MATHEMATICS

Paper 0580/12
Paper 1 (Core)

Key messages

After writing down an answer, read through the question again and check that it makes sense for what is being asked.

Where there is more than one stage in a calculator calculation, it is best to keep the answer to each stage in the calculator but if you do write each stage down, put all, or at least write down 5 or 6 figures, in preparation for the next calculator stage.

Exact answers need all the figures, not rounded off to 3 significant figures.

Always show working if there are 2 or more marks for all, or part, of a question.

General comments

All questions on this paper were considered accessible to all candidates who had covered, and thoroughly practised questions on, all topics in the syllabus. While certain questions were not quite straightforward applications of the syllabus statements, it was felt that all candidates could make some attempt. This seemed to be the case since the percentages of no responses on questions was below 10 per cent, apart from the last question on the paper.

The overall performance of candidates was high with many achieving marks over 40 and extremely few with marks below 10. Where candidates do not achieve the grade they expect, it will often have been from careless errors when the method was clearly known. The key messages indicate the common causes of these errors.

Presentation and clarity were good in general but candidates should always be clear with figures that can be misread, often a 4 mistaken for 9. Overwriting, either over a pencil attempt, or changing a figure, should be avoided. A simple line through the figure or item to be rejected with a clear correction makes marking far more straightforward.

Comments on specific questions

Question 1

While writing a large number in figures was well done, there were some errors seen. In particular, one or three zeros between the 3 and the 5. Other slips included starting with a 5 and writing 13 instead of 30 for the first two digits.

Question 2

Most candidates had no problem rounding to the nearest ten but some misunderstood the question. Just 30 or 20 or 60 alone were seen as well as 593. A rounding to the nearest thousand or hundred were seen occasionally.

Question 3

Apart from a few slips on using a ruler, marking the midpoint of a line was done successfully by virtually all candidates. Some markings of the point were barely accurate and some could have been clearer. While a constructed point was acceptable, it was not necessary.

Question 4

(a) Shading a fraction of the 36 squares was generally well done but shading 9 squares was often seen. Some shaded just one side while others shaded 7, 2, 4 or even 11 squares.

(b) Writing a fraction as a percentage was more successful than the shading in **part (a)**, and was attempted by all. A minimum of 3 figures was required so an answer of 22 did not score. Just a few showed a lack of understanding of percentages offering answers of 0.22 or 2.22 but it was rare to see any other digits besides ‘2’ in the responses.

Question 5

While nearly half of the candidates managed a correct length of time, many struggled with the topic. Few candidates showed a pair of times for each day which should have given a simple addition to be done. 16 h 32 min from subtracting the times was just one of many incorrect responses seen, some of which suggested there is 100 minutes in an hour!

Clearly working out time periods is something that many simply guess at rather than making a structured response to periods of time going over the end of one day.

Question 6

(a) The vast majority of candidates could pick out the 2 multiples of 11 correctly. ‘All the multiples’ should suggest at least 2 but just one choice was seen at times. The other main error was to include 111, and occasionally a multiple of 11 not in the list was given.

(b) Simply following the example shown for another number meant that, with care, this was a very straightforward 2 marks, which was gained by the vast majority. A few responses simply copied out the given example, while a few made errors in the list but did not check that their sum was not a multiple of 11. Strangely a few added a zero at the end of the list, but since this made no difference to the calculation it was condoned.

Question 7

Although many candidates struggled with this question, many did find at least one of the values for the eighth number. Most understood the meaning of range, although some answers had little evidence of this.

Question 8

This mark was gained by nearly all candidates, which clearly showed accurate use of the calculator. Although candidates should be reminded that for exact answers all figures should be written down, in this case a correctly rounded 3 or 4 significant figure was accepted. Some found 5.26 from incorrectly doing $\sqrt{(5.76 + 2.8^3)}$ and another error seen was squaring 2.8 instead of cubing it.

Question 9

Regardless of common confusion over signs, in particular answers involving $-10k$ or $5m$, this simplification was done correctly by the vast majority of candidates. Some had the correct answers but then lost a mark for combining the two parts.

Question 10

(a) Some of the higher scoring candidates worked out correct answers to the highest product of 2 numbers. A basic difficulty was that many did not understand that ‘product’ meant multiplication and not addition. In fact, many chose the correct numbers but did not perform any operation on them. 48 was often seen as it was the highest product of 2 positive numbers meaning these candidates did not appreciate the positive result of the product of 2 negative numbers.

(b) This part was found more challenging than **part (a)**, although some did gain the mark having got **part (a)** incorrect. An additional error here was that a significant number of candidates did not notice that it was the product of 3 numbers, not 2 numbers as in **part (a)**. Lack of understanding directed numbers meant that many were trying to get an answer as close as possible to zero. A commendable attempt, though not gaining any credit, was –189 from the product of the 3 highest negative numbers.

Question 11

(a) Centres have now clearly got to grips with the recently introduced topic of stem-and-leaf diagrams, resulting in a very high percentage of fully correct responses. A few missed out numbers losing a mark which could have been corrected with a check on 14 items in the table. In particular omitting 72 in the diagram occurred far more than omission of any other number. Some lost a mark by not having entries in order or by putting a zero in the 3 row instead of leaving it with no entries. A minor point on presentation is that a number of candidates put lines through entries, (probably to help with **part (b)**) but making it tricky to recognise the digits in the leaf part of the diagram.

(b) While starting again with the original list to find the median was acceptable, even though errors were common from those who did this, it was expected that candidates would use their **part (a)** to work with the two middle values. Answers of 58 and 64 showed an attempt at the middle but many did not realise that the median could be a number not in the list. There were a few who gave a range and those who did realise that it was the average of the two middle numbers often had 6 from (8 + 4) ÷ 2 since they ignored the stem.

Question 12

(a) Surface area from a net appeared to be well understood by most candidates resulting in many correct responses. The main error was to work out the volume in **part (a)** and then often the surface area in **part (b)**. Some did not realise there were 3 different size rectangles, repeating for example 10 × 5 while others who knew exactly what to do wrote 2(10 × 4) + (10 × 5) + (5 × 4) = 150.

(b) More candidates found success with the volume. Some gave the same answers for both parts which meant they gained 2 out of the total 4 marks for the question.

Question 13

(a) There was a very good response to this question, particularly **part (a)**. Lack of understanding was evident from some who did not start with the fraction.

(b) The probability was well done by most candidates but more would have gained the mark if they had read the question correctly. $\frac{3}{20}$ was the probability of a blue car, not the question which had the word **not** in bold.

Question 14

With only one factor to recognise, this question was done quite well. Extracting x but then not reducing x^3 to x^2 or still retaining $7xy$ showed carelessness rather than lack of understanding.

Question 15

There were a number of correct answers in finding the vector from a diagram. However, many gave a vector from B to A, rather than the required A to B

Question 16

This was a demanding question requiring sorting out whether to divide or multiply by two rates. However, many did resolve these decisions successfully producing a number of correct responses. Rounding calculations at intermediate stages often produced inaccurate answers. In questions involving exchange rates, candidates should look at their answer and consider if it is sensible for the amount being exchanged.

