MATHEMATICS

Paper 0580/12
Paper 12 (Core)

Key messages

1 Answer precisely what is asked in the question to find a possible answer for the context.

2 Give answers to the required accuracy in the question or to 3 significant figures if not an exact value.

General comments

The vast majority of candidates tackled the questions confidently. A few questions (specifically **Questions 12** and **19**) were more challenging and only the more able candidates made significant progress on these.

Candidates should read the question again after they have given an answer and ask themselves if the answer is sensible and to the correct accuracy where appropriate. Where calculators are used candidates should be aware of the expected approximate answer to the question to judge if their answer is sensible.

Comments on specific questions

Question 1

(a) While this part was answered correctly by most candidates, there were a few who gave 1524, 1325 or even 1425. The more significant error was to add pm to an otherwise correct value and this and 15 h 25 m were not permitted.

(b) This part was not well answered with a variety of incorrect responses seen, whether they were in the correct format or as a time period. While some gave a time period, 5 h 50 min, common errors were 610, 550 pm or 2102. Many candidates clearly struggled with subtracting a time period.

Question 2

(a) Almost all candidates could measure the length of the line but some gave 9.4 (centimetres), 9.4 or 940.

(b) A considerable number of candidates did not draw the circle on the given line *AB*, and tried to fit it below or on the blank page. This was marked if they showed the diameter or radius on their drawing. Most circles on the line *AB* were well or adequately drawn for full credit but some did not have the mid-point of *AB* as the centre or a correct radius. A few candidates either did not have compasses or used them poorly in producing drawings that were clearly not circles.

Question 3

(a) The calculation of the temperature was mainly answered in two stages, Tuesday then Wednesday rather than a single calculation subtracting 5 and adding 8. Errors were often made in subtracting 5 from -7 with $-7 - (-5)$ or $-7 + 5$ seen.

(b) While a few candidates missed the T, giving an answer of 2 or -2, most did attempt an algebraic expression. The most common error was $T + 2$, although $2T$ and $2 - T$ were also seen. However, many added C or °C to one or both of the terms in the answer. Some introduced another variable, for example $x =$ or simply $T =$ before their otherwise correct expression.

Question 4

Only a very few candidates gave an incorrect value of *x*, usually 124° or from an incorrect calculation of 360 – (124 + 107). While it was common to see a reference to angles in a circle it was quite rare to see the required word 'point' in the reasons for the answer. Many assumed that just the calculation was sufficient for the reason.

Question 5

(a) (i) The vast majority of candidates gained full credit in this basic probability question but a number had a denominator of 7, instead of 8, while a few gave $\frac{1}{8}$ or a fraction with a denominator of 49. A number of candidates did not understand probability and gave responses of whole numbers or the ratio 3 : 7.

(ii) A few candidates gave a whole number answer greater than 1. While $\frac{8}{8}$ and $\frac{1}{1}$ were awarded the mark, it is expected that candidates would know the best answer for a certain event.

(b) The expected number was answered well but some errors produced answers that weren't sensible for the context. Multiplying 3 by 160 to produce 480 suggests those candidates did not appreciate that there were only 160 spins. Quite a number of candidates divided by 3 as there were three 7's. Errors in **part (a)(i)** occasionally allowed a mark here for correctly following through.

Question 6

There were many correct answers seen to the number of seconds in July but multiplying by 60 three times instead of twice did occur. Quite a number of candidates did not multiply by 24. The number of days was given but some candidates chose to use 7 days and 4 weeks to give 28 days for the month. The final answer was exact so should not have been rounded to 3 significant figures.

Question 7

The net was generally not drawn well with a number of candidates attempting to draw some form of 3-dimensional shape on the grid. Many of those drawing connected rectangles did not realise that just two of each size rectangle was required. It was common to see four rectangles which were 3 cm by 2 cm. A few candidates had more than six rectangles in their net. While the dimensions of the cuboid were clearly given in the first line, rectangles of different dimensions to those required were often seen for all or part of the cuboid. Some made very good progress but gained only partial credit for five correctly connected faces, leaving the top open.

Question 8

(a) For those knowing the meaning of 'reciprocal' this was very straightforward with a fraction or decimal answer accepted. Many did not know the meaning and guesses included the square root, −40, factors of 40 or $\frac{100}{40}$.

(b) While many did know how to find the cube root using their calculators, it was common to see three times the square root of 40. The major problem experienced was correctly rounding to 4 decimal places and even those reaching 3.42 often did not add the required two zeros. 3.4199 was a very common response gaining partial credit. Answers of the wrong order suggested that some did not appreciate that the cube root of 40 had to be a small number. Over-rounding by rounding each digit was also seen.

