MATHEMATICS

Paper 0580/12
Paper 1 (Core)

Key messages

Candidates need to have completed full syllabus coverage, remember necessary formulae, show all necessary working clearly and use a suitable level of accuracy.

Candidates must read the question carefully and check that the answer is sensible for the context and is in the form required by the question.

General comments

The paper was answered well by the majority of candidates and the number of questions left blank was very small. It was clear that the whole syllabus was well covered for the vast number of candidates, although there were a significant number of cases showing lack of understanding of what was required in a question. Presentation and working was of a good standard. Candidates should avoid rounding answers at an intermediate stage of a calculation in order to avoid accuracy errors.

Comments on specific questions

Question 1

While writing the number in figures was correctly done by many candidates, there were a lot of attempts with an incorrect number of zeros, most often 5 or 7. A few misread the question and did not start with 25.

Question 2

(a) This part was usually correct, although $\frac{7}{100}$ was seen occasionally.

(b) This part was also correct for the vast majority of candidates but quite a few gave 0.65.

Question 3

(a) Most candidates understood numbers less than −5 and nearly always gave all 3 numbers. Some gave all numbers less than 5 while −3, −4 was quite common.

(b) Most candidates identified the largest and smallest values. However, many candidates did not understand the term ‘product’. Addition was the most common operation seen although division was also seen. Some did multiply but omitted the negative sign.

Question 4

The candidates who worked in the 24-hour system generally gave the correct time. The majority however, used the 12-hour system, but of these it was rare to see the essential ‘pm’ to distinguish their answers from the early morning time. Others were confused by the quarter hour and 2 15 or 14 15 were common responses.

Question 5

Most candidates successfully rounded to 1 decimal place although 56.1 was a common incorrect response. There were some cases of one or more 0's after the 2 in the answer.

Question 6

Changing hours to seconds was well answered with only a small minority of candidates just multiplying by 60 once.

Question 7

(a) The vast majority understood 'cube' and gave a correct answer. Various incorrect responses were seen, in particular 12 and 29.

(b) The prime number in the list was not so well chosen with the common error of 91 seen often. Some candidates gave more than one answer.

Question 8

(a) Only a small number of candidates did not understand vectors resulting in both parts of the question usually fully correct. However, subtraction of directed numbers resulted in some making an error in the first component. A fraction line between components appeared in a small number of responses.

(b) There were more correct responses seen in this part but a noticeable error was not multiplying the second component by 2.

Question 9

Nearly all candidates correctly multiplied by the exchange rate with very few dividing by it. However, some responses did not have the decimal point or misplaced it after the 8 instead of after the 4.

Question 10

This net question was a little more demanding than usual since candidates needed to find the height first from the given volume and the other dimensions. Many candidates did not find the height and so could score only partial credit for the other correct 4 by 3 face. Those finding the height, 2 cm, often gained full credit although some had only two sides correct or did not include the top face. Only a few candidates did not understand what a net was by drawing a 3D cuboid.

Question 11

The confusion between median and mean meant this question was not well answered. Many candidates attempted to find a mean and the answer 85 was common from using 61 as the mean of the 6 numbers. An answer of 61, the given median of the 6 numbers, was often seen. Those who did understand what was required often found the correct answer although a small error sometimes produced 64.5 or 58, the median of the given 5 numbers.

Question 12

Many candidates were clearly well practised on polygon angles and managed to find the interior angle. However some did not follow what was required and stopped at the stage of finding the exterior angle. A formula was often quoted but a significant number of responses had (n – 1) instead of (n – 2). Other errors were from 180 × 7 and 360 ÷ 9 without the further necessary steps.

Question 13

Nearly all candidates were familiar with Venn diagrams and could identify the intersection correctly. Some showed the sections in sets *A* and *B* which were not in the intersection and a few shaded a variety of other parts of the diagram, including the union of the sets.

Question 14

While this standard factorising question was answered well by the majority of candidates, quite a number gained only partial credit by taking a common factor of 2 or g instead of both. Some tried to combine the terms to give, for example, $6g^2$ or $4g^2$ as the answer.

Question 15

(a) Most candidates knew the triangle was right-angled and so gained the credit for angle x. However, quite a number assumed the two parts of the question were connected by parallel line properties and gave the answer 46, the answer for y. The reason was often not expressed accurately and often a triangle, rather than an angle, in a semicircle was given. The explanation also needed reference to the angle of 90° (or right angle).

(b) Again, the angle was usually correct. Some candidates gave 44 from assuming it was another right-angled triangle. For the reason many did specify isosceles triangle but did not specify that two angles were equal.

Question 16

While division by a whole number, rather than a fraction, should have produced an easier question some candidates were confused and showed inadequate working. Those who followed the normal division of fractions procedure usually gained the credit but some changed to multiply without inverting the fraction. Others felt it was too simple for any necessary working or just gave a decimal answer from their calculator.

Question 17

Many candidates understood the method for finding the mean from a frequency table and were successful with their calculations. However, this was an exact answer and quite a few rounded without showing the full value. A common error was to start correctly but then division by 7, or even 6, produced an answer that showed a lack of understanding of a mean as it was beyond the number of calculators in the table. A number of responses showed an incorrect addition of the frequencies instead of the given 40 in the question.

Question 18

The bounds question was well answered although some gave the two bounds the wrong way round. Common incorrect answers were 11.05 to 12.05 or 11 to 13.

Question 19

While a small number of candidates performed a simple interest calculation, the vast majority correctly used the compound interest formula. There were a few with an incorrect formula, adding 3000 instead of multiplying or writing 6 for the rate and 4 for the years. Having found the answer some then subtracted 3000 which would give the interest.

Question 20

The question was well started by most candidates who multiplied by the denominator, 3. Sign errors at the second stage of isolating the $2u$ were common and resulted in answers of −9.5 and 15.5.

Question 21

The vast majority of candidates gained partial credit by calculating 0.3^2 correctly. While many then continued to a correct standard form, answers of 9×10^{-1}, 9×10^2 and 9×10^{-3} were seen frequently.

Question 22

The expected number was correct for most candidates but a significant number did not read the question correctly and assumed they had to find the number who failed the test. Just a few added a decimal point into the answer, usually giving 2.16, which is an unrealistic answer for this context.

Question 23

The simultaneous equations question was quite well answered with many fully correct responses. The main error came after multiplying the equations and then, for example, subtracting x's and constants but adding the y's. Those using substitution generally were more successful with these equations.

Question 24

As the question was 'show that' the answer was required to greater accuracy than the given 31.9 for the angle. Of those who did give more decimal places, some had rounded 46 ÷ 74 too much before applying the tangent function. Consequently, their answers did not have sufficient accuracy to round to 31.9. Otherwise, some candidates didn't understand that trigonometry was required or used sine instead of tangent. Others found the hypotenuse first before sine to find the angle which usually lost the necessary accuracy. Starting with 31.9, seen occasionally, is not the required approach for a 'show that' question.

