenging. Many could multiply out the bracket, scoring that mark, but then were unsure as to how to progress and were confused by "signs". Candidates should be encouraged to take each stage individually and write down one step at a time.

Answers: **(a)(i)** 10 **(a)(ii)** 8 **(b)** $7fg - g^3$ **(c)** $6h(3h-2j)$ **(d)** $\frac{(t-15)}{8}$ **(e)** 9

Question 4

Candidates sometimes looked for a more difficult question than this relatively straightforward time graph.

(a) (i) This was very well answered by many.

(ii) This was generally well answered although there were occasions where the horizontal scale was misread as one square equal to 2.5 minutes instead of 5 minutes, leading to an answer of 7.5 minutes.

(iii) Again, well answered but the misreading of the scale gave the answer 5 minutes.

Clear workings were generally missing throughout part **(b)**, and premature roundings often meant that marks were not gained.

(b) (i) Premature roundings led to a speed of 3.03 which did not score, and candidates sometimes wrote 20 minutes as 0.20 hours giving the answer 5 (being 1/0.20).

(ii) Again, candidates understood how to calculate speed but some thought that 10 minutes was 0.10 hours.

(iii) Candidates could recognise 5 km and 45 minutes, but again some converted 45 minutes to 0.45 hours and gave the answer 11.11 (5/0.45) or calculated 45/5 and gave the answer 9.

(c) Candidates found the horizontal line easier than the line travelling home and many scored at least one mark. A few candidates thought the line had to return to (0,0).

Answers: **(a)(i)** 1 **(ii)** 15 **(iii)** 10 **(b)(i)** 3 **(ii)** 24 **(iii)** 6.67

Question 5

The graph drawing was well done. Finding the gradient and the application of '$y = mx + c$' proved more challenging.

(a) (i) Candidates found the different scales on the axis challenging. Others divided the x-step by the y-step, giving the answer 0.5.

(ii) Those candidates that had an answer to part **(i)** were often able to attempt this and follow through from their answer to part **(i)**. A large number of candidates did not attempt this question.

(b) (i) This was well done by most candidates.

(ii) Plotting the graph was well done and curves were greatly improved with less straight lines and less thick lines. Centres should encourage candidates to be aware of the parabolic shape of $y=x^2$ which would help them to spot when their plotting is incorrect either because of an error in the graph, or an error in their table.

(iii) This was not attempted by a large number of candidates. Some solved algebraically. Incorrect answers included –2, 0 and 2.

(c) This part was generally well done and candidates were able to read the points of intersection.

Answers: **(a)(i)** 2 **(ii)** $2x+1$ **(b)(i)** 2, -2, 2 **(iii)** –1.5 to -1.3, 1.3 to 1.5 **(c)** (-1,-1) and (3,7)

Question 6

Part **(a)** was well done, although the later parts proved more challenging.

(a) (i) This part was generally correct.

(ii) This part was generally correct.

(iii) This part was generally correct although 159 or 161 were sometimes given.

(iv) This part was generally correct although 103 or 161 were sometimes given.

In parts **(b)**, **(c)** and **(d)** there was often confusion between the mathematical terms given. Candidates need to understand the meaning of product, factor and multiple.

(b) Very few candidates were successful here. Some could identify 11 but then wrote 8 x 11 or 2 x 4 x 11. Many tried to make 88 as the sum of prime numbers.

(c) Candidates found this challenging. However many scored one mark for identifying a common factor (often 12) rather than the highest common factor.

(d) Some candidates were confused by the term multiple and often gave the common factor of 5.

Answers: **(a)(i)** 144 **(ii)** 125 **(iii)** 103 **(iv)** 159 **(b)** 2^3 x11 **(c)** 24 **(d)** 60

Question 7

This question was quite challenging for candidates.

(a) (i) The reflection was generally well done.

(ii) Candidates often rotated the shape correctly but not always about the correct point.

(b) (i) Many candidates could identify that it was an enlargement. Some recognised they needed to identify a scale factor and those that did often recognised it as "2". The centre of enlargement was often omitted. There were several candidates that stated more than one transformation and hence did not gain marks.

(ii) Many candidates knew what had happened to the shape but were not able to use the correct mathematical term – instead they used "moved", "slid", "shifted". Having identified the transformation some then misread the scale and gave the vector as $\begin{pmatrix} 6 \\ 10 \end{pmatrix}$.

Answers: **(b)(i)** enlargement, scale factor 2, about origin **(ii)** translation by $\begin{pmatrix} 3 \\ 5 \end{pmatrix}$

Question 8

This question was generally well done by candidates of all abilities.

(a) The frequency table was completed successfully by the majority of candidates.

(b) (i) This part was the least well answered of this question. Some candidates gave the answer 10 or 1 – 10 showing that the term 'range' wasn't fully understood.

(ii) The mode was found correctly by most candidates.

(iii) Many candidates were successful although some gave the answer 5.5 believing there had to be a calculation involved. Some gave the answer 3 which was the median of the frequencies.

(iv) Many candidates understood how to calculate a mean. However some found the mean of the frequencies. Many showed workings and scored part marks even if they did not calculate the correct answer.

In part **(c)** probabilities were generally given in a correct format. There were some candidates who gave their answer as ratios and therefore did not score.

(c) (i) This part was generally well done.

(ii) This part was generally well done.

(iii) This part was slightly less successful than the previous two parts.

Answers: **(a)** 5, 3, 3, 0, 2 **(b)(i)** 9 **(ii)** 3 **(iii)** 5 **(iv)** 4.8 **(c)(i)** $\frac{3}{30}$ **(ii)** 0 **(iii)** $\frac{17}{30}$

Question 9

Candidates were challenged by this question and a large number of them did not attempt parts of it, often because they could not manage earlier parts and could not therefore follow through the instructions. Marks were lost for inaccuracies in measurements. Centres should encourage candidates to leave in construction lines.

(a) Some candidates did not show construction arcs and others were inaccurate.

(b) Those that produced an answer to **(a)** could generally measure their angle correctly.

(c) (i) Candidates were often confused between perpendicular bisector and angle bisector – they found the angle bisector of *ABC* and extended that to *AC* or bisected *BAC* and extended it to *BC*.

(ii) Those candidates who interpreted the instructions correctly could measure *AP*. Many did not extend their bisector and placed *P* at the intersection of their construction arcs.

(d) Some candidates drew an arc from a point other than *A*.

(e) This proved challenging – some candidates scored one mark as they could identify one condition correctly. The question relied on previous parts and was therefore omitted by many.