Question 17

With no diagram shown, this was a challenging question. There were a fair number of correct responses but it would have been more if some had given the coordinates the correct way round. Realising that intersection with $y = 3$ meant that the y coordinate had to be 3 ensured quite a number scored at least 1 mark. Substitution of $y = 3$ into $y = 2x - 5$ was done by the vast majority of candidates but solving the linear equation caused some issues. Those who did not show the working rarely gained 2 marks and often not even 1 mark.

Question 18

(a) While most candidates realised the transformation involved rotation, many of them ignored the instruction (in bold) that a single transformation was required. However, many gained 1 or 2 marks with most often the centre of rotation either missing or incorrect.

(b) Those candidates who realised the reflection line, $x = -1$ was a vertical line usually gave a correct response. Many reflected in the line $y = -1$ which could gain 1 mark but many horizontal lines were not through that line.

Question 19

This was a demanding question due to several stages to work through. However, there were a number of fully correct responses. A basic error often seen was working with the formula for circumference instead of area. Rounding in calculations often caused a mark to be lost. The π in the calculations was correctly eliminated by some of the more able candidates but this was not essential. Candidates approaching this question should look at the diagram and realise that the answer had to be greater than 7, the radius of the small circle, but quite a number of responses were less than 7.

Question 20

(a) The terms of this sequence were well understood producing a high proportion of candidates gaining both marks. Some did find the first term correctly from substituting $n = 1$ but then incorrectly worked out the answers for n values of 2 and 3. It seemed that a regular pattern was often assumed rather than just working out the 3 calculations.

(b) This was not done as well as **part (a),** but there were still a high proportion fully correct solutions. The most common error was $n + 7$.

Question 21

The length in metres and the accuracy in centimetres caused confusion for some candidates. Some worked in centimetres but did not change back to metres for the required answer, while others simply added and subtracted 10 centimetres from 18.7.

Question 22

Many did not know how to start this question, but many others did reach the answer 8400 but did not change to standard form.

Question 23

Most candidates realised that a proportion statement was needed and many were successful in reaching the correct answer. Where workings were absent it was rare for a correct answer to be seen. Rounding once again in the middle of a calculation often lost a mark for poor accuracy.

Question 24

A high proportion of candidates understood subtraction of fractions and gave sufficient working for the 3 marks. Almost exclusively the method of improper fractions was used. Marks were often lost by not showing the method of common denominators and simply following the improper fraction with the answer. Decimals were seen and not accepted as the final answer, even if given as an alternative to the correct fraction answer.

Question 25

For the last and intended hardest question on the paper there were a good number of correct responses. Many who were not sure how to reach a correct answer did gain a mark from their answers having HCF of 6 or LCM of 90. Multiplying 6 by 90 to get 540 was a good start but often not sufficiently developed for a mark to be gained.

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

This examination gave the candidates plenty of opportunity to display their skills with many high scoring scripts seen. There was no evidence that the examination was too long. Some candidates omitted questions or parts of questions, but this appeared to be a consequence of a lack of knowledge rather than any timing issues. The work was presented clearly with full working nearly always shown meaning that when questions were worth three or more marks many candidates were able to gain method marks. A number of candidates showed correct method, but gave incorrect answers, showing possible carelessness in using their calculator or an inability to use their calculator correctly. This was most noticeable for **Question 17** and **25**. Most answers were given to the required level of accuracy although rounding to 2sf or truncating was sometimes seen particularly in **Question 2** and **20**. This was acceptable if a more accurate answer was seen in the working, but this was not always the case. Candidates are reminded to pay careful attention to the rounding requirements for the paper. Answers only need to be rounded to three significant figures if the answer is not exact, not heeding this instruction was noticeable in **Question 2** and **17**, where the exact answer was often not the answer on the answer line. Also, angles should be written correct to 1 decimal place which was not always done in **Question 23(b)**.

Comments on specific questions

Question 1

This question was not always well answered, whilst many were able to find the required time interval even some of the more able candidates found this question difficult. Where incorrect answers were seen a common error was to convert 2150 to 1150pm leading to an answer of 5 h 28 minutes. Another error was not identifying that moving on 38 minutes from the start time meant that the time had progressed into the next hour leading to an answer of 8 h 28 minutes or adjusting the wrong way and giving an answer 6 h 28 minutes. Some candidates made an error when dealing with the minutes leading to answers of 7 h 38 minutes. Another common incorrect answer was and 8 h 32 minutes where candidates counted on 8 hours from 2100 to 0500 and then subtracted the minutes. A minority subtracted the values given the wrong way around which led to an answer of 16 h 32 minutes or 4 h 32 minutes.

Question 2

There were many correct answers to this question, although it was noted that many candidates did not write down all of the decimal places of the exact answer. Candidates should be reminded that when an answer is exact it should not be rounded. A small minority of candidates truncated their answer to 24.3 which was not acceptable. Candidates who attempted to write out the working in stages occasionally made slips and did not reach the required answer. A few candidates incorrectly calculated $(\sqrt{5.76 + 2.8})^3$ or $\sqrt{5.76} + 2.8^2$.

Question 3

Most candidates simplified the given expression obtaining both the term in m and the term in k correctly. Very occasionally just one of the terms was incorrect, often the $4m$ being wrongly simplified to $5m$. It was common, even among some of the more able candidates, to see answers that were not simplified far enough, many muddled this question with a factorising question. Consequently, common incorrect answers scoring 0 included $(4 - 1)m + (7 + 3)k$ and $(m + k)(4 - 1)(7 + 3)$.

Question 4

There were some fully correct answers, but it was clear that candidates struggled with the visualisation of the cuboid as many candidates did not score full marks. Some candidates appeared to have ignored the base given on the diagram and so proceeded to put some dimensions in the wrong place, notably labelling c as 5 cm. This was often the only error but more often it led to other errors, most commonly to give length a as 20 cm from a combination of 10 and two lengths of 5. Length d given as either 10 or 8 was also common. It was also common to see this error of 20 for length a along with all other lengths correct. Weaker candidates often put the three dimensions in the answer spaces without considering the combinations required for a and d and some halved lengths to give values such as 2 and 2.5.

Question 5

(a) Most candidates gave the correct answer of 54, some with a degree sign and some without. The common correct method was $\frac{3}{20} \times 360$. For those who gave wrong answers, the most common error was to be confused between percentage and degrees, with 15% or 15° occasionally seen as the answer. The most common incorrect methods shown were $\frac{3}{20} \times 100$ and $\frac{3}{100} \times 360$. Another misconception that was sometimes seen was to try to find the area of the sector for the blue cars, even though no radius was given in the question some attempted to use π in their calculations. In a very few cases, candidates thought that the total number of cars was 23, leading to an answer of 46.95°

(b) Almost all candidates got this question right. Most gave the answer $\frac{17}{20}$ and some gave the same answer in decimal form 0.85 both answers were equally acceptable. The common incorrect answers were $\frac{3}{20}$ and $\frac{1}{17}$ and very rarely 85 without a percent sign.