Question 25

Since questions involving entirely Pythagoras' theorem are usually better answered than those involving trigonometry functions, this question was quite well answered. However, a considerable number of candidates did not compare their answers to the diagram. Clearly an answer for AC had to be greater than 52 and so 34.4 from squaring and subtracting had to be incorrect. Long methods using trigonometry were seen a few times and rarely made significant progress.

Question 26

(a) This was a fairly straightforward question provided the formulas for area and circumference of a circle were known. While this was the case for the vast majority, having an area in terms of π and asking for an answer in that form was a challenge for many candidates. Many worked out a value for the area and even those who did find the correct answer in terms of π often changed it to a numerical value for their final answer. Otherwise 25, rather than $\sqrt{25}$ was often taken as the radius.

(b) The vast majority of candidates did not know that the total area for the cylinder meant using the formula $2\pi rh + 2\pi r^2$ or more simply $2\pi r(r + h)$. The few who used that correctly and got **part (a)** correct gained full credit. Most just took the curved surface area or the area of one or two ends as the total surface area.

MATHEMATICS

Paper 0580/22
Paper 2 (Extended)

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

There were many high scoring scripts with a significant number of candidates demonstrating an expertise with the content and showing good mathematical skills and communication. Where candidates scored highly but did not get full marks, it was frequently **Questions 12**, **20** and **24** that were the cause, either wholly or in part. There was no evidence that candidates were short of time, as all attempted the last few questions. Only a very small number of candidates were unable to cope with the demand of this paper. Candidates showed particular success in the skills assessed in **Questions 1(a)**, **4(a)** and **3**. It was rare to see candidates showing answers with no working. Some candidates lost marks due to rounding prematurely in an earlier stage in the working, this was particularly evident in **Questions 14**, **18** and **22**.

Comments on specific questions

Question 1

Almost all candidates answered **part (a)** correctly, the common incorrect answer seen was 3 arising from cube rooting the cube number 27.

Part (a) was less well answered than part **(a),** however the majority of candidates still answered correctly. The most common incorrect answer was 91 with a few also answering 93.

Question 2

Nearly all candidates gained both marks in this question. There were a few making arithmetic errors when dealing with the negative values in **part (a)**. A very small number of candidates treated the vectors as fractions, and so for example treated **part (a)** as $-\frac{1}{3}-\frac{2}{5}=-\frac{11}{15}$ and in **part (b)** similar misconceptions lead to a common incorrect answer $\begin{pmatrix}-2\\3\end{pmatrix}$. Some candidates did not read the question carefully and multiplied the wrong vector in **part (b)**, consequently another common incorrect answer was $\begin{pmatrix}4\\10\end{pmatrix}$.

Question 3

Very few incorrect responses were seen in this question. The most common error was to shade $\boldsymbol{A} \cup \boldsymbol{B}$.

Question 4

Part (a) was almost always correct except for some very occasional answers of 1 instead of –1.

Part (b) was usually correct. The most common error was to start with 23 + (n – 1)6 and give 17 + 6n as the answer. 23 – 6n was seen occasionally and weaker candidates gave a value for their answer rather than an expression. A few candidates seemed aware of a correct method but wrote 23 + (n – 1) –6 rather than 23 + (n – 1) × –6 or 23 + (n – 1)(–6) and did not recover from the missing brackets or missing multiplication sign.

Question 5

The vast majority of candidates were able to answer this correctly, using the correct simplified notation. A very small number had a correct partial factorisation, writing only 2 or only g outside the bracket. Candidates are advised to check their answer by expanding to see that common incorrect answers such as $2g(4 – g^2)$ or $2g(4g – g)$ would not give the original expression. Occasionally it was evident that the candidate thought factorisation meant it needed to be the product of two brackets.

Question 6

This question was generally well done with most candidates reaching the correct answer by showing the most common method of $\frac{4}{7}\times\frac{1}{8}$. Some cancelled before the multiplication and others chose to multiply before cancelling. A small number used a common denominator method $\frac{4}{7}\div\frac{56}{7}=\frac{4}{56}$. This method was more likely to be incorrect as occasionally it would lead to the misconception $\frac{4\div 56}{7}$. Some candidates did not show all, or any, working. A very small number used an incorrect method, sometimes by taking the reciprocal of $\frac{4}{7}$ leading to $\frac{7}{4}\times 8$. There were also a few who made errors in the multiplication or did not follow the instruction to give their answer in the simplest form.

Question 7

In both parts of this question the vast majority of candidates scored full marks.

In **part (a)**, for the few candidates who did not get full marks, the most common errors were to see sign errors when collecting terms such as evaluating $15t + t = 8 – 4$. Weaker candidates who reached $16t = –4$ then followed this incorrectly by $t = 16 \div –4$ instead of $t = –4 \div 16$.

In **part (b)** most candidates took the first step of clearing the fraction to get $25 – 2u = 6$ and were very successful from there. The loss of marks was usually due to sign errors in the rearranging of $25 – 2u = 6$. Quite often this was followed by $2u = –19$ with the negative sign omitted from the term $– 2u$ leading to the most common incorrect answer of – 9.5. A small minority attempted to the split terms from $\frac{25-2u}{3}$ before clearing the fractions and this usually led to incorrect answers.

Question 8

Most candidates gave a correct answer in standard form, as required. A small number found 0.3^2 correctly but did not express it correctly in standard form, with 0.09 or 0.9×10^{-1} being the most commonly seen partially correct answers. Occasionally 9×10^2 was seen as the attempt to change 0.09 to standard form. It was very rare to see 0.3^2 not correctly evaluated.

Question 9

The most common method was to multiply the second equation either by 2 or 3. Some who multiplied by 2 subtracted the two equations instead of adding them. Those who multiplied by 3 had to subtract and a few could not get $-2y - 3y$ correct., giving y or $-y$. The alternative method of substitution usually favoured $3(3 - y) - 2y = 19$. Some candidates did not multiply the brackets correctly, with $9 - y$ seen and again a few did not combine $-3y - 2y$ correctly. An error usually led to an incorrect value for x or y but most of those candidates did correctly follow through to find a value for the other variable from the second equation.

Question 10

The majority of candidates understood that the triangles were similar and used the base of each triangle to find the scale factor. From this point, some candidates correctly multiplied by 2.7 to reach 6.75 but then omitted the final step of adding 2.7. A very common error was to confuse the sides of the triangles and multiply by 2 rather than 2.7. It was common to see candidates using a trigonometrical approach rather than using similar triangles. Angles in the small triangle were found using the cosine rule, and then vertically opposite angles used where the two triangles meet at X, followed by the sine rule in the large triangle. Some did this correctly and accurately, however this method often led to inaccuracies due to rounding partway through the calculation. It was also common to see the final answer given as 9.5 cm, because all the numbers in the question were given correct to 2sf. Candidates are advised that the question paper states when an answer is exact it should be given as exact and not rounded. Candidates who did not score were often inconsistent with the scale factor, stating for example $\frac{7.5}{3} = \frac{2.7}{XC}$. The weakest candidates subtracted 3 from 7.5 to get length XC as 4.5.