Answers: **(b)** 68° to 71° **(c)(ii)** 3 to 3.4 cm

Question 10

This question gave more able candidates an opportunity to demonstrate their knowledge of trigonometry.

(a) (i) Many candidates scored method marks for correct identification of the sine ratio. A number lost accuracy marks for premature rounding.

(ii) A common incorrect answer was 37 i.e. candidates took 53 away from 90 instead of adding 53 to 180.

(b) (i) Again method marks were earned for correct identification of the tangent ratio. Inaccuracies arose due to premature roundings.

(ii) Many candidates recognised this as a Pythagoras' theorem question, but did not recognise that 20 was the hypotenuse so added 20^2 and 9^2 to give a final answer of 21.9.

Answers: **(a)(i)** 95.8 **(ii)** 233° **(b)(i)** 20.6° **(ii)** 17.9

MATHEMATICS

Paper 0581/32
Paper 32 (Core)

Key Messages

To succeed in this paper candidates need to have completed full syllabus coverage, remember necessary formulae, show all necessary working clearly and use a suitable level of accuracy.

General comments

The paper gave most candidates an opportunity to demonstrate their knowledge and application of mathematics. Most candidates were able to complete the paper in the allotted time, but there were some candidates who omitted part or whole questions. The standard of presentation was generally good. However there were occasions when candidates did not earn method marks as they did not show working. Centres should continue to encourage candidates to show formulas used, substitutions made and calculations performed. Attention should be paid to the degree of accuracy required in each question. On construction questions candidates should clearly show all construction lines and arcs. On graphical questions candidates should clearly show all points plotted and show clear lines and curves.

Comments on specific questions

Question 1

(a) (i) This type of question where the candidate had to show that a given answer was true was answered better than in previous years. Most candidates showed the method clearly and correctly with only a very small minority working backwards from 857.

(ii) This was generally correct, with candidates showing either the full method from 3000 or 125 x 4.

(b) Many correct and fully simplified fractions were seen, although a few candidates stopped at 8/24 or 2/6. A common error was calculating the area used for vegetables rather than finding the fraction, sometimes earning part marks for showing 8/24 as part of their calculation.

(c) A well answered question with the majority of candidates able to find the required percentage. A small yet significant number got to 560 but then subtracted from 875 to find the ‘not flowers’ area.

(d) Once again this question on percentage profit caused difficulties for many candidates. Although many were able to find the correct actual profit of $20 few were able to apply this figure to the correct calculation to find this profit as a percentage. Many different incorrect calculations were seen, including 20/105 x 100, 85 x 20/105, 20/100 x 105 and any combination of these numbers.

(e) The majority of candidates were able to calculate the required compound interest correctly, with use of the compound interest formula seen. Unfortunately a significant number did not round their final answer to the nearest dollar as stated in the question. Answers of 5660.48 and 5660.5 were common, as well as some answers of 5661. Those few candidates who calculated the interest in two stages, were often uncertain as to which number should be their final answer. Common errors were finding simple interest giving an answer of 5640, or using incorrect versions of the compound interest formula.

Answers: **(a)(ii)** 500 **(b)** $\frac{1}{3}$ **(c)** 560 **(d)** 23.5 **(e)** 5660

Question 2

(a) (i) The negative and fractional scale factor proved challenging for many candidates. The transformation of enlargement was generally seen, but often in combination with rotation, reflection or translation. Those who did identify the single transformation sometimes omitted the centre or scale factor resulting in an incomplete description.

(ii) The majority of candidates were able to calculate the area correctly. Those who did not get the correct area generally had incorrect dimensions in their area formula or did not use the factor of half.

(iii) Candidates were significantly less successful with the perimeter calculation. The common error was an answer of 14 coming from 6 + 4 + 4, where candidates counted the squares on diagonal sides and didn't realise that they needed to measure lengths here. A small number of candidates were seen to use Pythagoras's theorem to work out the length rather than measuring.

(b) Many correct reflections were seen, although the common error of reflecting in the *y*-axis was also seen regularly.

(c) Many correct rotations were seen although a correct clockwise rotation about an incorrect point was a common error, for which partial credit was given.

(d) Describing the resultant transformation proved difficult for many candidates. Many thought it was a rotation and, again, there were many combinations seen despite the question asking for a single transformation. Few of those who identified the reflection gave the correct equation of the line.

Answers: **(a) (i)** enlargement, centre (0,0), scale factor = -0.5 **(ii)** 12 **(iii)** 15.7 to 16.5 **(d)** reflection in y=-x

Question 3

(a) The required bar chart was generally answered well with many fully correct answers seen. A mix of acceptable scales was seen, although a scale in 2s was most common. Some scales did not start from 0. Few line graphs or other alternatives were seen, although some candidates drew bars of varied widths.

(b) The mode was generally correctly stated, although common errors were to give 15 or state that there was no mode. A very small minority found the mean of the given numbers.

Answers: **(b)** Silver

Question 4

(a) (i) Candidates who appreciated the need for two operations were able to score full marks. Common errors were to multiply by 7 only to get 45.5 or to add the 12 and 6.5 before multiplying.

(ii) Those candidates who had appreciated the two operations involved were generally able to write down the correct expression. Common incorrect answers were 6.5*n*, and less common, 18.5*n*.

(iii) Those candidates with a correct expression were generally able to correctly calculate the number of hours worked. A number of candidates started again and worked from the initial information given and again were generally successful. A significant number were able to score a follow through method mark for showing their working following an incorrect part **(ii)**.

(b) Many fully correct solutions were seen and the majority of candidates had an idea of how to solve simultaneous equations, although numerical errors were often seen. The elimination method was most commonly applied and it was noted that those who attempted to use the substitution method were generally less successful.

Answers: **(a)(i)** 57.50 **(ii)** 12 + 6.5*n* **(iii)** 5 **(b)** *x*=5, *y*= -7

Question 5

(a) The majority of candidates were able to correctly identify the three shapes described although it was naming the triangle which caused most problems and gave rise to more incorrect terms. A full and varied list of incorrect names was also seen.

(b) (i) The majority of candidates were able to correctly work out the size of the exterior angle by using the formula 360/ no. of sides. A small number attempted to measure the angle as drawn. It was also noted that a significant number appeared to mix up the terms 'exterior angle' and 'interior angle'. Another common error was to use 180° rather than 360°.

(ii) The calculation of the interior angle was generally well done either correct or on a follow through basis.

Answers: **(a)** triangle, pentagon, octagon **(b)(i)** 40 **(ii)** 140

Question 6

(a) This statistical question was in general well answered and an improvement on previous years was noted. However there was still the usual mixing up of methods for mean, median and mode for a small number of candidates.