(c) It is unusual to ask for standard form of a number such as 40 and many candidates found it challenging. Many did not apply the rule that the mantissa had to be between 1 and 10. Common incorrect answers were 0.4×10^2 and 4×10^0.

Question 9

(a) Many candidates clearly did not know the meanings of '*m*' and '*c*' in the equation $y = mx + c$. Of those identifying the coefficient of *x*, many gave the response $2x$. Otherwise it was common to see −3 or $2x - 3$ as answers.

(b) The table of values was generally completed correctly. Most errors were due to an incorrect sign but a few candidates gave entries apart from 7's and 3's.

(c) Most candidates could plot the graph from a correct table of values. However, a significant number did not know it had to be a single straight line. For example, plotting (3, 3) at the point (3, −3) to give a curve or two joined lines was seen at times. Some lines showed that a ruler had not been used.

Question 10

Candidates find it more challenging to write a vector between two points when no diagram is given. Most realised that the components had to display the differences between the *x*-coordinates and the *y*-coordinates although just adding the vectors to give $\begin{pmatrix} 8 \\ 11 \end{pmatrix}$ was often seen. Many candidates did not write the correct signs or had the components the wrong way round. Thus, many answers were one of $\begin{pmatrix} 4 \\ -3 \end{pmatrix}$, $\begin{pmatrix} -4 \\ -3 \end{pmatrix}$, $\begin{pmatrix} 3 \\ -4 \end{pmatrix}$ or $\begin{pmatrix} -3 \\ -4 \end{pmatrix}$.

Question 11

(a) The topic of stem-and-leaf diagrams is new to the syllabus and some candidates did not understand how to complete the diagram. Those who did know about splitting the digits generally managed to write the numbers in the correct line but many not in the correct order. Some did not check that they had all the 12 numbers and so only gained partial credit by missing a number.

(b) Those completing the diagram correctly mostly found the median. Many reverted back to the original data to find the median. However, there were many responses of 26 or 28 and single digit figures 6, 7 and 8. Some candidates confused median with mean and others put the calculation $26 + 28 \div 2$ into their calculators to give the answer 40.

Question 12

Many candidates did not read the question carefully and used the sum of the parts rather than the difference between the red and green. Consequently, various calculations were seen using 19, usually $112 \div 19$ and a non-integer answer was found. Just a few candidates realised the first step was to divide 112 by (12 – 5) and most often they went on to the correct solution. There were a high number of blank responses.

Question 13

For a fractions question this was one of the most straightforward and many candidates achieved full credit. Most did invert and multiply and, apart from a few inverting the wrong fraction, nearly all were correct. Writing the fractions with a common denominator, usually 28, caused some to go wrong by writing $\frac{(15 \div 16)}{28}$. A very small number worked in decimals or just gave an answer without working, both of which could not score any credit.

Question 14

(a) With a diagram showing a right-angled triangle with given base and height some candidates omitted to halve the answer after multiplying the given values. Hence, they found the area of a rectangle. Some candidates found the hypotenuse in this part rather than the area. However, the question was generally well answered even though some multiplied the product by 2 or simply added the lengths.

(b) The confusion between area and perimeter continued in this part. Many found the hypotenuse but did not go on to add the other lengths. Writing the sign incorrectly in the Pythagoras' theorem calculation occurred at times and some produced their own formula for perimeter, such as 2(8.5 + 10.8).

Question 15

Now that the formula for compound interest is part of the syllabus, candidates need to ensure they can progress beyond quoting the formula for the given values to using it correctly to find the value of the investment. There were some candidates who calculated simple interest and some who subtracted 30 000 from their answer (to find the interest) or added 30 000 to the correct answer. Many did not observe the instruction to give the answer to the nearest dollar.

Question 16

(a) While this question was quite well answered, asking for a letter to the power of 0 did confuse quite a number of candidates. Answers of $5x$ and 1 were often seen.

(b) This part was better answered with the majority getting it correct. Some managed the question but gave their answer as 9^8 instead of the value of w. Some added the indices to give 16 or divided to give 3 or 9^3.

Question 17

Apart from a small number of candidates not familiar with trigonometry, the vast majority did realise that the sine ratio was needed for the solution. Just a few thought cosine or tangent was the ratio and a small number attempted a long method from cosine and Pythagoras' theorem. Many candidates only gave an answer correct to two significant figures, 2.8 or an incorrect 3 significant figure answer, 2.76.