Question 11

This question was one of the more challenging questions on the paper. Candidates seemed very unsure how to deal with applying the highest common factor to algebraic terms. The most common incorrect answers included 4 and $4x^4$. It was much rarer to see the power of x as 12.

Question 12

This question was answered well by the more able candidates, usually with clear accompanying working. The most successful method was to find the exterior angle and then divide that into 360. Those who found the interior angle first occasionally made mistakes in remembering the correct expression for the interior angle of a regular polygon with n sides, $\frac{(n-2)\times 180}{n}$. Another successful method, often used by the most able candidates was the starting point $180(n - 2) = 11 \times 360$. A number of candidates offered no response as they were unable to deal with the ratio aspect of the question. By far the most common error was to think that the interior and exterior angles summed to 360 instead of 180. Consequently instead of the correct starting point of $\frac{1}{12}\times 180$ or $\frac{11}{12}\times 180$, a large number of candidates began instead with $\frac{1}{12}\times 360$ or $\frac{11}{12}\times 360$. This resulted in an incorrect exterior angle of 30 and then candidates simply divided 360 by 30, giving 12 as the number of sides.

Question 13

The correct answer was the most common response to this question, usually done by candidates adding the area of a rectangle and a triangle, with a very small number using area of a trapezium. For the few candidates not scoring, it was often for simply multiplying the initial speed, 10, by the overall duration, 10. It was uncommon to see an attempt which did not try to use area under the graph.

Question 14

This was one of the more challenging questions on the paper. Most candidates were able to use the formula for finding the length of an arc once they had found an angle but a large number then had problems finding the angle at O. Many chose to use the cosine rule in triangle OPQ to find the angle, with some of these making errors in the structure of the formula. Another error often seen was $\sin^{-1}\left(\frac{6}{9}\right)$ leading to the common incorrect answer 6.57. Another common problem in this question was to use insufficient accuracy in the working. At least 4 figure accuracy should be used throughout the steps of the method if the final answer is to have 3 significant figure accuracy. Quite a few rounded their angle to 2 or 3 significant figures in the working leading to a common inaccurate answer of 6.11. Use of the formula for the area of the sector was occasionally seen instead of the arc length. A very small number of candidates tried to use areas to find the angle, assuming incorrectly that the area of the triangle and the sector were equal.

Question 15

There were some candidates who had difficulties with how applying the power of $\frac{1}{5}$ affected both the constant and the variable parts of the term differently. There were also some who didn't realise that they shouldn't have brackets in a fully simplified answer of this form. Some treated the term as $3125(w^{3125})^{\frac{1}{5}}$ amongst other bracketing misinterpretations whilst others thought that the power affected both the same, e.g. treating it as $3125^{\frac{1}{5}}w^{3125^{\frac{1}{5}}} = 5w^5$ or $\frac{1}{5}\times 3125w^{3125\times\frac{1}{5}} = 625w^{625}$.

Question 16

Most candidates correctly answered this question. A small number of candidates gave partially correct answers, expressing y in terms of a constant *k* and *x* and finding *k* correctly, but then omitting to square 2 when finding *y* when $x = 2$. A very small number of candidates thought that y being inversely proportional to x^2 meant that *y* was proportional to the square root of *x* or that y was directly proportional to x^2.

Question 17

Most candidates struggled to answer all parts of this question correctly. Many marked the intersection of AC and BD as right angles.

Part (a) was one of the better answered parts of the question. A common error was 95 from 180 – 85. Some candidates gave angle *ABD* as 55 and thus gave 40 as the answer, from 95 – 55. Others thought it was 55 some stated that they had used the alternate segment theorem to reach this answer.

Part (b) was more challenging. Some gave the same angle as **part (a)** as they thought there was an isosceles triangle.

Part (c) was the best answered part as many candidates were confident finding *CBA*, from angles on a straight line and then finding the opposite angle of a cyclic quadrilateral. Some marked *ACD* as 55 and so gave the answer as 83 from 180 – 55 – 42. The other common incorrect answer was 55, mainly from incorrect angles previously marked on the diagram or equating it to the given angle of 55.

Part (d) depended on what the angles *BCA* and *ACD* were found to be. Many candidates did get angle *ACD* as 53, but had angle *ACB* as 42, so their answer was 95.

Part (e) was the most challenging part. The most common incorrect answer was 55, possibly from angle *BAQ*. Many candidates could not use the alternate segment theorem so even though angle *ACD* was marked as 53 they gave a different answer.

Question 18

This question was quite challenging for candidates, however there were still a large number of correct answers. There were a variety of equivalent correct methods and first steps to deal with the question. The most successful candidates found the cube root of $\frac{81}{24}$ to get the length scale factor and then squared this answer for the area scale factor. Others set up an equation such as $\left(\frac{81}{24}\right)^2 = \left(\frac{X}{44}\right)^3$ or $\sqrt[3]{\frac{81}{24}} = \sqrt{\frac{X}{44}}$ which they then went on to solve. The majority of candidates using a correct method arrived at the correct exact answer but there were some who rounded mid-calculation which led to inaccuracies, particularly those who calculated $\sqrt[3]{81}$ and $\sqrt[3]{24}$ separately. It was common to see an answer of 66 where candidates had found the cube root of $\frac{81}{24}$ but had then omitted to square the result before multiplying by 44. Candidates who did not score either treated all scale factors as length scale factors resulting in a common incorrect answer of 148.5. Others confused squaring, square rooting, cubing and cube rooting. A common incorrect first statement was $\left(\frac{81}{24}\right)^3 = \left(\frac{X}{44}\right)^2$ and other examples of the confusion are: $\left(\frac{81}{24}\right)^2 \times 44$, $\sqrt{\frac{81}{24}} \times 44$, $\sqrt{\frac{81}{24}} \times 44^3$, $\left(\frac{81}{24}\right)^3 \times 44^2$ and $\left(\frac{81}{24}\right)^{\frac{3}{2}} \times 44$.

Question 19

A significant number of candidates correctly answered this question. Those that did not obtain full marks often had a correct unsimplified quadratic. They then went on to incorrectly rearrange, often incorrectly simplifying $-3x + 6x$ to $-3x$, resulting in the quadratic $x^2 - 3x = 0$. Of those who correctly found $x^2 + 3x = 0$, some were unsure how to solve this and stopped. Many did not realise that a simple factorisation, $x(x + 3)$ was required and some attempted to use the quadratic formula to solve, often incorrectly as they were unable to understand what to do without a constant term. Some candidates attempted a method that looked like solving the two given equations separately. Others ignored the first equation completely and solved the quadratic $x^2 - 3x + 10 = 0$ either by using the formula or factorising to $(x - 5)(x + 2)$ with the answers $x = 5$ and -2 often seen. A few candidates gained some credit for correctly simplifying their quadratic to the correct form. This was usually following an incorrect rearrangement, often this was $6x - 10 = x^2 - 3x + 10$ followed by $x^2 - 9x + 20$.