(i) The correct answer for the range was generally seen although sometimes left as 2800 - 1100.

(ii) The correct answer for the mean was generally seen but errors in the addition of the values given were also seen.

(iii) The calculation of the median was less successful. The common error was that many incorrect answers came from the middle of the centre two values given in the table and not ordering the values first.

(b) (i) Many correct angles for both sections of the pie chart were seen. A small number were able to gain a single mark for realising the sum of the two angles to be found was 220°.

(ii) The required pie chart was generally well drawn although common errors were inaccurate measurement and drawing of the angles and the omission of labelling to identify each sector.

(c) (i) The scatter diagram was generally well drawn although a small number lost the accuracy mark. It was noted that a small number of candidates seemed to miss the question asking them to plot the final points as the graph was often left blank.

(ii) The correct answer was seen in the majority of cases although a full and varied list of incorrect terms and explanations was also seen. A significant number of candidates attempted to embellish their answer whereas the simple term of 'positive' was sufficient.

(iii) The majority of candidates managed to explain the connection between increasing temperature/sales. A common error was to attempt to quantify the statement and/or to explain why the relationship existed.

Answers: **(a)(i)** 1700 **(ii)** 1858 **(iii)** 1750 **(b)(i)** (strawberry) 120, (vanilla) 100 **(c)(ii)** positive
(iii) hotter weather more sales

Question 7

Overall in this question many better attempts were seen of the graph of a quadratic equation than in previous sessions. Graphs were plotted more accurately and much smoother curves were drawn.

(a) (i) The function values were generally correctly calculated. A common error was writing the value of *y* as -9 from the value of *x* at –2.

(ii) Many had fully correct graphs or earned 3 out of 4 marks for a correct graph from their table of values. However a small number connected their plots with a series of straight lines.

(iii) Those candidates who used their graph to solve the given equation were generally successful. There was a small yet significant number who attempted to solve this equation by algebraic means and were rarely successful.

(b) (i) The majority of candidates were able to draw the line of symmetry on their graph, although a small number were unable to attempt this part.

(ii) Candidates struggled more with this part and often a numerical answer rather than an equation was seen. Common errors were x=0.5, y=0.5, y= -0.5, y=0.5x, 0.5, x + 0.5 and x - 0.5.

(c) (i) Most candidates gained this mark but some did not extend the line to the full length asked for in the question.

(ii) This was generally answered well with most candidates giving (3, 9) but some sign errors seen in the other co-ordinate. It was infrequent to see the co-ordinates the wrong way round.

(iii) This question on calculating the gradient remains challenging for many candidates. Various attempts at the gradient were seen but were not always successful. The drawing of a relevant triangle on the graph would have helped many candidates as in a number of calculations it was difficult to see where the numbers had come from. Other common errors included using incorrect formulae such as difference in x / difference in y or y(1) - x(1) / y(2) - x(2).

(iv) This connected part question was more successful than similar recent questions. Follow through marks were available and enabled candidates to score full marks here even if they had the gradient incorrect. There were a few candidates confusing '*m*' and '*c*' in the equation of a straight line, whilst others gave a purely numerical answer.

Answers: **(a)(i)** -1, -3, 3 **(iii)** -2.4 to -2.2, 1.2 to 1.4 **(b)(ii)** x = - 0.5 **(c)(ii)** (-2,-1), (3,9) **(iii)** 2
(iv) y = 2x + 3

Question 8

This construction question was marked on a strict follow through basis which then worked fairly for all candidates and rewarded partially correct answers.

(a) (i) The appropriate bearing was generally measured accurately.

(ii) Candidates struggled more with this part and produced some very unrealistic answers –very large or very small. Few candidates appeared to use the simple ratio method of 3 km in 30 minutes; 6 km in 60 minutes; speed is therefore 6 km/h. Common errors were in using an incorrect formula or mis-use of units.

(b) The drawing of the given journey showed a general awareness of what was required. The distance was generally within the required accuracy. The bearing caused more of a problem with the most common errors being (other than outside the required accuracy): measuring 145° anticlockwise in error or just extending line AB.

(c) (i) This was generally answered correctly with an accurate reading from their diagram.

(ii) This was generally answered well although not all candidates appreciated that the scale to be used was given at the start of the question. A small number of candidates tried to calculate this value by trigonometry or Pythagoras' theorem, often losing the marks, rather than recognising it was just a straightforward multiplication by 0.5.

(iii) The required bearing was not measured correctly or accurately by many candidates. The problem was knowing exactly which angle was required, the drawing of the relevant North line, the drawing of line *AC*, and the measurement of the correct angle to give the bearing. The fact that this angle was over 180° also seemed to cause problems. Many of the given answers did not match with the candidate's diagram.

(d) (i) Generally a good understanding of the question was shown, although a small number of candidates were possibly careless in reading the question and used either the same radii for both arcs/circles constructions or the wrong sizes. Most who drew two arcs/circles knew where *P* and *Q* were but a small number placed *P* and *Q* on a common tangent to both circles on a line parallel to *AB*. Unfortunately some candidates had *P* and *Q* in 'random' positions found with no reference to any arcs/circles, whilst others did not appreciate the given condition that *P* and *Q* were on opposite sides of the line *AB.*

(ii) This was generally answered correctly with an accurate reading from their diagram.

(iii) This was generally answered well although again not all candidates appreciated that the scale to be used was given at the start of the question. A very small number of candidates tried to calculate this value by trigonometry or Pythagoras' theorem, and were again largely unsuccessful.

Answers: **(a)(i)** 055° **(ii)** 6 **(c)(i),(ii),(iii)** correct follow through answers **(d)(ii),(iii)** correct follow through answers

Question 9

This question was less successfully answered with the full range of marks awarded in equal measures. The working seen and methods shown did seem to indicate that candidates knew the formulae but were not always understanding fully or thinking carefully about where to apply them. Accuracy of answers was generally within the acceptable bounds where the correct method was used.

(a) (i) This first part was generally answered well although the common errors included finding the volume or finding only a partial surface area with one or more sides omitted.

(ii) Finding the volume was generally answered well although common errors included finding an area, 60 x 18 and using an additional factor of 1/2, 1/3 or 1/4 within an otherwise correct formula.

(b) (i) This was generally not answered as well as previous parts. Common errors included use of 2 x π x 9 x 60, π x 18 x 18 x 60, omission of π, π x 9 x9 x18, 1/2 (or 1/3) x π x 9 x 9 x 60(or 18).