Question 18

(a) The factorising was well done by most candidates, with just a small number gaining partial credit for taking one of the common factors outside the bracket. A small number made errors in dividing 12 by 3. A few did not understand the question and combined terms or cancelled them. Some found the correct answer but then thought they had to combine the terms.

(b) A considerable number of candidates answered this question well. Many identified the four terms but did not know how to proceed or made errors in signs for the middle term. Other errors were attempting an equation or simply adding the terms in the brackets, $m - 3 + m + 2$.

Question 19

Very few candidates made significant progress with this challenging question. The question needed the distance travelled, the circumference of the wheel and converting units as well as the step of dividing distance by circumference. A number of candidates did find one or both of distance and circumference. Finding the area, instead of circumference, of the wheel was common. Even for those who made the correct steps, there was much over-rounding during the calculations and very few gave a correct rounded down answer for the complete revolutions.

MATHEMATICS

Paper 0580/22
Paper 22 (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 a significant number of excellent scripts with many candidates demonstrating an expertise with the content and showing good mathematical skills. There was no evidence that candidates were short of time, as almost all attempted the last few questions. Candidates showed particular success in the basic skills assessed in **Questions 1**, **5**, **7**, **8** and **9**. The more challenging questions included the algebra and shape and space **Questions 10(b)**, **15**, **16**, **20** and **21**. Candidates were very good at showing their working and it was rare to see candidates showing just the answers with no working. There were instances of rounding or truncating prematurely within the working or giving answers to less than the required 3 significant figures but these were very limited.

Comments on specific questions

Question 1

This question was answered very well with very few incorrect answers seen. In **part (a)** a very small minority incorrectly answered 4, from 12 being the 4th multiple of 3, and also very occasionally seen was the incorrect answer $\sqrt{196}$. In **part (b)**, $\sqrt{196}$ was also a common incorrect answer and also 2 from the cube root of 8. **Part (c)** had a common incorrect answer of $\sqrt{7}$. **Part (d)** sometimes had two answers, usually one was the correct one and the other an incorrect one. The two most common incorrect answers were 3.56 and $\sqrt{196}$ again because these were seen as irrational numbers.

Question 2

The stem-and-leaf diagram in **part (a)** was often correctly completed. Most of the candidates who did not gain full credit scored partial credit for two correct rows, with the third row missing an 8 being the common error along with other occasional missing values or the leaves were not ordered. **Part (b)** was less well answered, even by those with a fully correct answer in **part (a)**. The most common incorrect answers included 26, 28 and 7, the last one from forgetting the stem from the diagram. A small number of candidates calculated the mean.

Question 3

This was one of the least well answered questions on the paper. A common error came from adding rather than subtracting the vectors $\overrightarrow{OA}$ and $\overrightarrow{OB}$. Another fairly common error came from subtracting $\overrightarrow{OB}$ from $\overrightarrow{OA}$ rather than the other way around. A few candidates were unable to form appropriate vectors from the given coordinates and occasionally a 2 by 2 matrix answer was given.

Question 4

This question was well attempted by many candidates. There were a fairly even number of candidates who found the exterior angle as a first step and those who found the total number of degrees in the polygon as a first step. In both methods, candidates often didn't go any further than the first stage and so answers of 15, the external angle, and 3960, the total number of degrees were commonly seen. The method of finding the exterior angle first was usually more successful. Those who found the total number of degrees first usually had more errors in the formula, for example, using $n - 1$ triangles $\times$ 180 rather than $n - 2$.

Question 5

This question was nearly always answered correctly with full working shown and most candidates scored full credit. The most common method was to multiply by the reciprocal $\frac{15}{28} \times \frac{7}{4}$, with only a few choosing to find $\frac{15}{28} \div \frac{16}{28}$ and then giving the correct answer. In some cases, the candidate clearly assumed that a common denominator was required and found $\frac{15}{28} \div \frac{16}{28}$ but followed it by $\frac{15}{28} \times \frac{28}{16}$ before the correct answer. Those who did not gain full credit were often confused by this apparent need for a common denominator and $\frac{15}{28} \times \frac{7}{4} = \frac{15}{28} \times \frac{49}{28} = \frac{15 \times 49}{28}$ was sometimes seen. Most who had a correct method cancelled down at the end with very few candidates scoring only partial credit by giving the unsimplified fraction $\frac{105}{112}$ as the final answer.