Question 20

This question was one of the more challenging on the paper, particularly **part (b)**.

In **part (a)** most candidates were able to find the third differences as 6, although some did not due to arithmetic errors, or not going as far as third differences. If they reached the third differences many were able to deduce it was a cubic sequence and then the most efficient candidates compared the sequence to the cube numbers 1, 8, 27, 64, 125 and reached $(n - 1)^3 - 1$. However, of those scoring full marks, it was more common to see the correct answer in the form $n^3 - 3n^2 + 3n - 2$ rather than as $(n - 1)^3 - 1$. This was due to the candidates solving the problem using standard results for the differences and an algebraic approach to find each coefficient one at a time. For some using that method there were occasional arithmetic slips leading to incorrect coefficients.

In **part (b)** many candidates attempted to find the answer to this part in the same way as **part (a)**, by finding differences and not knowing how to carry on when differences were all different. Many wrote working to show they understood that terms could be found by halving the previous term, but then often stopped. 0.75 was a common incorrect answer from the lower scoring candidates as the next term in the sequence. The most common successful approach used the general term for a geometric sequence, ar^{n-1}, reaching an answer of $24 \times 0.5^{n-1}$. However, some who attempted this were unable to find r successfully. The correct answer was seen about a third of the time written in many different equivalent forms such as $24 \times \left(\frac{1}{2}\right)^{n-1}$, $\frac{24}{2^{n-1}}$, $\frac{48}{2^n}$, $3 \times 2^{4-n}$ and $12 \times 2^{2-n}$. Of those who realised ½ was involved some wrote nth terms such as $\frac{n}{2}$ or had an incorrect answer of $\frac{48}{2n}$. A small number of candidates incorrectly thought $24 \times 0.5^{n-1}$ would simplify to 12^{n-1}.

Question 21

The vast majority of candidates knew to divide distance by time, with most using a correct lower bound of 13.5 in the numerator and so few scored no marks. Whilst very many went on to reach the correct answer of 1.08, the most common error was to also use a lower bound, 11.5, in the denominator. A much smaller number used an upper bound on top or tried bounds by adding/subtracting 0.05 rather than 0.5. Some divided 14 by 12 to reach 1.17 again and then attempted to use bounds on this answer, e.g. offering an answer of 1.165. Very occasionally some candidates converted the time into hours.

Question 22

A large number of candidates got this question fully correct, it proved to be difficult for many weaker candidates whose understanding of three-dimensional trigonometry was limited. It was quite common to see candidates attempting to find angle *PCB* or *PBA* rather than *PCA* as required. Most of these were able to r use Pythagoras' theorem to find the length *AC* or *PC.* Accuracy was often lost due to use of an insufficient number of significant figures in the calculation of the side lengths. A small number of candidates worked in triangle *PBA* and they usually earned no marks.

Question 23

A significant number of candidates achieved full marks for this question. Sign errors in the factorisation of the numerator were very common with $(5x + 4)(x - 3)$ or $(5x - 4)(x + 3)$ both seen fairly often. Quite a few candidates could not factorise the numerator at all and started with expressions such as $x(5x - 19) +12$, which usually earned no marks. It was also quite common to see those who had used the formula or their calculator to find the roots of $5x^2 - 19x + 12$ and who then gave $5(x - 3)(x - 0.8)$, or just $(x - 3)(x - 0.8)$, as the factorisation. Other problems in factorising the numerator were caused by attempts to factorise by grouping but instead of writing $5x(x -3) - 4(x - 3)$ writing $5x(x - 3) - 4(x + 3)$ and therefore not having a common factor; sometime compounded by cancelling a factor of $(x - 3)$ from the denominator and the factor of $(x - 3)$ from the denominator. Factorisation of the denominator was generally more successful with many candidates getting the correct factors but sign errors also occurred here, with $(x - 3)(x - 3)$ sometimes seen.

Question 24

This proved to be the most challenging question on the paper with few correct answers. Those candidates that were successful usually multiplied successive appropriate fractions together until they reached the required probability. A small number successfully took a more algebraic approach. Some candidates did not find the probability of not hitting the target, namely $\frac{2}{3}$, and simply divided $\frac{64}{2187}$ by $\frac{1}{3}$ or divided $\frac{1}{3}$ by $\frac{64}{2187}$, giving an answer of 11. A few candidates did not provide a response to this question. Some of the more able candidates used a more deductive approach, realising that they needed a power of 3 to get to 2187 and got to the correct answer very efficiently.

Question 25

Candidates demonstrated a good understanding of finding an inverse function with a very high proportion of correct answers. Those who were not awarded both marks often gained a mark for a first correct step of either interchanging x and y or rearranging to isolate x^3. Some made errors in the rearrangement to give for example, $y + 1 = x^3$ or $x + 1 = y^3$. An answer of $\sqrt[3]{x} - 1$ was fairly common, either with no other working shown or after $y^3 = x - 1$. Some candidates incorrectly added in a ± sign before the cube root. Weaker candidates divided $x - 1$ by 3 rather than taking the cube root or gave the reciprocal.

MATHEMATICS

Paper 0580/32
Paper 3 (Core)

Key messages

To succeed in this paper, candidates need to have completed full syllabus coverage, remember necessary formulae, show all working clearly and use a suitable level of accuracy. Particular attention to mathematical terms and definitions would help a candidate to answer questions from the required perspective.

General comments

This paper gave all candidates an opportunity to demonstrate their knowledge and application of mathematics. The majority of candidates completed the paper and made an attempt at most questions. Although a number of questions have a common theme, candidates should realise that a number of different mathematical concepts and topics may be tested within the question. The standard of presentation and amount of working shown was generally good. Centres should encourage candidates to show formulae used, substitutions made and calculations performed. Attention should be paid to the degree of accuracy required in particular questions. Candidates should be encouraged to avoid premature rounding in workings as this often leads to an inaccurate answer. Candidates should also be reminded to show all steps in their working for a multi-stage question and should be encouraged to read questions again to ensure the answers they give are in the required format and answer the question set.

Comments on specific questions

Question 1

(a) This part was generally answered well although candidates found the reverse time calculation needed for Sunday more challenging. Common errors included the notational errors of 10.30 pm, 10.3 (Sunday), 4.00, 4 am (Friday) and 8.30 (Thursday).

(b) (i) This part was generally answered well. Common errors included omitting one of the values from the required multiplication, using the additional or incorrect alternative values of 7 and/or 365.

(ii) This part was generally answered well. Common errors included using the yearly pay rather than the hourly pay, and just finding the increase.

(c) This part was generally answered very well.

(d) Both parts, completing the frequency table and drawing the bar chart, were generally answered very well.