Question 6

Many candidates correctly identified the required column vector with the most common error being to find vector $\overrightarrow{BA}$ instead, approximately a fifth of candidates gave the answer $\begin{pmatrix} 10 \\ -3 \end{pmatrix}$. There was a small number who inverted the x and y components of the vector or omitted any negatives giving $\begin{pmatrix} 10 \\ 3 \end{pmatrix}$. Other rare errors included adding the position vectors of the two given points to get $\begin{pmatrix} 4 \\ 5 \end{pmatrix}$ or finding the product of the x-coordinates and the product of the y-coordinates obtaining $\begin{pmatrix} -21 \\ 4 \end{pmatrix}$. A small minority mistook the notation and found $|AB|$ instead of $\overrightarrow{AB}$.

Question 7

There were a high proportion of fully correct answers indicating positive correlation. The most common incorrect response was to indicate direct correlation or directly proportional. Only a small number wrote negative correlation or left the answer blank.

Question 8

(a) Almost all candidates gave all three terms correctly. Very occasionally the terms were given as –3, –2, 1 where the candidate substituted $n = 0$ instead of $n = 1$ for the first term. The other error occasionally seen was to think $1^2 = 2$ then to give the first term as –1 instead of –2. The error of multiplying by 2 instead of squaring was not usually seen in the other terms.

(b) Many correct expressions were seen for the *n*th term. A small number found successive differences and thought that a quadratic or a cubic equation was required. Realising the term-to-term rule was to multiply by 3 but then following this with an *n*th term of $3n$ was seen among some of the weaker candidates.

Question 9

The majority of candidates gained both marks for this question. The most common misconception was confusing the word intersect with intercept and so the most common incorrect answer was (0, 3) along with (0, –5) and (4, 0). Some candidates made the correct first step of substituting 3 in the place of *y,* but then made an error rearranging the equation to find *x* often resulting in the answer (–1, 3).

Question 10

The candidates who used the formula for the area of a trapezium almost always found the correct answer of 26.6. The only common error with this method was to use 4.4 as the height of the trapezium rather than 3.8. Many candidates attempted to split the area into two triangles and a rectangle. They usually found the base of triangle with vertex at ‘*P*’ with Pythagoras’ theorem or trigonometry (2.22) and the base of triangle with vertex at ‘*Q*’ by subtraction (1.18). Many had the correct method, but inaccuracies crept in, usually by prematurely rounding their values part way through the calculation resulting in an answer close to the exact answer of 26.6 but losing the accuracy mark. Some used 3.4 as the base of triangle with vertex at ‘*Q*’ and then calculated the base of triangle with vertex at ‘P’ hence using an incorrect method. Some assumed the trapezium was isosceles and did not check that 2.22 + 5.3 + 2.22 did not equal 8.7.

Question 11

Candidates nearly always scored full marks here. It was a little more common to see use of a common denominator of 24, rather than the more efficient 12, but those using 24 usually then remembered to simplify their answer of $\frac{10}{24}$, very occasionally not simplifying this resulted in the final mark not being scored. Very few made errors dealing with the mixed number although there were a small number who having correctly converted $1\frac{1}{4}$ to $\frac{5}{4}$ went straight to the answer, presumably resorting to their calculator. Candidates were instructed to show all their working and to not use a calculator.

Question 12

Nearly all candidates gave the correct answer of 14. A small minority of the candidates gave the answer as a fraction, $\frac{14}{40}$ which scored 0. A few of the very weakest candidates showed the following incorrect method and answers $40 \div 0.35 = 114.28\ldots$ or $0.35 \div 40 = 0.00875$.

Question 13

Many fully correct answers were seen. The most successful candidates began their solution by drawing a diagram to illustrate the given bearing. The most common incorrect answers seen were 253° or 73°, obtained by subtracting the given bearing from 360° or from 180°, these two common incorrect answers were given by about a fifth of the candidates.

Question 14

This was the most challenging question on the paper with less than half of the candidates scoring full marks. Stronger candidates were able to gain full marks in this question and successfully converted the speed and used the correct distance of the train plus the bridge. Candidates showed different preferences for the order of their calculations. For example, some converted the speed to m/s first and then divided the full distance by this; others converted the units into km and then used the given speed in km/h, multiplying by 3600 at the end. Most of those gaining full marks added the distances as a first step but others found the time for the train and the bridge separately and added as a final step. There were many candidates who gained one mark for correctly converting the speed to m/s and they often used this to find the time for parts of the full distance, either using the length of the train, the length of the bridge or often the length of the bridge subtracted from the length of the train. Many candidates found a multiplier of how many times longer the train was than the bridge and they multiplied the time for the bridge but then omitted to add the time taken for the bridge on to the value for the train. Some made fundamental errors, for example not using the speed, distance, time formula correctly. Figures 198 were commonly seen for the speed conversion from $55 \times 60 \times 60$. Weaker candidates did not attempt a conversion of one or both the units between km and m or hours and seconds. Many combinations of multiplications and divisions of the given values were seen among the weaker candidates.

Question 15

(a) (i) Most gave ‘reflection’ as the transformation, some gave a double transformation, which usually included translation, and a few stated just ‘rotation’ with centre (–2, 0) and angle 180°. Some used incorrect language to describe the transformation such as ‘flip’ or ‘mirrored.’ Most gave the correct line with the common incorrect line usually being $y = -2$ or instead they gave a point such as (– 2, 0). A few candidates gave two properties for ‘reflection’ where it should only have one property.

(ii) This was less well answered than **part (a)(i)**. Most gave the correct transformation ‘enlargement,’ other incorrect terms seen were ‘negative enlargement,’ ‘magnification,’ ‘shrink,’ ‘reduction,’ ‘dilation,’ ‘de-enlargement’ and ‘transform.’ Some gave a double transformation with translation as the first or second one. The scale factor was often $-\frac{1}{2}$ or 2 or – 2. The centre was often correct, with working shown on the diagram of corresponding pairs of vertices joined. The ordinates were switched sometimes to (–4, –3) or given as (0, 0) or one of the vertices of *A* or one of the vertices of *C*. Some candidates wrote their answer as ‘enlargement centre - (–3, 4), SF - $\frac{1}{2}$’ in the case of the centre it was clear it was just a dash in front of the coordinates but in the case of the scale factor it was impossible to tell if it was a dash or a negative sign so the marks could not be awarded.

(b) Many candidates gave the correct answer, a very few were inaccurate, and some used the wrong centre commonly (3, 1). Candidates are advised, in rotation questions, to check that their image is congruent to the object as not all triangles were.

Question 16

Most candidates scored 1 mark here with the most common reason for scoring only 1 being omitting one or all of the numbers outside of P and Q. Other errors seen were to include a number in more than one region or to enter the *number* of numbers rather than the actual numbers.

Question 17

This was attempted with varying amounts of success. There were many fully correct responses to the question. Where incorrect responses were seen there were a significant number of arithmetic errors or slips seen in otherwise correct working. The vast majority of methods involved an attempt to sum the products between a height value in the intervals and the frequencies and then divide by 200. A minority of candidates did not use the midpoints, but often used a value within the height interval instead or an end point of the interval. Some candidates knew to find midpoints of the intervals, but then struggled with the next step of the calculation, often finding a mean of the midpoints. In other cases, candidates dividing their Σfx by 4 was also seen. Some candidates performed incorrect calculations using the class width of the intervals rather than values within them. Candidates are advised to check the common sense of their answers when finding a mean. A mean value should be representative and so should, at the very least, be between 100 cm and 190 cm (the minimum and maximum height values in the table).