Question 6

This question was answered very well. Common incorrect methods seen included $\frac{(5+6+7+8+9+10)}{6}$; $\frac{8+5+11+7+5+4}{6}$; finding the mid-points between the groups $(5.5 \times 8 + 6.5 \times 5 + \ldots) \div 40$; $\frac{288}{6}$ and $\frac{(8+13+24+31+36+40)}{40}$ (cumulative frequency). Occasionally candidates thought the final answer of 7.2 should be rounded. Those who showed the 7.2 first before rounding were credited but there were some who went straight from $\frac{288}{40}$ to an answer of 7 which gained the method marks.

Question 7

Part (a) was well answered by nearly all candidates. Some candidates overcomplicated the area formula and rather than using $\frac{1}{2} \times 8.5 \times 10.8$ they used $\frac{1}{2} \times 8.5 \times 10.8 \times \sin 90$. A small minority of candidates could not score the accuracy mark as they gave an answer of 46 but those who showed the correct answer of 45.9 in the working were not penalised for this and most gave the correct answer. It was rare to see area and perimeter muddled in this question.

In **part (b)** some candidates found the hypotenuse of 13 .7… and then gave that as the answer. Those who then went to use the correct method of 13.7… + 8.5 + 10.8 nearly always gave the correct answer. A small minority of candidates did not find the hypotenuse and used just two sides either 8.5 + 10.8 or 2(8.5 + 10.8).

Question 8

Almost all candidates gave the correct standard form answer. The most common error, which was still very rare, was giving a decimal answer not in standard form. Occasionally there was evidence of candidates attempting this question without a calculator, which was not necessary, and they sometimes made an arithmetic error.

Question 9

In **part (a)**, most candidates correctly factorised the expression completely. It was rare to see an expression that had only been partially factorised. The most common error was a change of sign inside the brackets and consequently the most common incorrect answer was $3x(x + 4y)$. Most candidates correctly expanded and simplified the given expression in **part (b)**. A small number spoilt their answer by putting some brackets back into their final expression. There were rare occasional sign errors or arithmetic slips usually in evaluating 2×-3 or $-3m + 2m$.

Question 10

Many candidates were able to sketch a correct line in **part (a)**. Candidates would occasionally draw a line with a negative gradient, possibly $y = 3 - x$ and there were some who drew a curve. Another common error was to draw $y = x$. **Part (b)** was more challenging. Alongside many correct curves were a variety of straight lines and other curves. Graphs resembling $y = x$ and $y = x^3$ were common, along with straight lines with a negative gradient. Candidates often had the correct shape of the parts of the graph but put one or more sections in the wrong quadrant, or only drew the positive quadrant. In both parts of the question many candidates worked out a table of values in order to plot points. In **part (b)**, this often led to candidates stopping their curves before an asymptote was demonstrated, usually at the point (1,1) which they plotted. Many graphs started to curve back in rather than get closer to the axes. Some also joined plotted points with straight lines. Candidates should understand that graph sketching involves demonstrating the shape of a curve or line and showing its main features such as where it crosses axes, turning points, asymptotes, etc. rather than plotting a series of points.

Question 11

Almost all candidates recognised **part (a)** as a rotation and most also stated 90°, although a fair number thought that it was an anticlockwise rotation. Quite a few chose to state the angle as 270° anticlockwise or, less frequently, simply 270°, and very rarely –90°. While many scored full credit, the centre of rotation caused quite a few problems and there were many different centres given. A small number gave two transformations such as a rotation followed by a translation which couldn't gain any credit. **Part (b)** was less well answered than **part (a)**. Many recognised it as a reflection and were able to identify the line $y = x$ as the line of reflection. Some struggled with the equation of the line and answers such as 'Reflection in (0, 0)' were sometimes seen. A significant number of candidates thought it was a 90° rotation and another common error was to think it was a translation. Again, a small number missed the fact that the question asked for a single transformation and gave two transformations such as a rotation followed by a reflection. **Part (c)** was often correct but many seemed confused by an enlargement making the shape smaller and the most common error here was to state that it was a negative enlargement or to give the scale factor as –2 or $-\frac{1}{2}$. Some seemed to think that enlargement was inappropriate and used words such as 'reduced' or 'diminished'. The centre of enlargement was often found by drawing and slight inaccuracies meant answers such as (4, 5.5) were sometimes seen. Double transformations were less common here but they were seen at times, usually an enlargement and a translation or an enlargement with a rotation.