(ii) Whilst the follow through of **(a)(ii)** – **(b)(i)** was generally used effectively, a significant number of candidates started again, and were generally unsuccessful. A significant number did not appreciate the usefulness of the previous parts and attempted to use a variety of incorrect formulae.

(iii) This part was the least successful part of the question and was often not attempted. Common errors included finding the total surface area, finding the area of one or both circular ends, or using incorrect formulae such as 2 x π x 18 x 60, 2 x π x 9 x 9 x 60, 9 x 60 and 18 x 60.

Answers: **(a)(i)** 4968 **(ii)** 19440 **(b)(i)** 15300 **(ii)** 4170 **(iii)** 3390

Question 10

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

(ii) This was again generally answered correctly showing a good understanding of sequences.

(b) Again this was generally answered well although the long, but equally valid, method of continuing the sequence to find the 15th term was often seen or implied.

(c) This was generally answered correctly although common errors of 21 - 4*n*, 4*n* - 17 and 4*n* + 21 were seen. The common error in finding the term to term rule, usually resulting in *n* + 4 or 4 - *n* was also seen.

(d) (i) This part was less successful. There was little evidence to show use of the expected correct method of equating the two formulae to obtain the equation of 78 - 7*n* = 4*n* - 21 which could then be solved. Other common errors were 78 - 7*n* + 4*n* - 21(=0), 15, -19 and 43. There was little evidence to show that candidates were continuing both sequences to find this common value. A significant number were unable to attempt all of part **(d)**

(ii) Again this part was less successful for similar reasons. There was little evidence to show use either of the expected correct methods of using the two expressions to obtain the value of 78 - 7x 9 or 4 x 9 - 21. Method marks were also available for a follow through method used. There was little evidence to show that candidates were continuing both sequences to find this common value. Most candidates who obtained 9 in part **(i)**, also obtained 15 in part **(ii)**.

Answers: **(a)(i)** 43, 36 **(ii)** -1,3 **(b)** – 27 **(c)** 4*n* – 21 **(d)(i)** 9 **(ii)** 15

MATHEMATICS

Paper 0581/41
Paper 41 (Extended)

Key Message

To succeed in this paper candidates need to have completed full syllabus coverage, remember necessary formulae, make their working clear and use a suitable level of accuracy. Candidates should also possess the ability to succeed in multi-step and contextual questions.

General Comments

Many excellent scripts were seen. Only a small minority of candidates could make little progress with any questions.

Candidates presented neatly written scripts and none seemed to be short of time. Good calculator skills were demonstrated and appropriate levels of accuracy were usually seen. Candidates do need to be aware of the need to work to more than 3 significant figures and not to round off during calculations. When several steps of the working can be done on a calculator candidates should write down any methods used and not take the high risk of losing many marks by only giving answers. Candidates do have responsibility to show some of their working.

Comments on Specific Questions

Question 1

(a)(i) There are many ways of verifying the 744 by showing that it agreed with all the other numbers. The mark was only awarded if the candidate worked towards 744, such as $\frac{62}{115} \times 1380$.

(a)(ii) Most candidates knew what was required. Some presented their answer as 7 or 7.2 or 7.3, with insufficient accuracy.

(a)(iii) This was answered well. Just a few candidates did not cope with the cents and dollars and found the answer 0.42 lengths.

(b)(i) This problem was found challenging by many candidates. To find a bearing from *C* requires a north/south line to be drawn through *C* so that the relevant angles can be seen and calculated. A consolation mark was awarded for finding angle *BCA* = 55 with no other angles being found. Just a few found the bearing of *C* from *A* then added 180°, a very efficient method.

(b)(ii) The problem was solved very efficiently by some candidates using $18.9 \times \frac{4}{6}$,or working with the bases, $6.9 \times \frac{4}{6}$ soon leads to the result by adding 4 × 2. Some candidates found the required distance by trigonometry, 2 × 4 cos55 + 8; this leads to 12.59 but that was acceptable for full marks.

(c) This was only successfully answered by a few. The candidate needed to realise that 92% of the 2009 amount = 1380, and then find out what 100% is.

Answers: **(a)(ii)** 7.27 **(iii)** 42 **(b)(i)** 235 **(ii)** 12.6 **(c)** 1500

Question 2

(a),(b) These parts were answered very well by many candidates. The tree was correctly composed and the three probabilities were correctly calculated using the product rule and the sum rule. Some candidates were unfamiliar with the work and made no progress.

(c) This was a challenging part for many candidates and was a very difficult calculation unless one realised that *p* (it rains on at least one day) is equal to 1 – *p* (it does not rain at all).

Answers: **(b)(i)** $\frac{12}{35}$ **(ii)** $\frac{9}{35}$ **(iii)** $\frac{19}{35}$ **(c)** $\frac{34}{35}$

Question 3

(a) This was only tackled successfully by a few candidates. $p = \frac{k}{m+1}$ was very rarely seen; p = km and p = k(m + 1) were common errors.

(b)(i) Many candidates knew about "the difference of two squares", although weaker candidates did not seem as familiar with the method.

(b)(ii) Many candidates found this part challenging with the factors of the numerator often not found correctly. Combined with the difficulties in the previous part, few fully correct solutions were seen. Weaker candidates started to cancel *x*'s and 5's immediately.

(c) The majority of candidates successfully solved the inequality. A few could not expand the brackets correctly, and some could not collect like terms or handle the inequality symbol correctly.

Answers: **(a)** 3 **(b)(i)** $(x + 5)(x - 5)$ **(ii)** $\frac{2x+1}{x-5}$ (c) $x < 7$

Question 4

This question asked for three straightforward calculations using three standard formulae from trigonometry; the sine rule, cosine rule, and $A = \frac{1}{2}ab\sin C$. The majority of candidates had no trouble scoring the full 9 marks. Unfortunately some candidates appeared not to have ever met this work and scored zero.

(a)(i) Of those candidates who didn't score full marks, some applied the cosine rule to the wrong angle.

(a)(ii) These marks were allowed if the candidate correctly calculated $\frac{1}{2}ab\sin C$ using their angle from part **(i)**.

(b) This was the best known formula and many correctly quoted and used the sine rule. Some candidates had difficulties making sin*Q* the subject.

Answers: **(a)(i)** 58.4 **(ii)** 35.8 **(c)** 36.4

Question 5

Candidates unfamiliar with transformations scored very poorly here; the rest managed as follows.

(a)(i) This was well answered, although for a few candidates there was some confusion between *x* and *y*.

(a)(ii) This was less well answered. Some candidates were not sure where the line $x = -1$ was and many used $x = 0$, $y = 0$, $y = -1$.