Question 18

This question was one of the more challenging ones on the paper. Many candidates were able to find the highest numerical common factor correctly gaining at least 1 mark. Of those that made a mistake, the most common answer was 14 alone or $14x$, $14x^2$, $14x^5$ or $14x^8$. A small number of candidates found the lowest common multiple, rather than the highest common factor. Methods seen were factor trees, listing factors or re-writing $28x^5$ as $2 \times 2 \times 7 \times x \times x \times x \times x \times x$ and $98x^3$ as $2 \times 7 \times 7 \times x \times x \times x$. Of these methods the latter method was by far the most successful with other methods often resulting in confusion and wrong values/expressions being selected. This question had one of the higher omit rates on the paper.

Question 19

The vast majority of candidates understood that distance is the area under the graph and most carried out this correctly to gain full marks. Some candidates used the area of a trapezium formula, but most split the shape into a rectangle and two triangles. Those who did not score full marks often gained a mark for a correct section, commonly the rectangle. Some candidates did not halve the base multiplied by height for the triangles and weaker candidates either omitted them completely or were doing something completely incorrect such as finding the length of the hypotenuse. Candidates who did not score usually gave the total time multiplied by the top speed, 190×15.

Question 20

Most candidates correctly found the area of the triangle and most gave the answer correct to at least 3sf. In a small number of cases the answer was only given as 5.4 which, although it was the same accuracy as the data in the question, did not score full marks as the requirement is for answers to be given to 3sf or more. The most successful method was to use the formula $\frac{1}{2}absinC$. Some candidates took a longer approach of using trigonometry to find the vertical height of the triangle but often got muddled or prematurely rounded their height resulting in inaccuracies. Some used the cosine rule to find side AC but did not know where to go from there. Another common error was to see $\frac{1}{2} \times 4.9 \times 5.6 \times \cos 23$.

Question 21

(a) Many candidates gave the correct value for h either as $\frac{1}{5}$ or as 0.2. The most common error was to give 5 or sometimes –5 rather than $\frac{1}{5}$. A small number did not score because they gave the answer $3\frac{1}{5}$ which is not the value for h. A few misinterpreted the question and evaluated $\sqrt[5]{3}$ giving an answer of 1.25.

(b) This part was answered better than **part (a)** with most candidates being able to simplify the expression correctly and if not scoring 2 marks more scored 1 rather than 0. A small number incorrectly simplified the power by adding to give 6 rather than multiplying to give 9. Others correctly multiplied the powers but also multiplied the coefficient giving the incorrect answer of $12x^9$. Some did not score full marks as they wrote 64 as 4^3 or as 2^6. It was more common for the coefficient of 64 to be correct than for the x^9 part to be correct.

Question 22

There were a good proportion of correct answers seen, with the most efficient starting point being to write $y = \frac{k}{(x+3)^2}$ followed by substituting in values to find k. A common error was to work correctly with the given inverse proportionality but making an error when finding the constant or finding the correct constant of proportionality but using it with an incorrect relationship in the answer. There were also a significant number of candidates who were not able to find the required relationship. A considerable proportion of candidates misinterpreted the information given and worked with y inversely proportional to the square root of $(x + 3)$, y inversely proportional to $(x + 3)$, y inversely proportional to x, or y proportional to the square of $(x + 3)$. A small number of candidates expanded the bracket in the denominator, usually but not always correctly. Another common error was to think a numerical answer was required and a few candidates spoilt a correct $y = \dfrac{24}{(x+3)^2}$ by substituting in various values.

Question 23

(a) Most candidates drew correct sketches of a cosine curve passing through (0, 1), and passing sufficiently close to (180, –1) and (360, 1). Some candidates incorrectly drew straight lines between these points, rather than appropriate curves, and others drew a correct shape for a cosine curve, but with an incorrect period or amplitude. Some candidates incorrectly started their curve at (0, 0) rather than (0, 1).

(b) Most candidates found the two correct solutions for the given equation, with some using their sketch of the cosine curve in **part (a)** to help them and some using other methods such as a 'CAST' diagram sometimes less successfully. The most common error was to see the second solution given as 252.9 (from 180 + 72.9) or sometimes 107.1 (from 180 – 72.9), –72.9, 432.9 (from 360 + 72.9) or 342.9 (from 270 + 72.9). This question had one of the higher omit rates on the paper. Some found the correct angle of 72.9 but then used this to produce two new solutions as their answer. Very occasionally candidates rounded to the nearest degree instead of to the nearest 1 decimal place which is the requirement for angles.

Question 24

This was one of the more challenging questions on the paper particularly among the weaker candidates and it had the highest omit rate on the paper. Stronger candidates often obtained both marks in this question. There were a few different successful strategies. Many candidates knew that completing the square would give $(x - 8)^2$ and so immediately inferred that a would equal 64 and showed little working. Another common strategy was to multiply out $(x + b)^2$ to $x^2 + 2bx + b^2$ and then equate the coefficients so that $2b = -16$ and then $b^2 = a$. There were many errors with the signs of the values. Some candidates used $(x + 8)^2$ but were still able to gain the mark for $a = 64$. The value of a was often negative, either because of an error in calculating -8×-8 or confusing the question and thinking that 64 needed to be subtracted to equal zero. There were many candidates who were confusing the difference of two squares with completing the square which resulted in $(x - 4)^2$, $(x + 4)^2$ or $(x + 4)(x - 4)$. Weaker candidates put the two expressions equal to each other and could either get no further or they then tried to solve by taking square roots, leaving a and b as algebraic expressions.

Question 25

This was one of the more challenging questions on the paper with many candidates scoring 1 or 2 marks. There were also a good proportion of fully correct methods and answers in this question with the most common successful approaches being to consider the six potential ordered combinations $\left(\frac{2}{13}\times\frac{5}{12}+\frac{2}{13}\times\frac{6}{12}+\frac{5}{13}\times\frac{2}{12}+\frac{5}{13}\times\frac{6}{12}+\frac{6}{13}\times\frac{2}{12}+\frac{6}{13}\times\frac{5}{12}\right)$ or the total probability minus the three combinations where the colours were the same $\left(1-\left(\frac{2}{13}\times\frac{1}{12}+\frac{5}{13}\times\frac{4}{12}+\frac{6}{13}\times\frac{5}{12}\right)\right)$. Few candidates used the most efficient method of considering the probability of blue followed by not blue and so on. Errors in arithmetic or slips when using the calculator meant that a fully correct method was not always followed by a correct answer. Where candidates did not reach the answer required there were a good proportion of partial attempts with many candidates able to find the sum of three or more correct product pairs and no incorrect pairs. This sum was sometimes seen where candidates did not take into account the possible ordering of the pairs of colours and worked out $\frac{2}{13}\times\frac{5}{12}+\frac{2}{13}\times\frac{6}{12}+\frac{5}{13}\times\frac{2}{12}$ and in other instances was due to candidates finding the probability of picking the same colour twice, $\frac{2}{13}\times\frac{1}{12}+\frac{5}{13}\times\frac{4}{12}+\frac{6}{13}\times\frac{5}{12}$. There were very few candidates who did not recognise the significance of the lack of replacement of the first counter, although where this was an issue some still gained credit for an answer of $\frac{104}{169}$ with others compounding their error by missing some of the required pairs. Some candidates incorrectly combined probabilities, multiplying three or more fractions or adding where multiplication was appropriate (and vice versa). There were also those who simply listed combinations of the pairs of colours without consideration of the frequencies. A small minority incorrectly added 2, 5 and 6 to reach 12 or 14 as the total number of buttons instead of 13.