Question 2

(a) (i) This part was generally answered well, with the majority of candidates able to find the correct three pie chart sector angles.

(ii) This part on drawing the pie chart was generally answered well, although a small number of inaccurate angles and/or unruled lines were seen.

(iii) This part was generally answered very well.

(b) (i) This part on writing down the mode was generally answered well. Common errors included 3, 5, 45, and calculating the mean or median.

(ii) This part was generally answered well. Common errors included 18 and 6 (the number of students rather than the lowest score).

(iii) This part on working out the range was generally answered well. Common errors included 4 (from 6 – 2) and 9 (from 9 – 0).

(iv) This part on using the range was not answered as successfully. Common errors included 70 and 25 (from 22 + 3) and 48 and 42 (from 45 $\pm$ 3).

Question 3

(a) (i) This part on ratio was generally answered well, although a significant number did not give the ratio in its simplest form with 30 : 25 : 10 being common. It was also noted that a number attempted to use the value of 325 (from 150 + 125 + 50) in their calculation.

(ii) Those candidates who used the value of $\frac{50}{20}$ or 2.5 were more successful and generally worked out the three correct amounts required. A common error was attempting to use the ratio from **part (i)**.

(b) (i) Candidates found this part quite challenging and it proved to be a good discriminator. Common errors included incorrectly converting the 16 kg, using 600 ÷ 16, giving the answer of 26.67 loaves, and giving the answer of 0.67 g of flour left over.

(ii) This part on working out a percentage decrease was generally answered well. Common errors included answers of 0.0625 or 93.75, and incorrectly using $\frac{16-15}{15}$ in their calculation.

Question 4

(a) This part was generally answered very well.

(b) This part was generally answered very well.

(c) This part was generally answered reasonably well. Common errors included –0.6, $\frac{6}{10}$, $\frac{3}{5}$, and the final answer of $\frac{1}{0.6}$.

(d) This part was generally answered well although the common error of 14 was seen.

(e) Candidates found this part quite challenging with many seemingly unaware of the definition of an irrational number. The common correct answers were 5π and $\sqrt{300}$ (for example). Common errors included 16, 17.5, π, 4.12311 (from $\sqrt{17}$), $\sqrt{5}$ and $\sqrt{256}$.

(f) This part on finding an estimate was not answered as successfully. Common errors included using a calculator with the given values, using 420 instead of 400, and using $\frac{424-78}{24}$.

Question 5

(a) This part on measuring an angle was generally answered very well, although the common errors of 10.8, 72 and 108 were seen.

(b) (i) (ii) This part was generally answered reasonably well, although the full range of the words given were seen, with obtuse and reflex being the most common.

(c) This part on finding the area of a triangle was not answered as successfully. A significant number did not appreciate that the formula could be used to give $\frac{1}{2} \times 6 \times 3$. Common errors included a variety of incorrect formulas used, answer of 18, inaccurate and unnecessary measurement of the 3 sides, multiplying or adding their 3 sides. The units were generally correct.

(d) (i) This part was generally answered reasonably well with a good number of candidates able to identify the given transformation as an enlargement and able to correctly state the three required components. The identification of the centre of enlargement proved the more challenging with a significant number omitting this part, and (0, 0), (2, 0) and (–2, 0) being common errors.

(ii) This part was generally answered well with the majority of candidates able to identify the given transformation as a rotation and able to correctly state the three required components. The identification of the centre of rotation proved the more challenging with a significant number omitting this part, and (0, 0) and (2, 6) being common errors.

(e) (i) A good number of candidates were able to correctly draw the required translation although common errors included getting only the horizontal or vertical component correct, with a small number omitting this part.

(ii) Although a smaller number of candidates were able to correctly draw the required reflection, this part proved to be challenging for many candidates. Common errors included reflections in $y = 4$, reflections in a variety of other vertical lines particularly $x = 5$, $x = 4.5$ and $x = 0$.

Question 6

(a) This part on finding the equation of the given line was generally reasonably answered, although a significant number did not seem to appreciate that the intercept value could be read directly from the given graph.

(b) This part on writing down the coordinates was generally well answered, although the common errors of (0, –3.5) and (0, 7) were seen.

(c) (i) The table was generally completed very well with the majority of candidates giving the 5 correct values.

(ii) This part was well answered by a good number of candidates who were able to gain full credit for accurate, smoothly drawn curves. Most others scored partial credit, with one or more points being plotted inaccurately, or for just plotting the points without drawing the curve through them.

(d) (i) This part was generally answered very well, although the common error of drawing the line $x = 6$ was seen.

(ii) This part on solving the given equation was generally answered well. Common errors included using the intersection of the graph with the x-axis, or misreading the scale.

Question 7

(a) The majority of candidates were able to measure accurately at 6 cm and then use the given scale to correctly work out the actual distance.

(b) This part was generally answered reasonably well with the more successful candidates drawing the two given bearing lines to identify their intersection as the position of town *V*. The bearing of 215° proved to be the more challenging bearing line to draw. Another common error was drawing the bearings of 073° and 305°.

(c) This part was not answered as well with many candidates not appreciating one of the required stages in this multi-stage calculation. Common errors included using $24 \div 8$ to get an incorrect distance of 3, incorrect conversion of the 1 hour and 50 minutes, incorrect use of the time, distance, speed formulas, not applying the scale and leaving their answer as 44, and not appreciating that the position of *C* had to be on the line *ST*.

(d) Candidates found this part quite challenging and it proved to be a good discriminator. The common error was using the incorrect 360 – 321 = 39.

(e) Candidates again found this part quite challenging with many not appreciating the method to be used or the conversions needed to rewrite the scale in the form 1 : n. Common errors included $8n$, $n/8$, 8, 8000, 800 and 1/8.

Question 8

(a) (i) This part was generally answered very well, although the common error of 4 was seen.

(ii) This part was generally answered well, although the common error of drawing 4 lines of symmetry was seen. The incorrect inclusion of the diagonals, together with the common error in **part (i)**, suggests that the significance of the shaded regions was not appreciated.

(b) (i) This part was generally answered very well, although the common error of applying only one of the changes, increasing the number of white columns by one or increasing the number of rows by one, was seen.

(ii)(a) This part was generally answered well, although not all candidates appreciated the fact that all the diagrams contained 2 grey columns. The common error was the incorrect number of 12.

(ii)(b) This part was generally answered reasonably well, although the common errors included $n + 1$, $(n + 2)^2$ (from the number of squares) and a variety of other expressions both linear, quadratic or numerical.

(ii)(c) Candidates found this part very challenging and it proved to be a good discriminator. Many candidates did not appreciate that their previous two answers were to be used.

(iii)(a) This part was generally answered well. The errors tended to be in the 'number of white squares' row.

(iii)(b) This part was generally answered well. The common errors included $n + 2$ and +2.