Question 12

Many candidates gained full credit for this question. Those who scored partial credit usually gave 229 460…, having missed the instruction to round to the nearest hundred. A significant number of candidates misread the figure 250 000 using 25 000; these candidates were still able to score the method mark and the rounding mark and usually did score both of the possible marks. Other candidates misread the question and found the increase rather than the decrease. They often scored the rounding mark, if they showed a more accurate answer in their working; consequently a common incorrect answer was 272 000. Less able candidates often used a 'simple increase' method, e.g. $250\,000 - 250\,000 \times 0.017 \times 5$; again the rounding mark was often scored. Premature rounding part way through the calculation was seen, for example rounding $(1 - 0.017)^5$ to 0.9178 with an answer of 229 450.

Question 13

Some candidates thought the recurring decimal was 0.262626.. and their answer was usually $\frac{26}{99}$. Others tried correctly to work out 2.666 – 0.266 but gave their answer as $\frac{2.4}{9}$ without converting to a proper fraction. Some did not use enough 6's so attempted e.g. 2.6 – 0.26 = 2.34 and hence the answer of $\frac{2.34}{9}$ or 26.66 – 0.26 = 26.4 and the answer of $\frac{26.4}{99}$. Some candidates showed little or no correct working yet gave the correct answer and candidates are advised that in this question there is an instruction to show all working.

Question 14

Part (a) was usually well answered. A small number of candidates gave an incorrect answer, often 11.45, possibly from misreading the scale. **Part (b)** was answered more successfully than **part (a)**, although a small number of candidates mixed up range and interquartile range. In **part (b)(i)** a small number gave an answer such as $2 < x < 14$ or 2 – 14 rather than 12. In **part (b)(ii)** the most common error was calculating the range or semi-interquartile range as well as a similar error to that in **part (b)(i)**, e.g. $5 < x < 13.5$ or 5 – 13.5. Again, there was evidence of a possible scale misread as 8.45 was also a common incorrect answer.

Question 15

This was one of the more challenging questions on the paper and was a good discriminator. Some candidates provided a fully correct explanation for their answer of 116°, but it was more common to see a partially correct explanation, with many omitting to mention the alternate segment theorem or incorrectly calling it the alternate angle theorem. There were some fully correct alternative explanations seen, but most candidates appeared to be using the alternate segment theorem followed by the fact that opposite angles in a cyclic quadrilateral are supplementary. It is important, in a question such as this, that candidates include the names of the theorems being used when giving reasons for their answer; explanations such as angle *ACQ* = angle *ADC* and angle *ADC* + angle *ABC* = 180° are not sufficient.

Question 16

This proved a challenging question for many. Successful candidates used the most efficient method of substituting $(7-3y)^2$ for x^2 into the second equation and were able to multiply out the brackets correctly. A large number of candidates made the first correct step of the substitution but then multiplied out incorrectly, usually resulting in $49 \pm 9y^2$. Squaring all the terms in the first equation was an incorrect first step for many, who then used elimination by adding or subtracting the second equation, resulting in an equation involving kx^2 or ky^2. Many spotted that the second equation could be expressed as the difference of two squares and some successfully used this to substitute for x, resulting in $(7-3y+y)(7-3y-y)$ which they then simplified and multiplied out. Others who expressed the equation as the difference of two squares often went on to equate each bracket to 39, hence $x + y = 39$ and $x - y = 39$ and then used substitution or elimination with the first equation. Those who got to a correct quadratic equation, usually in terms of y, generally went on to solve it correctly. Most saw that the expression could be factorised and many others substituted correctly in to the quadratic formula to solve. Candidates should be aware that a question which requires all working to be shown does require each step to be shown; some went straight from the quadratic equation to writing down the solutions. A significant number of candidates, used to dealing in equations in terms of x, solved their equation which was originally in terms of y, as if it was in terms of x, hence incorrectly reaching $x = 5$ and $x = 0.25$ so consequently the two pairs of answers were incorrect.

Question 17

This question was often correctly answered and where full credit was not gained, most candidates started correctly by finding the gradient of *AB*, with occasional signs errors, particularly with the double negative. Having found a gradient, most gave the correct negative reciprocal as the gradient of the perpendicular line, although a few forgot the negative and simply used the reciprocal. A fair number of candidates missed this step out completely and used the gradient of *AB* in their final answer. The final step of finding the equation of the line passing through (3, 5) was also generally well done. The most common error here was to use either the other given point (1, –7) or the mid-point (2, –1). There were a small number of candidates changing $-\frac{1}{6}$ to a decimal which very often resulted in an inaccurate intercept due to premature rounding.