Question 26

This was one of the more challenging questions on the paper with many candidates scoring 1 or 2 marks. There were also a lot of stronger candidates with fully correct solutions. By far the most common error was to omit the use of the midpoint of *AB*, instead using one of the end points *A* or *B*, and so scoring at most 2 marks from 5. Most were able to find the correct gradient of *AB,* but a minority then forgot to find the perpendicular gradient or found the perpendicular gradient incorrectly e.g., by subtracting it from 1 or –1 instead of taking the negative reciprocal. Those who attempted the midpoint were generally successful and usually went on to score full marks. There was a small number of these who never simplified the perpendicular gradient leaving it as $\frac{1}{1.5}$ and so did not reach an equation of appropriate form for the final mark. Others made arithmetic errors when substituting the midpoint to find the intercept. A few were unable to score the final mark by using inaccurate decimal equivalents in their equation. Some knew they needed to find the midpoint but found $\left(\frac{x_1 - x_2}{2}\right), \left(\frac{y_1 - y_2}{2}\right)$ instead of $\left(\frac{x_1 + x_2}{2}\right), \left(\frac{y_1 - y_2}{2}\right)$ or made arithmetic slips in the process. Candidates need to be careful how they write algebra with fractions e.g., $\frac{2}{3}x$ sometimes looked very much like ${}^{2}\!/_{3x}$ or $\frac{2}{3x}$ which were award 0 marks.

MATHEMATICS

Paper 0580/32
Paper 32 (Core)

Key messages

To succeed in this paper, candidates need to have completed the full syllabus, remembered necessary formulae, shown all working clearly and used 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 and, therefore, the loss of the accuracy mark. 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 answered very well, Common errors included parallel lines, lines with angles outside the permitted tolerance and lines reflected in a vertical axis or with a numerically equal but positive gradient.

(b) This part was answered well with most candidates able to identify at least one of the correct quadrilaterals. The most common error was a square though parallelogram and kite were also seen. There were very few instances of candidates drawing sketches to help them with answering this part.

(c) This part was answered well, particularly by those who used the 'counting squares' method. Common errors included inaccurate answers of 10 or 12, 3×5, $\frac{1}{2} \times 3 \times 5$, or attempting to use the formula for a trapezium.

(d)(i) This part was answered very well, although a small number of errors such as obtuse, or reflex were seen.

(ii) The value of *x* tended to be correctly worked out. The correct geometrical reason was less successfully stated, and candidates should note that the full reason should be stated and not partial reasons such as 'a line is 180'.

(iii) The value of *y* was, on the whole, correctly worked out. Again, the correct geometrical reason was less successfully stated, and candidates should note that the full reason should be stated and not partial reasons such as 'a quadrilateral adds to 180'.

Question 2

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

(ii) This part was answered very well.

(iii) This part proved demanding for many candidates although most were able to show some knowledge on how to calculate the mean. The majority of successful candidates split the method into two stages; adding the six given values and then dividing by 6 and 1.41 in either order. The alternative valid method of firstly dividing each term by 1.41 to find the number of litres bought for each of the given amounts and then finding the mean of their 6 values was seen. This often involved premature approximation which led to the loss of the accuracy mark. Common errors included 283.5… (from 399.83 divided by 6), 66.63… (from 399.83 divided by 1.41).

(iv) This part, on finding the percentage increase, was answered well.

(b) This part proved difficult for many candidates. A significant number did not appreciate that the given information led to the 39 litres was $\frac{3}{5}$ of the tank.

(c) (i) This part was answered reasonably well although not all appreciated that the easiest way to draw the conversion graph was simply to join (0, 0) to (100, 22).

(ii) This part was also answered reasonably well although a small but significant number attempted to use the graph, usually resulting in an inaccurate answer.

(d) The majority of candidates were able to correctly find the volume of the given cylinder in m^3, but did not, or could not, convert this into litres.

Question 3

(a) This part was answered very well, though the construction arcs were not always seen.

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

(ii) This part was less well answered, with common errors of B and C seen.

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(c) (i) This part was, on the whole, answered well, although the final mark was often lost as the required accurate value was not seen.

(ii) This part was answered very well. Although, common errors were for incorrect or omitted units.

(iii) This part proved challenging for many candidates. The most successful method was to use the exterior angle of 56 and then 360 ÷ 56 = 6.429, although the final A1 mark was rarely given as a valid reason was not seen. Alternative valid methods using the interior angle were seen but were rarely successful. Common errors included using a variety of incorrect calculations with 62 and 7, assuming the shape was a pentagon or octagon, and statements such as ‘it will not fit’.

Question 4

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

(ii) This part was answered well. Common errors included 11, $\frac{11}{16}$ and $\frac{11}{47}$.

(iii) This part proved difficult and demanding for many candidates. Common errors included incorrect use of the ratio, heights of 2 and 3, heights of 10 and 7 (from 20 ÷ 2, 20 ÷ 3), and use of 58 or 24 in the ratio calculation.

(iv) This part was answered well, although the common errors of 16, 4, Tuesday and/or Thursday were seen.

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(b) This part was answered very well, although the common errors of 22, 550 × 1.04, 550 ÷ 0.96 or 1.04 were seen.

(c) This part was answered very well, although the common errors of negative, increasing and no correlation were seen.

(d) (i) This part was answered reasonably well, with a significant number of fully correct tree diagrams seen, with a further number able to score 1 mark for a partially correct diagram. Incorrect values seen included 0.2 throughout, 9.8, 0.04 and 0.96.

(ii) This part proved challenging for many candidates. Common errors included 0.02 × 2, 0.02 + 0.02, 1/50 and 0.04 ÷ 2.

(iii) This part was answered very well, although the common errors of 4150 × 0.98, 4150 ÷ 0.98 and 4150 ÷ 0.02 were seen.

Question 5

(a) (i) The table was completed very well with the majority of candidates giving 5 correct values for full marks.

(ii) This was well answered by a good number of candidates who were able to score all four possible marks for accurate, smoothly drawn curves. Most others scored two or three marks, the marks being most commonly lost for one or more points being plotted out of tolerance, or for just plotting the points without drawing the curve through them.

(iii)(a) This part on identifying the equation of the line of symmetry was found challenging. Common errors included 2.5, $x = 2$, $x = 3$, $y = 2.5$, $y = \text{m}x + \text{c}$ and $y = -x^2 + 5x + 7$. Although not required it may have helped candidates to draw the line of symmetry first.

(iii)(b) This part on the use of symmetry was found demanding with few candidates appreciating the method to be used of 2– –8 = 10.5, 2.5 + 10.5 = 13. Common errors include 8, 776 and 2.5.