(iii)(c) This part was generally answered reasonably well. The common errors included the incorrect expansion of 30 (30 + 2) as 900 + 2, 30 + 32 and the substitution of numerical values other than 30.

(iii)(d) Candidates found this part very challenging and it proved to be a good discriminator. Many candidates did not appreciate that the initial line of the algebra needed was better as $(n + 2)^2 = 1296$, by spotting the square numbers in the final row of the table. A significant number were able to correctly start with $(2n + 4) + n(n + 2) = 1296$ but then made errors in the difficult algebra steps needed to solve this equation. Others attempted to use a purely numerical method, with 1296 ÷ 9 being a common error.

Question 9

(a) This part was generally answered reasonably well. The very common errors included $2y + 3y = 5y$, $2 \times (2y + 3y) = 10y$, $2y \times 3y = 6y$, $2y \times 3y = 5y$ and $2y \times 3y = 5y^2$.

(b) This part was generally answered well with the majority able to recognise the method and apply the algebra to be used. A good number of clearly set out and fully correct solutions were seen. Common errors included incorrect use of 180 or 360, equating each side to 526, attempting to multiply the sides, and an incorrect algebra step. A trial and improvement method was rarely successful.

MATHEMATICS

Paper 0580/42
Paper 4 (Extended)

Key messages

To do well in this paper candidates need to be familiar with all aspects of the syllabus. The recall and application of formulae in varying situations is required as well as the ability to interpret situations mathematically and problem solve with unstructured questions. Work should be clearly and concisely expressed with intermediate values written to at least four significant figures with only the final answer rounded to the appropriate level of accuracy. Candidates should show full working with their answers to ensure method marks are considered when final answers are incorrect.

General comments

There were a number of strong candidates who demonstrated an expertise with the content and proficient mathematical skills. There were also some weaker candidates in which a lack of expertise was clearly evident, as well as a lack of familiarity with some topics, resulting in significant number of no responses. There was no evidence that candidates were short of time, as most candidates attempted nearly all of the later questions. Premature rounding and not following instructions about the accuracy of answers resulted in some candidates losing a number of marks. For example, in **Question 10(a)** and **10(b)**, candidates were asked to show that answers rounded to particular values. The topics that proved to be most accessible were simple percentages and ratio, simple interest, statistics and graphs, transformations, area of a triangle, finding turning points and working with simple functions. The more challenging topics were monthly compound interest, vectors, length of a line segment, Venn diagrams and interpreting set notation, dependent events and probability, harder trigonometry and shortest distance from a point to a line, and sketching trig graphs.

Comments on specific questions

Question 1

(a) (i) Almost all candidates were able to show that Alain received \$400. In a small number of cases some candidates did not show all the steps of the calculation by omitting the division by 15.

(a) (ii)(a) Almost all candidates gave a correct percentage. The few errors seen usually involved calculating 150% of 400 or calculating 400 as a percentage of 150.

(a) (ii)(b) Most candidates showed a good understanding of simple interest and calculated the correct amount. The most common error involved calculating the interest only. A small number of candidates could not recall the correct method for simple interest, sometimes attempting to calculate the compound interest instead.

(a) (iii) Fewer fully correct responses were seen as a number of candidates struggled to deal correctly with a compound interest rate of 0.25% per month. Many treated 0.25% per month as 3% per year and $350\left(1+\frac{3}{100}\right)^5$ was frequently seen. Some appeared not to notice that the interest was monthly, instead treating it as annual interest. Those that understood what was required usually obtained the correct amount, although some forgot to give their answer correct to the nearest dollar.

(b) Success in this question was dependent on correct manipulation of the given ratios. Candidates that were able to rearrange them to 6 : 9 : 10 almost always found the correct number of oranges. Some had a some understanding and equated the two parts for Carl, but then did not scale up the two parts for Dina and Eva. Many others struggled to make any progress. Sharing 100 oranges in the ratio 3 : 5 and in the ratio 2 : 3 was common with many candidates simply adding the two results, with 77 and 78 common wrong answers. Others added the four parts to get 13 and calculated $\frac{5}{13}\times 100$, leading to the other common wrong answer of 38.

(c) Most candidates opted to find the cost of the house by working backwards one year at a time. The majority successfully converted the percentages to multipliers before dividing by one then the other. Many were unsuccessful in their attempt, mistakenly calculating 97% of the value followed by calculating 95%. Others attempted to convert the two increases to find the multiplier for the overall increase. Many did obtain 1.0815 but a significant number simply added the two percentage increases. Some attempted to set up an equation based on the price paid. The value after 1 year was usually correct but errors appeared when trying to increase this by 3% with $x+\frac{3}{100}\left(x+\frac{5x}{100}\right)$ being a common error.

(d) Most candidates displayed a good understanding of compound interest and found the correct rate of interest. Some had a correct method but premature approximations and rounding issues resulted in answers that were not always accurate enough. After starting correctly by setting up the equation $500\times\left(1+\frac{r}{100}\right)^8=609.20$ errors such as $\left(\frac{r}{100}\right)^8=\frac{609.20}{500}-1$ and $500\times\left(1+\frac{r}{100}\right)=\sqrt[8]{609.20}$ were seen in the rearrangement.

Question 2

(a) (i) Almost all candidates identified the mode correctly. In a few cases some gave the answer as 32, the number of students, instead of the reaction time.

(a) (ii) Many candidates were able to find the median from the table. A common incorrect answer was 8.5, the result of finding the median of the list of reaction times without considering the number of students with each time.

(a) (iii) Most candidates calculated the mean correctly with a few having a clear correct method which was then evaluated incorrectly. Others found the sum of products correctly but divided by 6, the number of groups, rather than 100, the total frequency. Some found the sum of either the reaction times or the frequencies and divided the result by 6. A small number of candidates attempted to apply the method for estimating the mean of continuous data to the discrete data in the table.

(a) (iv) A small majority identified the two correct probabilities and the correct product, with a small number spoiling their product by multiplying by 2. Many other candidates identified that there are 46 students with a reaction time greater than or equal to 9 seconds and showed the correct probability $\frac{46}{100}$ for selecting the first of these students. Some gave this as their answer rather than calculating the probability of selecting two students. Others calculated a product with replacement rather than without replacement or applied a mix of both.

(b) (i) Most candidates found the range correctly, although in some cases the interquartile range was found in this part. Incorrect answers usually resulted from misreading the scale or slips with numeracy.

(b) (ii) Almost all candidates gave the correct interquartile range.

(c) (i) Most candidates demonstrated a good understanding of the mean of grouped data and many obtained the correct answer. A few made slips, usually with one of the midpoint values. Incorrect methods usually involved the use of the class widths instead of midpoint values.

(c) (ii) Most candidates drew two correct bars in the histogram. Few candidates wrote down the frequency densities, so, if they had misinterpreted the scale on the frequency density axis, they could gain no credit.