(b)(i) Many knew the name "stretch" and many got the factor 3. It was quite rare to see "*y*-axis invariant". Candidates should note the phrase "single transformation" in the question, as all marks are lost if two are mentioned, e.g. "Stretch, factor 3, then move to the right 3 units" would score no marks.

(b)(ii) This rotation was recognised correctly by most candidates.

(c) Only the more able candidates gave the correct matrix.

(d) Again, only the more able candidates recognised this rotation round the origin.

(b)(i) Stretch, factor 3, *y*-axis invariant **(ii)** Rotation, 90 clockwise, centre (1, -1) **(c)(i)** $\begin{pmatrix} 3 & 0 \\ 0 & 1 \end{pmatrix}$

(c)(ii) Rotation, 180°, centre origin.

Question 6

Candidates with good spacial skills found their way round the various faces, lines and angles. Others found this question more challenging.

(a) The majority of candidates realised that Pythagoras' theorem was needed to find *BC*.

(b) The areas of two triangles and three rectangles were needed here and all straightforward to calculate, although some found it difficult to see those faces on the prism.

(c) Many candidates knew about "area of cross-section times length", but not all could apply that formula to this solid. Some quoted "1/3 base area times height".

(d) Many candidates correctly used 36 and their part **(a)** answer.

(e) This was a more challenging part. Only the most able achieved full marks. Many candidates could not see that the line *AE* was needed to form the required angle with *CE*.

Answers: **(a)** 23.6 **(b)** 2300 **(c)** 4790 **(d)** 43.0 **(e)** 19.0

Question 7

(a) Most candidates calculated the missing *y*-coordinates for the table correctly, with just a few thinking that $x = -2$ and -1 should give $y = -1$ and -4.

(b) Plotting the points was usually done accurately, although some had difficulties with (0.6, 11.11). The curve drawing varied greatly in quality but it was generally acceptable. Some candidates lost a mark by joining the two points at $x = -0.6$ and 0.6.

(c) These two marks were available provided the candidates had produced two sweeps for their curve in roughly the correct positions, even if it was clear that they had calculated the values, ± 0.816. Without any curve ± 0.816 did not score.

(d) To score any marks in this part the candidate had to have drawn a convincing tangent; this could not be done if the plots had been joined by a ruler. Some tangent attempts were clearly chords of the curve and therefore could not score the marks available.

(e) Only the more able candidates could see that the equation to be solved could be transformed to $f(x) = x - 2$. Many who tried this achieved $2 - x$ and marks were available from this line in part **(ii)** and the correct line in parts **(ii)** and **(iii)**.

Answers: **(a)** 1, 4, 11.1, 1, 0.25 **(b)** ± 0.8 **(d)** –2.5 **(e)(i)** $y = x - 2$ **(iii)** 2.6

Question 8

(a) Most candidates can confidently calculate a mean using a grouped frequency distribution and many fully correct answers were seen. The median was usually correct, although generally no reasoning was seen. The mode was well known.

(b)(i) Most candidates successfully rearranged the table.

(b)(ii) Most candidates correctly calculated the frequency density, although some candidates seemed unfamiliar with the term.

(c) Many candidates competent in algebra produced the relationship $(10 \times 2.5 + 12 \times 3 + 4n)/(22 + n) = 3.1$ and successfully solved it. A few reached the right answer by “trial and improvement”.

Answers: **(a)** 14.2, 14, 13 **(b)(i)** 21, 30, 15 **(ii)** $\frac{20}{1.05}$ $\frac{20}{1.5}$ $\frac{10}{1.5}$ **(c)** 8

Question 9

Many candidates made good progress with this question. A few, however, seemed unfamiliar with the topic..

(a), **(b), (c)** and **(d)** These parts were all well answered, with occasional marks being lost for the use of the wrong symbols, > for ≥, ≤ for ≥. Some could not translate $x + y = 9$ and $6x + 14y = 84$ into lines on their grid, but many could and the required region was correctly indicated.

(e) Many candidates by various methods, found the correct minimum cost for the trees.

Answers: **(a)** $x \geq 3, y \geq 2$ **(b)** $x + y \leq 9$ **(c)** $6x + 14y \leq 84$ **(e)** 70

Question 10

(a), **(b)** and **(c)** Most candidates showed a good understanding of sequences and answered these parts correctly.

(d) In this more challenging part there had to be a slightly deeper investigation but many discovered the relationships. The more able candidates correctly found a version of the n^{th} term for sequences *D* and *E*.

Answers: **(a)** 8, 27, 64, 125 ; 8, 12, 16, 20 ; 9, 16, 25, 36 **(b)** 512, 169 **(c)** 25, 99
(d) 145, $n^3 + 4n$; 16, $(n + 1)^2 – 4n$

MATHEMATICS

Paper 0581/42
Paper 42 (Extended)

Key Message

To succeed in this paper candidates need to have completed full syllabus coverage, remember necessary formulae, make their working clear and use a suitable level of accuracy. Candidates should also possess the ability to succeed in multi-step and contextual questions.

General comments

Almost all candidates were well prepared for this level of paper and were able to attempt all questions in the allotted time.

Most candidates set out the work clearly and showed sufficient working in the questions which required showing that a given value was correct. Good calculator skills were demonstrated and appropriate levels of accuracy were usually seen. Candidates do need to be aware of the need to work to more than 3 significant figures and not to round off during calculations. When several steps of the working can be done on a calculator candidates should write down any methods used and not take the high risk of losing many marks by only giving answers. Candidates do have responsibility to show some of their working.

Good skills with number work, algebraic manipulation, trigonometry, graphs and statistics were frequently seen.

Questions that were particularly well answered were in number, trigonometry, graph drawing, solving linear and quadratic equations, calculating a mean of a continuous distribution, drawing and interpreting a cumulative frequency diagram and simple sequences.

Areas needing more attention include mensuration, inequalities, describing stretches and shears and more difficult sequences.

Comments on specific questions

Question 1

(a) (i) Almost all candidates answered this single mark question correctly. Occasionally $\frac{1}{0.04}$ was given as the final answer.

(ii) This was also answered well with only a few candidates using the calculator incorrectly and giving $\sqrt{5.1^2} + 4 \times 7.3^2 = 218.26$.

(iii) Most candidates gave $25^{\frac{1}{2}} = 5$ and many also correctly showed that $1000^{-\frac{2}{3}} = 0.01$ or $\frac{1}{100}$. A small number gave 12.5 x 0.01 = 0.125.