(b) This part was answered well, although the common errors of –9, –4, 4 were seen.

(c) This part was answered less successfully. Common errors included $5x + 19$, $5x - 19$, $-5x - 19$ and $19x - 5$.

(d) This part was answered well, although the common errors of $x + 2$, $x - 2$ and $-2x - 1$ were seen. A significant number did not seem to appreciate that the intercept value could be read directly from the given graph.

(e) This part was answered very well, although the common errors of $m\text{y} + c$, $(y + c)/m$ and $y/m - c$ were seen.

Question 6

(a) (i) This part was answered reasonably well, with the more successful candidates accurately drawing the line to identify the position of town *S.* The bearing of 117° proved to be the more challenging. Common errors included drawing the bearing of 063° and 243°.

(ii) This part proved difficult for many candidates. Although the majority correctly used the formula of D ÷ S to find the journey time only a small number were then able to find the time of arrival. Common errors included leaving the answer as 3 hr 40 min, incorrect conversions such as 3 hr 36 min or 3 hr 66 min, incorrect addition of the journey time, and 0528 or 2203 (from 44 × 12).

(b) Candidates found this part quite demanding 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 the very common $20 \div 16 = 1.25$, with 8*n, n* / 8, 8, 8000, 800, $\frac{1}{8}$ also seen.

(c) (i) This part was answered reasonably well with the more successful candidates using either 360 – 288 = 72 then 72 + 18 = 90 or 288 – 18 = 270 then 360 – 270 = 90. Common errors included $270 \div 3$ and 288 – (18 + 180).

(ii) This part was answered reasonably well, though a significant number of candidates did not appreciate that Pythagoras was required. A very common error was 6 + 9.7 = 15.7.

Question 7

(a) This part was answered very well.

(b) (i) This part was answered very well.

(ii) This part was answered well, though a significant number gave the inaccurate answers of 1.87 or 1.9 and only scored the method marks. Common errors also included incorrect first steps of $8x + 7 = 63$, $72x - 7 = 72$ and/or incorrect second steps such as $8x = 1$ and $72x = 9$.

(c) This part was answered well, though the common errors of 32, –16, 3 and –3 were seen.

(d) This part was answered reasonably well, though a significant number did not appreciate that the two given equations could be directly added to find the value of $2x$ and subsequently x. Common errors included a variety of sign errors and/or arithmetic errors, with a small yet significant number unable to attempt the question.

(e) This part was answered well, though the common errors of –3, –2, –1, 0, 1 and –2, –1, 0 were seen.

(f) This part proved challenging for many candidates**.** Common errors included $35 / x + 160 / t$, $35 + x + 160 + t$, $35\ x\ 160t$, 35 + 160, and a variety of other expression involving 35, x, 160 and t.

(g) This part was answered reasonably well with the majority recognising that the first step was to find the area by multiplying together the two given algebraic sides. Common errors included use of perimeter, omission of brackets, and incorrect expansions such as $x^2 + 7x + 10$, $x^2 - 3x - 7$.

Question 8

(a) This part proved difficult for many candidates. Although a number of fully correct answers were seen, and the majority were able to demonstrate some knowledge of using a two-way table, there were a number of errors made. The common errors included arithmetic errors using the two given values of one fifth and/or 30%, incorrect positioning of these calculated values, and arithmetic errors when completing the rows and/or columns.

(b) (i) This part was answered well, with most candidates able to demonstrate knowledge of Venn diagrams and score at least one or two marks. The very common error was in interpreting the given statement of ‘$n(F) = 3 \times n(V)$’ leading to the incorrect values of 72 or 99.

(ii) This part was answered very well, particularly with the follow through allowed.

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 large number of very good scripts in which candidates demonstrated an expertise with the content and proficient mathematical skills. There were a few weaker scripts in which a lack of expertise and familiarity with the content was evident.

There was no evidence that candidates were short of time, as most candidates attempted nearly all of the later questions. The majority of candidates showed clear working leading to their solutions. Premature rounding resulted in some candidates losing a number of marks.

The omission of essential brackets resulted in number of errors, for example, in parts of **Question 5**, **7(b)**, **11(b)** and **11(c)(ii)**.

The topics that proved to be more accessible included calculations involving money, ratio or percentages, finding the range, mode and mean of discrete data, drawing a histogram, finding the volume of a pyramid, working with column vectors and some simple functions, finding values for a quadratic function and plotting the graph.

The more challenging topics included problems involving geometrical reasoning and similarity, problems involving surface areas of compound solids, simplifying algebraic expressions involving brackets and algebraic fractions, using graphs to solve related equations, problems involving volumes of 3 D shapes with cross sections as sectors.

Comments on specific questions

Question 1

(a) Almost all candidates calculated the correct total cost. Errors usually resulted from slips with the numeracy or by calculating the total cost for 1 kg of mushrooms and 1 kg of carrots.

(b) (i) Almost all candidates calculated the correct percentage. Most errors involved calculating the mass of potatoes as a percentage of the total mass.

(ii) Many correct answers were seen. Errors usually involved finding the mass of the potatoes. A small number of candidates lacked understanding of sharing in a ratio.

(iii) Calculating the total profit caused little difficulty for most candidates even when their previous answer was incorrect. In a small number of cases candidates divided the total mass by 0.75.

(iv) Candidates were slightly less successful in this part which involved reverse percentage. The most common incorrect answer involved finding 108% of \$1.15. Other incorrect methods usually involved incorrect use of the multipliers 0.08, 0.92 and 1.08.

(c) Many candidates demonstrated a good understanding of bounds and showed clear working in obtaining the correct number of bags. Others had the correct idea for the calculation but did not use the correct upper bound for the total mass and/or the correct lower bound for the mass in a bag. Some mistakenly thought they needed to use the upper bounds of both the total mass of onions and of the mass in a bag.

Question 2

(a) When explaining why $x = y$, candidates were expected to use correct vocabulary and angle notation. Responses with two correct statements and fully correct reasons were in the minority. The most common error was giving incorrect reasons for the angle statements. Some omitted cyclic when referring to the quadrilateral and the use of alternate segment theorem was a common incorrect reason. Incorrectly stating that the opposite sides rather than angles of a cyclic quadrilateral add to 180 was another common error. Use of the correct vocabulary for angles on a line was less of a problem although 'linear pair' was the most common error. The use of the exterior angle property of a cyclic quadrilateral was rarely seen. A number of candidates unnecessarily assigned a value to either x or y then proceeded to show that the other variable had the same value. Candidates should use the correct geometric terminology from the syllabus when giving reasons.

(b) Candidates were required to show that the two triangles had two or three equal pairs of angles and give a correct conclusion. Many used the pair from the previous part and most spotted the shared/common angle *CXD*. Some had issues with notation, especially when attempting the third pair, often referring to *CDX* as *D* which was not acceptable. Some candidates included incorrect statements such as angle *CDX* = angle *ABX* = 90. Others included incorrect conclusions such as stating the triangles were congruent. The most successful candidates stated all three equal pairs of angles using correct angle notation such as angle *DCX*.