Question 3

(a) There were two main approaches for this question. The efficient approach was to equate the volume of the hemisphere with the volume of a cylinder with height *h*. This led directly to the answer $h = 0.125$. The more common approach was to subtract the volume of the hemisphere from the volume of a cylinder of radius 12 and height 3 and use this to find the height of water when the hemisphere had been removed. This result had to be subtracted from 3 to give the answer $h = 0.125$. Many candidates showed the required substitution of 3 and 12 into the formulas, but some omitted this step so were not able to gain full credit. Others did not show the division stage of their method. Those who substituted values for π rather than cancelling it from all terms sometimes gave rounded intermediate values which led to an answer that rounded to 0.125 which was not acceptable. Using the formula for the volume of a sphere rather than a hemisphere was a common error.

(b) Understanding that they needed to use the volume of water was an essential step in obtaining the correct answer. Those candidates that did either used a depth of 2.875 in the original cylinder or simply used $432\pi - 18\pi$ or their equivalent values. Most reached the correct answer although some truncated their answer to 4.79 rather than rounding to 4.80. The most common error was to use a depth of 3 in the original cylinder or their 432π leading to the incorrect answer of 4.899. A small number of candidates used a depth of 0.125 leading to the incorrect answer of 1.

(c) Many candidates calculated the percentage correctly. Some calculated the difference in volumes correctly but then divided by the volume of the cubes rather than the volume of the sphere and others found the percentage of metal used rather than the percentage not used. Other common errors involved the using the volume of one cube or calculating the maximum number of cubes that could be made and using that value of 33 rather than the 30 stated in the question. A significant number of candidates did not use the correct formula to calculate the volume of a cube with some using the perimeter of the edges and others the area of a face or the total area of the cube.

Question 4

(a) (i) Many candidates enlarged the triangle correctly from the given centre. Some were able to enlarge the triangle but with the wrong centre. The use of ray lines was seen on occasions and in a few cases the lack of accuracy either resulted in an incorrect point on the enlargement or a triangle of the correct size in the wrong position. A slightly higher proportion of candidates made no attempt at a response.

(a) (ii)(a) Many correct rotations were seen with only a few candidates rotating in an anticlockwise direction. In a few cases candidates drew a triangle of the correct size and orientation with the wrong position, usually displaced by a square from the correct position.

(a) (ii)(b) Many correct reflections were seen. Most candidates that drew the line of reflection were successful in drawing triangle *Q*, although a significant number of candidates then drew triangle *Q* with the wrong orientation. Candidates that did not draw the line of reflection tended to be less successful, although a few did draw triangle *Q* correctly.

(a) (ii)(c) Candidates that were successful in drawing triangles *P* and *Q* almost always gave a correct description of the transformation with just a few omitting the line of reflection. Describing multiple transformations was rare if triangles *P* and *Q* were correct.

(b) This proved more challenging for some candidates and fully correct responses were in the minority. Those that showed clear working were usually successful. Many were able to make a start, usually quoting $\overrightarrow{HK} = \mathbf{b} - \mathbf{a}$, $\overrightarrow{KH} = \mathbf{a} - \mathbf{b}$ or $\overrightarrow{OZ} = \overrightarrow{OH} + \overrightarrow{HZ}$. Many dealt with the ratio correctly, writing $\overrightarrow{HZ} = \frac{2}{7}\overrightarrow{HK}$ but then went wrong by writing $\overrightarrow{HZ} = \frac{2}{7}\mathbf{b} - \mathbf{a}$ and working with this for the remainder of the question. Not all used the ratio correctly and $\overrightarrow{HZ} = \frac{2}{5}\overrightarrow{HK}$ was a common error. Another common error involved the directions of the vectors and errors such as $\overrightarrow{HK} = \mathbf{a} - \mathbf{b}$ were often seen.

Question 5

(a) Many candidates expanded the brackets and simplified to three terms correctly. A wide variety of errors were seen. Some of these included expanding to give a constant term of –6 instead of +6, $2p^2 \times 3p^2$ given as $6p^2$, simplifying $-9p^2 - 4p^2$ as $-5p^2$ as well as attempting to refactorise the correct expansion.

(b) (i) Almost all candidates found the correct value with just a few making a slip with the numeracy.

(b) (ii) Many candidates demonstrated good algebraic skills and rearranged the formula correctly. A significant number of others also rearranged correctly but left their answer in a form that needed some simplification. Common errors included expanding the brackets incorrectly such as $\frac{1}{2}u + vt$ or $\frac{u}{2} + \frac{vt}{2}$, multiplying by $\frac{1}{2}$ rather than dividing by $\frac{1}{2}$ to give $\frac{1}{2}s = (u + v)t$ and multiplying by t rather than dividing by t to give $st = \frac{1}{2}(u + v)t$. A significant number of candidates reached the stage $u + v = \frac{2s}{t}$ but then went wrong with the final step by writing $v = \frac{2s - u}{t}$. Candidates would be well advised to carry out one step at a time. Some candidates attempted to carry out two steps at a time but did so incorrectly and lost the credit for both steps.

(c) (i) Many correct answers were seen. The most common error resulted from factorising the pairs to give $t(2q - 3) - 2(3 - 2q)$ before giving the final answer as $(2q - 3)(t - 2)$, with candidates not realising that the expressions in the two brackets need to be the same before continuing to the final answer.

(c) (ii) Many fully correct answers were seen with a few candidates obtaining the correct answer and then spoiling it by further incorrect work. A significant number started correctly by stating $x(x^2 - 25)$, rewriting this as $x(x^2 - 5^2)$ and then went wrong by writing this as $x(x - 5)^2$. Other incorrect answers included $(x^2 - 5)(x + 5)$ and $(x^2 + 5)(x - 5)$.

Question 6

(a) Most candidates gave a correct equation for the horizontal line. Common errors included $y = x + 4$, $y = -\frac{1}{2}x + 4$, $y = x + 4$ and occasionally $y = mx + c$.

(b) Many candidates also gave a correct equation for the sloping line. Common errors included using a wrong method to find the gradient such as inconsistent subtraction of the coordinates or dividing in the wrong order. Some of those with the correct gradient went wrong when trying to find the value of the intercept, usually making an algebraic slip when working with the coordinates of point A or B. Some of those with an incorrect gradient also obtained the correct intercept if they used point A to do so.

(c) (i) This proved more challenging for candidates and fewer fully correct answers were seen. It was evident that many candidates knew what to do but forgot that as it is a 'show that' question they were expected to show all their working. Many stated that the gradient of the perpendicular line is 2 with no attempt to show why. When the gradient was found, most candidates knew how to work out the value of the intercept and did so correctly.

(c) (ii) To be successful in this part candidates needed to show clear working. Only a minority of candidates were able to find the correct length of CD. Firstly, candidates needed to find the coordinates of point D. Some did so correctly and usually went on to obtain the correct length. Instead of equating $2x - 1 = 0$, many substituted $x = 0$ to obtain $y = 1$. This was sometimes labelled as D, but not always. To earn credit for finding the length then candidates needed to identify the point D.