(b) Most candidates calculated the simple interest for 5 years correctly and also added the $7500 to find the amount. Candidates do need to read a question carefully as some calculated the interest only and some calculated the compound interest. A few candidates added the $7500 to each year.

(c) (i) This was often answered correctly but also often only partially with $2^2 \times 15$ a common final answer instead of a full list of prime factors. Some candidates gave answers which were sums of numbers to give 60.

(ii) Many candidates were able to recall the method for finding the highest common factor and were able to write down the answer from the given information for 48 and their answer to the previous part. Others wrote down $2 \times 2 \times 3$ and left this as their final answer which only earned 1 mark. A number of candidates gave smaller common factors of 48 and 60.

(iii) As with the previous part some wrote down the correct answer and others gave $2 \times 2 \times 2 \times 2 \times 3 \times 5$. Candidates do need to understand the vocabulary of the syllabus as occasionally the answers to parts **(ii)** and **(iii)** were reversed and in other cases a small factor (e.g. 2) was given as a common multiple.

Answers: **(a)(i)** 25 **(ii)** 15.5 **(iii)** 0.05 **(b)** 8812.50 **(c)(i)** $2^2 \times 3 \times 5$ **(ii)** 12 **(iii)** 240

Question 2

(a) Most candidates wrote down a correct first step using Pythagoras with two of the three given sides whilst the stronger candidates gave the more direct $2^2 + 1.5^2 + 1.7^2$ as their first step. Quite a number made a fundamental error by assuming $EG = 2 + 1.5$ but then proceeded to use Pythagoras in the next step.

Another error seen quite often was giving an answer of 3 when EC^2 was 9.14.

(b) Those candidates who joined *E* to *G* on the diagram were usually able to identify the angle required. Many went on to select a suitable trigonometrical ratio using sine with 1.7 and their answer from **(a)**, cosine with 2.5 (usually having calculated *EG* in **(a)**) and their final answer to **(a)** or tangent with 1.7 and 2.5.

Some candidates found the correct angle *CEG* but then went on to add it to angle *GEH* and a surprising number of candidates used sine rule in right-angled triangles.

A number of candidates used triangle *ECH* and found angle *CEH*. Tan x = 1.7/2 was also often seen.

(c) (i) This upper bound question was answered well. Some common incorrect answers given were 3, 3.05 and 3.04.

(ii) This single mark question tested the ability to give a clear reason and candidates need to be sure to give a reason and not just state a fact. Candidates must also make sure that an answer is unambiguous. The simple clear way to answer the question was to state that the length of the diagonal *EC* was greater than the upper bound of the length of the rod. Those that referred to a diagonal often did not specify that the longest diagonal, *EC*, was the one that should be compared with the length of the rod.

A number of candidates compared the rod with the dimensions of the box.

Answers: **(a)** 3.02 **(b)** 34.1 to 34.3 **(c)(i)** 2.95

Question 3

(a) (i) This was answered well with very nearly all candidates measuring *AC* accurately and then multiplying this by 20. A few did not measure the line to the required accuracy and a few only gave the length of the line on the diagram.

(ii) Many candidates wrote down the correct bearing. Some gave an answer of 240 °, the bearing of *A* from *C*.

(iii) This part was also answered well with almost all candidates giving the point *B* 7 cm from *C*. A few candidates did not draw the angle of 150° accurately enough and a few drew incorrect angles such as 130°, 30˚ and 210˚.

(iv) This part was answered correctly by many candidates with some simply writing down the correct answer and others showing the working of 360° - 30°. The most common error was 30° as the final answer.

(v) Candidates need to remember that an area factor is the square of the length factor (or map scale). Many candidates multiplied 0.15 cm^2 by the linear scale factor of 20 rather than the area scale factor of 20^2 (= 400).

Others squared the 0.15 as well as the 20 and some candidates tried to do a unit conversion of 0.15 cm^2 into km^2.

(b) Most candidates attempted to subtract the given times. There is the need for candidates to cope with hours and minutes and not give values in hours as though there are 100 minutes in 1 hour. 2 h 15 min was frequently written as 2.15 hours. The majority of candidates gained a method mark by dividing 1500 by their time and those that had the correct time in hours almost always gave the correct average speed.

(c) Many candidates recognised the need to use the cosine formula to calculate an angle of a triangle when three sides are given and those who were able to quote the version of the formula with cosine as the subject generally answered the question well. Those who used the version with a^2 as the subject often made a sign error when transposing the formula, either prior to substituting the values, or after doing. It was important for candidates to work with a sufficient number of figures, or to leave all the figures on the calculator, to give an accurate final answer. For example, candidates who wrote down the answer to $\cos^{-1}\left(-\frac{212775}{1777500}\right)$ as $\cos^{-1}(-0.12)$ and used this value to give 96.89° as their final answer, which was outside of the accepted range.

A number of candidates assumed the triangle to be right-angled.

Answers: **(a)(i)** 142 to 150 **(ii)** 059 to 063 **(iv)** 328 to 332 **(v)** 60 **(b)** 667 **(c)** 96.9

Question 4

(a) Most candidates were successful in completing the table of values, although the value when x = -1 was incorrectly given as -2 or 2 by some candidates.

(b) Candidates do need to take extra care when a scale is not straightforward as was the case with the y-axis in this question. There was a considerable number of errors on this axis. The two branches of the curve were drawn well and it was relatively rare for candidates to incorrectly join up the two branches.

(c) Not all candidates drew the line $y = 7$ but many gave the three solutions within the acceptable tolerance.

(d) Most candidates drew a correct tangent at the correct point and usually proceeded to calculate the gradient correctly. Those whose answer fell outside the acceptable range usually gave the correct method for obtaining the gradient. Some candidates did not attempt to draw a tangent and others drew a vertical line at $x = -2$. It was rare for candidates to use the incorrect formula (change in x)/(change in y).

Answers: **(a)** 4, – 5.8 or – 5.75 or – 5.7, – 2 **(c)** – 2.5 to – 2.3, – 0.5 to – 0.4, 2.75 to 2.9 **(d)** – 4 to – 2.5

Question 5

(a) Candidates need to read a question fully. Many candidates did not give the integer values as required and gave the very common answer of $1 \le x \le 5$, which earned 2 of the 3 marks. Some solved the right hand side correctly by showing $3n \le 15$ and then $n \le 5$ but then incorrectly gave the left hand side as $3 \le n$, thus earning 1 mark. Some correct working was spoiled by replacing the inequality signs by either equal signs or incorrect inequality signs.

(b) (i) This straightforward common factorisation question was answered very well with only a few candidates showing a partial factorisation.