(c) (i) Candidates found this part quite demanding. In correct responses it was common to see the correct ratios of corresponding sides such as $\frac{BX}{DX} = \frac{AX}{CX}$ or an equivalent statement. In such cases candidates usually substituted correctly for the sides, calculated *BX* and used that to find *BC*. Occasionally candidates forgot to subtract 12 from their length of *BC*. Some of those that assumed one pair of angles were right angles resorted to Pythagoras or trigonometry. Several attempted to state a scale factor but frequently did not use the corresponding sides with the most common error using *AX* and *DX* as corresponding sides instead of *AX* and *CX*.

(ii) Many candidates did not recognise that area scale factor was the square of the linear scale factor. Some of those with the correct linear factor gave the area factor as 4 but an area scale factor of 2 was more common.

Question 3

(a) (i) Almost all candidates gave the correct range. In a few cases some gave the answer as 4 by finding the difference between the highest and lowest frequency values.

(ii) Most candidates calculated the mean correctly with a few showing a clear correct method which was then evaluated incorrectly. The most common error was dividing the total marks by 6 instead of 10.

(iii) This part was completed less well. Some candidates were able to find the median from the table. A significant number of candidates gave a variety of incorrect answers with 16 the most common as it is the 5th mark out of 10 marks. Only slightly fewer gave the answer 17.5 as it is the median of the six marks listed in the table. A small number found the median of the frequencies.

(iv) Almost all candidates gave the correct mode. A few candidates gave answers of 1 and/or 2 using the most commonly occurring frequencies rather than the highest frequency.

(b) Many candidates were able to calculate the two correct totals from 7×17 and 8×17.5 and find the correct mark. Some earned partial credit by working out just one of the two totals. Some gave the answer as 18, thinking that the mark of 18 and the previous mean of 17 would result in a final mean of 17.5.

(c) This was well answered and most candidates drew accurate histograms. A common error resulted from incorrectly calculating the frequency density by dividing the interval widths by the frequencies.

Question 4

(a) (i) Almost all candidates calculated the volume of the pyramid correctly. The few errors usually involved slips with the numeracy or involved the use of an incorrect formula for the volume or for the base area.

(ii) This proved challenging for many candidates. A variety of methods were used to calculate the area of a triangular face. Relatively few used the efficient method of $\sqrt{9^2+6^2}$ to calculate the perpendicular height of the triangular face. Far more opted to calculate the half-diagonal of the base, using this to find the sloping edge of the face and then finding the perpendicular height. Others used the sloping edge with the cosine rule to calculate one of the angles of the triangle before using $\frac{1}{2}ab\sin C$. With these longer methods premature approximations usually had an adverse effect on the accuracy of the final answer. Common errors included the assumption that either the slant edge of the triangle or the height of the pyramid were the height of the triangle and occasionally that the triangular face was equilateral.

(b) This was a challenging question where only a small majority were able to set up a correct equation based on the total surface area. Many others included extra areas, usually the plane surface of a hemisphere and/or the base of a cone. A wide variety of errors were seen when candidates attempted to solve their equation. Writing the surface area of the hemisphere as $4\pi r^2$ was a common error. Some used $\frac{4\pi r^2}{2}$ and then made errors eliminating the division by 2 from the equation, forgetting to multiply all terms or multiplying $\pi r \times 3r$ to give $2\pi r \times 6r$ or similar. Incorrect attempts at factorisation were also seen such as $304 = 2\pi r^2 + 3\pi r^2$ which was often rearranged as $\frac{304}{2\pi + \pi} = r^2 + 3r^2$. As a result, the number of fully correct responses was in the minority.

Question 5

(a) (i) Most candidates successfully factorised the expression with some earning partial credit for factors that gave rise to two of the original terms.

(ii) Most candidates recognised the numerator as the difference of two squares and went on to obtain the correct answer if they had the correct answer to the previous part. Common errors included writing the numerator as $(x - 4)^2$ and attempting to cancel terms without any attempt at factorisation.

(b) Few candidates recognised the expression as the difference of two squares and opted instead to expand both brackets and then simplify. Fully correct answers were in the minority as many candidates experienced difficulties in expanding the brackets correctly. The most common error was to expand $-(x + 1)^2$ as $-x^2 + 2x + 1$. Others expanded the brackets by just squaring the two terms inside or, to a lesser extent, multiplying the terms inside by 2. Collecting the terms together also introduced errors because of the signs.

(c) Only a small majority of candidates were successful in writing the two terms as a single fraction. Most candidates had no difficulty with the denominator. Many set up the numerator correctly, either omitting brackets, such as $2x + 4(x – 3)$, or by writing $–x(x + 1)$ as $– x^2 + x$. Others had a correct numerator and denominator but made errors when collecting the terms together.

(d) Many candidates made a good attempt to expand the three brackets and went on to obtain the correct answer. Some expanded the first pair and then made errors when combing the result with the final bracket. Some candidates expanded correctly but the collection of the terms introduced some errors.

(e) Most candidates set up a quadratic equation in x or y correctly but many made errors when trying to simplify to a 3-term equation. Setting up the equation in terms of x was a more concise option and led to more success. Errors usually involved slips with the signs when eliminating either variable or when collecting terms. Having obtained a quadratic equation, candidates were generally successful in substituting into the formula, fewer used factorisation as a method and very few attempted to complete the square. Others did not show all of their working as requested and gave solutions from a calculator and did not score full marks as a result. Success in finding both pairs of solutions was dependent on full working shown and no errors previously to score full marks. Some found the solutions but rounded answers incorrectly. When considering all three stages together only a minority earned full credit.

Question 6

(a) Most candidates applied the sine rule correctly to find the length of *AC*. A small number had their calculator set in grads mode leading to an incorrect final answer and some did not recall the sine rule correctly. Other candidates incorrectly assumed that triangle *AMC* was isosceles and used right-angled trigonometry to find *AC*.

(b) Most candidates applied the cosine rule correctly to find the length of *AM*. Some substituted the correct values into the cosine rule but used an incorrect order of operations when evaluating the result. Candidates are advised to use their calculator to evaluate the expression in a single step after showing the substitution rather than working out the expression in stages which is when errors are likely to occur.

(c) Many candidates identified the shortest distance from *A* to *BC* as the length of the line perpendicular to *BC* passing through *A* and indicated this on the diagram. Most then used right-angled trigonometry with their length of *AC* and the 68° angle to find this length correctly. Some used the 17.2 and the angle of 54° which is not dependent on the answer to **part (a)** being correct.

A small number of candidates found the area of the triangle using $\frac{1}{2}ab\sin C$ and equated this with $\frac{1}{2}$ × base × perpendicular height. The most common error was to assume that the perpendicular intersected the midpoint of *MC* then to use Pythagoras's theorem with 6.4 and their length of *AC* to find the height.

Question 7

(a) (i) Almost all candidates gave a correct response.

(a) (ii)(a) Almost all candidates gave a correct response. Most of the errors resulted from numerical slips such as $–5 – 5 = 0$ or $8 – (–4) = 4$.

(a) (ii)(b) Most gave correct responses. Some candidates calculated $\sqrt{12^2 - 10^2}$ and others attempted to apply Pythagoras to all four components of **p** and **q**, such as $\sqrt{8^2 + (-5)^2 - ((-4)^2 + 5^2)}$.