Question 7

(a) Many correct responses were seen. In a significant number of cases candidates did not appear to understand the concept of the Venn diagram, writing 17, 14 and 24 in the spaces.

(b) (i) Candidates were less successful in this part with many unable to identify the correct subset $P \cap C'$. Common errors included 10 (from C'), 9 from $P \cap C$, 17 from P and 2 from $P' \cap C'$.

(b) (ii) Identifying the subset $P \cup C'$ proved more challenging and fewer correct answers were seen. The most common errors included 10 (from C'), 17 from P and 8 from $P \cap C'$.

(c) Candidates found this question challenging and only a small majority found the correct pair of probabilities. Some of those went on to double the product but many did not and in a small number of cases candidates added the correct pair. For other candidates, incorrect denominators were common, such as 24 and 24, 9 and 5 and 22 and 21.

(d) Candidates fared better with this question and a majority gave a correct probability. In a few cases candidates multiplied the correct product by 2. As in the previous part incorrect denominators were often seen, usually 24 and 23, 22 and 21 or 14 and 13.

Question 8

(a) Almost all candidates calculated the area correctly. Occasional slips were seen such as forgetting to divide by 2 or adding the base and height.

(b) The question produced a spread of marks with a small majority of candidates reaching the correct value of x with all working shown. Most candidates were able to set up the correct initial equation but rearranging to a three-term quadratic produced some errors. Some had difficulty dealing with the $\frac{1}{2}$ and quite a few candidates multiplied 50 by $\frac{1}{2}$ rather than divide by $\frac{1}{2}$. Other errors usually occurred when expanding the brackets or collecting terms together. Having obtained a quadratic many attempted to use the formula with a few candidates making slips with the substitution and evaluation. Not all candidates showed the working for solving the quadratic and just gave the answer so full marks were not awarded in this case.

Question 9

(a) Not all candidates recognised the need to differentiate in order to find the gradient. Those that did were often successful in finding the gradient function. Many of these continued correctly and found the gradient with just a few making numerical slips with the substitution. Other candidates usually substituted $x = 1$ into the equation of the graph.

(b) Many candidates demonstrated a good understanding of turning points including some of those that did not differentiate in the previous part. Most of those with a correct derivative went on to find the two correct turning points. Others struggled to solve the quadratic $3x^2 - 6x = 0$, either factorising incorrectly or applying the formula incorrectly. Those with an incorrect derivative earned partial credit for equating the derivative to zero and attempting to solve their quadratic. A few candidates found the second derivative and equated this to zero.

(c) A majority of candidates were able to draw a positive cubic curve but many did not link their sketch to their answers in the previous part. Many attempted to draw a scale, plot a few points and draw the curve. This can produce a good sketch but quite often it gives a sketch with poor curvature because of the inaccurate scale. Candidates need to be aware of the shape, the orientation and any turning points if asked for.

Question 10

(a) Almost all candidates used a correct method to find the length of *AB*. Many of these gave their answer as 10.54 when they were expected to give an answer to a minimum of three decimal places and show that it rounds to 10.54. Most used the cosine ratio but a significant number used less efficient methods such as calculating *BC* using the sine ratio and then applying Pythagoras or even the sine or cosine rules.

(b) Almost all candidates used a correct method to find angle *DAC*. Many of these gave their answer as 41.80 when they were expected to give an answer to a minimum of three decimal places and show that it rounds to 41.80. Most used the cosine ratio but a significant number used less efficient methods such as calculating *CD* using Pythagoras and then using the sine ratio or the sine or cosine rules.

(c) To calculate *BD* candidates needed to apply the cosine rule and many did so successfully. The majority opted to work with triangle *ABD* (the more efficient method) with some opting to calculate *BC* and *CD* and then apply the cosine rule to triangle *BCD*. A significant number of other candidates calculated *BC* and *CD* and then applied Pythagoras to triangle *BCD*, treating angle *BCD* as a right angle rather than 149°, possibly mistaking the diagram for a 3-D problem. Some candidates rounded prematurely which sometimes resulted in answers outside of the acceptable range.

(d) Candidates found this part more challenging and fully correct responses were in the minority. A variety of methods were seen. Some opted to calculate angle *ABD* and subtract the result from 90°. Many others opted to work with triangle *BCD* and use the cosine rule or the sine rule. Those opting for the cosine rule usually did so correctly with just a few errors seen in writing the formula and some in rearranging from the implicit form. Those using the sine rule were also successful with just a few slips seen. Many others incorrectly applied simple trigonometry thinking that triangle *BCD* was right-angled at *C*. Some candidates rounded prematurely which sometimes resulted in answers outside of the acceptable range.

(e) Candidates found this part more challenging and fully correct responses were in the minority. Quite often there were no diagrams in the candidates working to indicate the recognition of the shortest distance. Where diagrams were drawn to show the correct shortest distance candidates were often successful in calculating the distance. Some candidates assumed the shortest distance would occur at the midpoint of *BD*, others thought that it was the length of the line from *C* to the intersection of *BD* and *AC*. The use of the tangent ratio was very common. A higher proportion of candidates made no attempt at a response.

Question 11

(a) Most candidates gave the correct answer. The most common error was writing j(–1) as -1^2 and giving the answer as –1.

(b) Most candidates solved the equation correctly. Simplifying $2x - 1 + 3x + 2 = 0$ to give $5x - 1 = 0$ was a common error.

(c) Most candidates were successful in writing gg(x) in its simplest form. Common errors included the incorrect expansion of $3(3x + 2)$ as $6x + 6$ and to a lesser extent writing gg(x) as $(3x + 2)^2$.

(d) This part proved more challenging and only a minority of correct responses were seen. Many candidates were able to set up a correct expression with later stages proving difficult for some. After writing gh(x) as $3\left(\frac{1}{x}\right) + 2$ a significant number of candidates simplified this incorrectly as $\frac{3}{3x} + 2$. When combining the terms it was common to see the two terms involving x combined leaving the 2 left to be dealt with later, often incorrectly, usually as $\frac{x + 3(2x - 1)}{x(2x - 1)} + 2$ simplified to $\frac{x + 3(2x - 1) + 2}{x(2x - 1)}$.

(e) A large majority of candidates identified the correct function.

Question 12

(a) Some candidates were able to produce a good sketch of the graph of $y = \tan x$. Some attempts at the correct graph only covered part of the domain between the asymptotes or showed incorrect curvature. It was also common to see graphs of the correct shape but with the wrong period. Some candidates sketched graphs of $y = \sin x$ or $y = \cos x$.

(b) Many candidates gave the solution $x = 30°$ only and did not use their sketch to help identify the second solution of $x = 210°$. A small number of candidates just gave the $x = 210°$ solution despite having also shown $x = 30°$ in their working. After showing 30 in the working some went on to give answers such as 150 and or 330, even when not supported by their sketch.