(ii) This factorisation question carried 3 marks and candidates need to realise taking out a single common factor would only be part of the solution. Many candidates wrote down $3(a^2 – 4b^2)$ and did not factorise further by using the difference of two squares and were awarded with 1 of the 3 marks. Factorising $a^2 – 4b^2$ led to errors such as $(a +4b)(a – 4b)$ or $(a – 2b)^2$.

(c) Candidates need to be familiar with this type of multi-step question which frequently appears on a paper 4, i.e. using some given information to arrive at an equation and then solving the equation.

(i) The majority of candidates correctly used the formula area = ½ base × height to write down the first step and then proceeded to arrive at the given equation without any errors or omissions. One common error was to omit brackets and give an equation such as $\frac{1}{2} \times x^2 + 17x = 84$. This was given 1 of the 2 marks since a 'show that' question requires all steps to be fully correct.

(ii) This quadratic factorisation was answered well by most candidates. There was the occasional sign error and a few candidates omitted this part, possibly because the product of – 168 and sum of 17 was quite challenging.

(iii) This was also answered well. Some candidates did not use their answer from the previous part choosing to use the formula for solving a quadratic equation.

(d) This part was answered particularly well with only the occasional sign error made.

(e) Many candidates used the formula for a quadratic equation correctly and gave their answers to the required accuracy. The errors seen included $– b = – 5$ and not $– (– 5)$, $– 5^2$ becoming – 25 instead of $(– 5)^2$ being 25 and answers not given to 2 decimal places.

A few candidates used the completing the square method but this was more challenging in this question since the coefficient of x^2 was not 1. A few candidates omitted this part and others made an attempt to factorise the equation, although the requirement of 2 decimal places was a clear signal that the quadratic expression would not factorise.

Candidates need to know that the question required working to be shown and correct answers without working were only awarded with 2 marks out of 4.

Answers: **(a)** 2, 3, 4, 5 **(b)(i)** $2x(x + 5y)$ **(ii)** $3(a + 2b)(a – 2b)$ **(c)(ii)** $(x + 24)(x – 7)$ **(iii)** – 24 and 7 **(d)** – 3 **(e)** – 0.89 and 3.39

Question 6

(a) (i) This was answered well. A few gave the mid-value of the correct interval and a few gave one of the adjacent intervals.

(ii) This part was answered very well with most candidates working accurately using the correct mid-values and the correct method for the estimate of the mean. A small number of candidates gave one or more incorrect mid-values and a few made a careless error in the calculation. A few others used interval widths instead of mid-values. Candidates need to understand that it is advisable to show the working since a slip with the calculator would lead to an incorrect answer but the correct method seen earns 2 of the 3 marks.

(b) (i) Most candidates showed a good understanding of cumulative frequency and completed the table correctly. One error seen was to add successive class widths rather than the frequencies.

(ii) The majority of candidates used the correct scales with only a few either making an error with the numbering of a scale or reversing the axes. Points were generally plotted accurately with a small number making an error with one or more points.

(c) (i) This was answered well with most identifying 75 on the vertical axis and using this to obtain the median.

(ii) Most candidates appeared to accurately read off the values of the upper and lower quartiles correctly and to work out the inter-quartile range. Candidates should write down the upper quartile and the lower quartile so that if their answer to the inter-quartile range was incorrect then they could score the mark available for a correct upper or lower quartile.

(iii) This was answered well with most candidates correctly reading off their values at 50 and 60 minutes.

(iv) This part was also answered well. Some candidates used their reading at 50 minutes but did not subtract it from 150 before writing down the probability.

(v) The stronger candidates answered this more discriminating part involving the product of two probabilities well but this part was omitted quite frequently. Those that did attempt it sometimes used the square of their answer to **(c)(iv)**, for example $\left(\frac{94}{150}\right)^2$. Others subtracted 1 from the numerator and 1 from their denominator of a fraction that had been reduced to its lowest terms. For example $\left(\frac{47}{75}\right)\times\left(\frac{46}{74}\right)$, rather than $\left(\frac{94}{150}\right)\times\left(\frac{93}{149}\right)$ or $\left(\frac{47}{75}\right)\times\left(\frac{93}{149}\right)$.

Answers: **(a)(i)** $45 < t \le 55$ **(ii)** 52.6 **(b)(i)** 40, 77, 130, 150 **(c)(i)** 54 to 55 **(ii)** 18.5 to 22.5 **(iii)** their reading at 60 – their reading at 50 **(iv)** $\frac{150 - \text{their reading at } 50}{150}$ **(v)** $\frac{k}{150}\times\frac{k-1}{149}$ using their k from **(iv)**

Question 7

Parts **(a)** and **(d)** proved to be good discriminating questions with the stronger candidates scoring full marks with other candidates often being partially successful.

(a) Most candidates correctly calculated the area of one of the triangles forming a face of the pyramid using $\frac{1}{2}\times 2.5\times 9.5$ and then went on to multiply this by 6 to give the total area of the faces.

Some candidates did not do any further work assuming that this was the total surface area and so gave this as the final answer.

The candidates who used area = $0.5\times a\times b\times \sin C$ usually substituted correctly using $a = b = 2.5$ and $C = 60°$ and went on to give the correct answer for the triangle and the base and then complete the calculation for total surface area.

A number of candidates attempted to use $area = \frac{1}{2}\times base\times height$ with some correctly using Pythagoras to find the height but others incorrectly assuming that the height was 2.5 cm.

A few candidates gave the perimeter of the base.

There was a number of candidates who approximated prematurely in their working and gave a final answer out of range for the accuracy mark. This endorses the need for candidates to show their full methods.

(b) With a question of this type in which the answer is given it is essential to show all the necessary working and give the answer to at least 4 significant figures i.e. give the answer to a greater accuracy than the given answer of 108 cm^2. The majority of candidates did this and obtained full marks.

(c) (i) Most used a correct method applying the formula given in the question. The majority transposed their equation correctly and went on to give the correct answer. A number did not give an answer to the required accuracy of three significant figures and it was common for 2.3 to be seen as the answer. A few used an alternative method by finding the arc length *AB* from the diagram in part **(b)** and equating this to the circumference of the base, which earned full marks if correct.

(ii) The majority of candidates correctly identified Pythagoras theorem as the most appropriate method to find the perpendicular height. A few made an error, such as omitting to take the square root or taking the perpendicular height to be the hypotenuse, but most carried out the calculation correctly.

(d) Many candidates found this part challenging. The majority of correct answers were obtained by subtracting the volume of the small cone from the volume of the large cone.