(b) This proved more challenging for some candidates and only a small majority obtained a fully correct response. Those that showed clear working and interpreted the ratio correctly were usually successful. Many were able to make a start, usually quoting $\overrightarrow{MN}$ = **b** – **a**, $\overrightarrow{NM}$ = **a** – **b** or $\overrightarrow{OS}$ = $\overrightarrow{OM}$ + $\overrightarrow{MS}$ or an equivalent route. Many dealt with the ratio correctly, writing $\overrightarrow{MS} = \frac{5}{8}\overrightarrow{MN}$, or an equivalent, but then went wrong by writing $\overrightarrow{MS} = \frac{5}{8}\mathbf{b} - \mathbf{a}$ and working with this for the remainder of the question. A common error involved the directions of the vectors and errors such as $\overrightarrow{MN} = \mathbf{a} - \mathbf{b}$ were seen quite often.

Question 8

(a) A majority of candidates gave a correct ruled straight line. Some lines were short and, in some cases, attempts to draw a freehand straight line from plotted points were seen but not always successfully. Others produced lines with a positive intercept but with a positive gradient. A variety of curves was also seen.

(b) A small majority of candidates drew an accurate sketch of the curve. Some lacked accuracy by not passing through the origin and some positive quadratics passing through the origin were seen. Some sketches had incorrect curvature at the extremes. Some candidates drew straight lines and others drew curves such as cubics and reciprocal graphs. Many candidates attempted to plot scales on the axes and plot points to draw their sketches. These should not be necessary.

(c) (i) Many candidates demonstrated a good understanding of turning points and went through all stages correctly. Others made errors when attempting to solve $\frac{dy}{dx} = 0$, usually resulting in 0 and –3 while some made numerical slips when attempting to find the y coordinate for $x = 3$. Some of those with an incorrect derivative were able to earn some credit for attempting to find the turning points.

(ii) This part proved more challenging and fewer fully correct solutions were seen. Most attempts involved finding the second derivative and then following the standard procedure. As candidates were asked to show how they decided it was important to show the substitution into the second derivative, its evaluation and a comment on the value. Some omitted showing the evaluation and others omitted the comment on whether its value was positive or negative. Some obtained one turning point correctly and simply stated the nature of the second without showing any working. Only a very few candidates attempted to find the gradient on each side of the stationary points with roughly equal numbers attempting to find the y value on each side of the stationary point. Some attempted to show a sketch of the negative cubic. These alternatives were just as likely to provide a correct response as the method using the second derivative.

Question 9

(a) (i) Most candidates understood that this question involved simple interest and set up a correct expression for the interest received after 12 years. Many equated this with $12 800, the total value of the investment after 12 years, rather than $4800, the value of the interest after 12 years. This error led to the common incorrect answer of 13.3% rather than the correct answer of 5%. A minority of candidates used a compound interest formula.

(ii) Most candidates started correctly by forming an equation such as $12\,800 = 8000 \times \left(1+\frac{R}{100}\right)^{12}$ and many rearranged this correctly to find the correct interest rate of 3.99%. Some did not show enough figures in their working and gave an answer of 3.9% which was not acceptable. Some errors were seen when rearranging the equation such as $\frac{12\,800}{8000} - 1 = \left(\frac{R}{100}\right)^{12}$.

(b) Setting up a correct equation for exponential growth, usually $260\,000 \times \left(1+\frac{1.8}{100}\right)^{n} = 300\,000$ was achieved by many candidates. The correct answer of 9 years was often found although the answer 8 was also common. Many used a trial-and-error approach to find the number of years. When using this approach, candidates should show the results of their trials so that part marks can be awarded if the final answer is incorrect. Some candidates used logs which is not on the syllabus to solve the equation, and this was often successful. Another common approach was to rearrange the original equation to $1.018^n = \frac{30}{26}$ and then find a value of n to give this result. This approach often led to the incorrect answer of 8 because the value on the right-hand side had been rounded to 1.15 rather than using a sufficiently accurate value such as 1.154. A small number of candidates worked with simple interest rather than compound interest.

Question 10

(a) Almost all candidates completed the table of values correctly. The most common error was evaluating y as –0.75 when x = –0.5.

(b) Many candidates plotted the points correctly and drew a smooth curve through them. Some lacked accuracy when plotting one or more points, possibly due to the different scale on the y-axis. Others misread their table, for example, plotting (–3, 2.5) instead of (–3, –2.5).

(c) This proved challenging and fully correct responses were in the minority. When the correct line, y = 2, was drawn candidates mostly gave the three correct solutions. In a few cases, inaccurate curves gave answers outside of the acceptable range. A significant number of candidates made no attempt at rearranging the given equation and drew the line y = 4.5 . Many drew no line at all. Answers given from a calculator without showing a suitable line of the graph did not score.

(d) Only a small majority of candidates identified the two correct values of k.

Common incorrect answers were k = 0 and k = -2**.** Some candidates misunderstood the question and believed they needed to solve an equation and did not spot the connection with their graph.

Question 11

(a) (i) The vast majority of candidates found the correct answer. Some started correctly and then made numerical slips. Others were unsure of the meaning of gf(2) and a variety of incorrect interpretations were seen such as 2(f(x) + g(x)), 2g(x), g(x) = f(2) and fg(2).

(ii) Most candidates had no difficulty in obtaining the correct inverse function. Common errors included leaving the answer in terms of y, incorrect signs when rearranging, ambiguous final answers such as x + 5/3 and reciprocal answers such as $\frac{1}{3x-5}$.

(b) For many candidates finding g(x – 2) did not prove to be a problem. Some started correctly and then went wrong with the simplification. Omission of the brackets around (x – 2) and writing the function as (3x – 5)(x – 2) or similar were common errors.

(c) (i) Most candidates had no difficulty in setting up a correct equation and solving it. Some obtained $\frac{1}{3x-5}$ = 0.1 and went no further with others rearranging the equation incorrectly, such as $\frac{1}{3x}$ = –0.5 . Common errors included finding fg(0.1) and finding f(0.1) + g(0.1).

(ii) Many correct responses were seen. Some started correctly and reached the stage $2^x - 16 = 0$ but did not realise that 16 could be written as a power of 2. In some cases, candidates simply took the square root of 16 which was an incorrect step. The omission of essential brackets around (3 × 7 – 5) was the most common error and usually led to $2^x - 26 = 0$.

Question 12

(a) A number of candidates demonstrated a good understanding of sectors and obtained the correct answer. Occasionally, premature approximation affected the accuracy of the final answer. Some candidates calculated the length of the major arc but did not add on the two radii for the perimeter. A small number calculated either the arc length or the perimeter of the minor sector. Some mistakenly thought that they could calculate the required perimeter by subtracting the perimeter of the minor sector from the circumference.

(b) This proved to be more demanding and fewer fully correct responses were seen. Some set up a correct equation involving the height of the cake and then gave their answer as 9 or 9.0, neither of which were acceptable. In many cases, candidates treated the 3510 cm^3 as the volume of the whole cake instead of the volume of the remaining cake. This led to the common answer of 7.76.