Very few candidates identified the most efficient method of then using the ratio of the volumes of similar figures so it was rare to see the volume of the large cone divided by 8 and rarer still for a candidate to calculate the final answer by multiplying the volume of the large cone by $\frac{7}{8}$.

Some assumed the height referred to in the given formula was the slant height and so used $h = 7.5$ and $h = 15$.

Some also thought that the required volume could be found using the formula for a cone and taking h as 15 – 7.5

Some candidates did not use the fact that the radius of the small cone was half that of the large cone i.e. half of the answer to **(c)(i)** and so attempted to calculate the radius using Pythagoras with 7.5 and half their answer to **(c)(ii)**. This was usually done quite well but a number of candidates did not work with a sufficient number of figures on the calculator and so the final answer was outside of the accepted range. Similarly some candidates used Pythagoras with 7.5 and half their answer to **(c)(i)** to find the height, again not always working with a sufficient number of figures.

Another error seen quite often was to use Pythagoras with 7.5 and the radius of the large cone to calculate the height of the small cone.

Answers: **(a)** 87.5 **(b)** 107.9… to 108.0… **(c)(i)** 2.29 **(ii)** 14.8 **(d)** 70.9 to 71.5

Question 8

(a) The enlargement was almost always correctly drawn. A number of candidates did not draw the triangle in the correct position possibly because they did not use construction lines from *A* through the vertices of the given triangle or simply overlooked the fact that *A* was to be the centre of enlargement. A few candidates drew a figure with a scale factor of 3.

(b) (i) Candidates need to know the vocabulary of transformations and the necessary descriptions of transformations. A number of candidates did not give the correct transformation with shear or enlargement being the most common wrong answers. Some did not specify the invariant line fully with answers such as parallel to the *x*-axis or *y* invariant, rather than *y*-axis invariant. Those who gave the scale factor usually gave the correct value.

(ii) Many candidates were able to recall the form of the matrix for a stretch and the connection between the matrix and the scale factor but others found this part difficult and it was often omitted. A few gave the matrix $\begin{pmatrix} 1 & 0 \\ 0 & k \end{pmatrix}$ where k was their scale factor and this did receive some credit.

There are still candidates who use algebra with the matrix $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$ and are rarely successful.

(c) The comments in part **(b)(i)** also apply to this part. Many candidates were able to identify the transformation as a shear but had similar problems in accurately describing the invariant line. The factor for a shear is a difficult concept and this was often incorrect or omitted.

Answers: **(b)(i)** Stretch, factor 4, *y*-axis the invariant line **(ii)** $\begin{pmatrix} 4 & 0 \\ 0 & 1 \end{pmatrix}$ **(c)** Shear, factor 2, *x*-axis the invariant line

Question 9

(a) (i) Most candidates were able to write down the first 3 terms of the sequence, although a few made an error with the last term giving 12 or 24 for example.

(ii) This part was also answered well with many candidates showing some intuition and being able to write down the correct answer without any working. Some wrote down 12 x 14 = 168 or 12 x (12 + 2) and then selected the correct answer. Those candidates that attempted to use an equation usually wrote down $n(n + 2) = 168$. Some used this to give 12 x 14 and a few did correctly solve the equation by the usual quadratic methods.

(b) (i) This *n*th term of a linear sequence was generally successfully answered. Some gave $3(n – 1) + 5$ as their final answer but were awarded full marks on this occasion.

(ii) Generally candidates found this *n*th term of an exponential sequence difficult with many answers taking a polynomial form, often linear. This part was quite often not attempted.

(c) This part required candidates to read and understand all the information given and a question carrying 6 marks indicates that there must be a reasonable amount of working to be done. It was essential for candidates to understand that the formula applied to all of the first *n* diagrams and this information was given in bold type on the question paper.

There were some fully correct answers from the stronger candidates.

Many used the first diagram correctly and gave a + b + 1 = 3. The majority of candidates used the second diagram alone, as opposed to taking the total number of one centimetre lines from the first and second diagram. This led to the incorrect equation 8a + 4b + 2 = 9 rather than 8a + 4b + 2 = 12. Some used the third diagram but generally made the same type of error and gave 27a + 9b + 3 = 18. The majority of candidates showed the necessary algebraic skills to solve their two linear equations correctly. Most candidates correctly used the elimination method of equating the coefficients of one of the variables.

A large number of candidates gave expressions such as $a + b + 1$ and $8a + 4b + 2$ and then generating equations from these expressions being equal to zero.

This question was also omitted by a number of candidates.

Answers: **(a)(i)** 3, 8, 15 **(ii)** 12 **(b)(i)** $3n + 2$ **(ii)** 2^{n-1} **(c)** $\frac{1}{2}$, $\frac{3}{2}$

MATHEMATICS WITH COURSEWORK

Paper 0581/05

Paper 5 Coursework (Core)

General comments

Overall, candidates made good progress with their coursework tasks this year. It was pleasing to see such a high standard of work across all Centres.

This year, the majority of Centres did not give a choice of task to their candidates. Usually, the coursework task offered was an investigation such as 'Opposite Corners' or 'T shapes'. With this approach it is worth considering whether the task offered will limit the marks available to the more able candidates or make it difficult for the least able to make a start.

Good use was made of ICT packages in the work seen, particularly spreadsheets. Most candidates provided a commentary about their use of ICT and described any formula used. Good use was also made of statistical diagrams and the reasons why one particular diagram was more appropriate than another. There were no instances seen where candidates produced all possible statistical diagrams to illustrate the same data.

In general the controlled element was a written test completed under 'examination conditions'. This usually provided clear differentiation between candidates in a Centre. Some Centres chose to interview their candidates, particularly where a practical task had been chosen. In this case it is essential that teachers provide a clear justification for their award of marks in this strand.

Assessment of the tasks by Centres was accurate. The majority of coursework seen had helpful annotations by the teacher to show omissions or inaccuracy. The commentary provided to justify the mark awarded in each strand was usually clear and supported the work seen.

MATHEMATICS WITH COURSEWORK

Paper 0581/06

Paper 6 Coursework (Extended)

General comments

Overall, candidates made good progress with their coursework tasks this year. It was pleasing to see such a high standard of work across all Centres.

This year, the majority of Centres did not give a choice of task to their candidates. Usually, the coursework task offered was an investigation such as 'Opposite Corners' or 'T shapes'. With this approach it is worth considering whether the task offered will limit the marks available to the more able candidates or make it difficult for the least able to make a start. To gain the highest marks, candidates need to be able to demonstrate their ability to work with mathematical topics at grade A standard.

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