Question 18

This question was well answered with many candidates gaining full credit. Many candidates gained partial credit, usually for 146.25. Not many candidates wrote out all four bounds to test and choose the appropriate pair to use. This meant that some couldn't score if they chose the wrong two bounds and did not show the others. A few candidates found $\frac{146.2}{7}$ and then attempted to find the upper bound for the answer. Incorrect answers often came from $\frac{146.25}{7.5}$ or $\frac{145.7}{6.5}$. The incorrect working of $\frac{146.15}{6.5}$ giving 22.48… then rounded to 22.5 was occasionally seen and scored only partial credit for the 6.5.

Question 19

In **part (a)** some candidates drew the graph of $y = \sin x$ whilst a few appeared to guess and the graph was not a trigonometric one. Most candidates plotted the main points of (0, 1), (90, 0), (180, –1), (270, 0) and (360, 1) but few knew the true shape of the curve and most were too linear, with some using a ruler to draw two straight lines joining these points. Drawing light or dashed horizontal lines at 1 and –1 would have assisted to keep the maxima and minima in roughly the correct places. In **part (b)** many did reach $\cos x = \frac{1}{4}$ but then couldn't correctly find the angle giving this cosine value by using $\cos^{-1}$. Most candidates were unable to find the obtuse answer, either using 180 + 75.5… = 255.5… or 270 – 75.5… = 194.4…. Few used the graph they had just drawn in **part (a)** which would have assisted them to find the second solution.

Question 20

This question was one of the most challenging questions on the paper as it did not explicitly ask candidates to complete the square and many did not realise that this was what was expected of them. Consequently, there were many unsuccessful attempts involving trying to expand the bracket $(x + b)^2$ leading to answers that included *x*. Of those scoring partial credit, this was usually for $a = 36$. Common errors were the answers of $a = -36$ and/or $b = 6$.

Question 21

This was another challenging question. Of those candidates who provided one correct statement, it was usually one equivalent to saying that *X* is the mid-point of *ZY*. The statement that was often omitted was that the three points are collinear. A significant number thought that the two vectors were perpendicular or that the three points formed a triangle. Quite a few were able to answer simplistically that *ZY* was double *XY*, which was allowed as an alternative to *X* is the mid-point of *ZY*, but then some went on to spoil this statement by adding the contradictory statement that *Y* was the mid-point rather than the common point.

MATHEMATICS

Paper 0580/32
Paper 32 (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. Most 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, and candidates should be encouraged to avoid premature rounding in workings as this often leads to an inaccurate answer and the loss of the accuracy mark. In 'show that' questions, candidates must show all their working to justify their calculations to arrive at the given 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) (i) The majority of candidates understood the method to be used in this multi-stage calculation, and a good number of fully correct answers were seen. However, the first step to find the costs of each parcel proved challenging for a significant number. Common errors included one or more of; incorrect conversion of 0.3 kg to 30 g with the consequent incorrect cost of \$0.76, linking the 250 g to an incorrect cost of \$5.60 due to a misinterpretation of the table, linking the 55 g to the incorrect cost of \$0.95 due to misreading the table. Most of these candidates were able to show correct follow through working for the addition and subtraction required and were then able to be awarded the two available method marks. Candidates should be reminded that as the answer was an exact answer it should not have been rounded to either £5.80 or \$6.

(a)(ii)(a) This part involving finding a percentage increase was generally very well answered. As this was a 'show that' question, the statement of '5% $\times$ 5.60' was insufficient.

(ii)(b) This part on understanding of a percentage increase was again generally well answered. The common explanations either corrected the given statement by calculating the increase was \$0.11 and/or the total cost would be \$2.31, or stating that the large parcel costs less so the percentage increase will be less. Simply stating that the costs and/or the masses were different was not sufficient. A small yet significant number did not appreciate that 'the cost of sending any parcel increased by 5%' as stated in the question, and gave answers such as 'it is Large, not Extra Large so does not change'.

(b) (i) Again the majority of candidates understood the method to be used in this multi-stage calculation, and a good number of fully correct answers were seen. The most successful candidates were those who followed the line of '$w + 35 = 2000$, $w = 1965$ g, $w = 1.965$ kg'. However, the first step to change one set of units proved challenging for a significant number, with common errors including 35 g = 0.35 kg and 2 kg = 200 g. Other common errors included $w = 35$, $w = 35 - 2 = 33$ and $w = \frac{35}{2} = 17.5$.

(ii) This part was generally answered reasonably well although a significant number found the concept of upper and lower bounds challenging. Common errors included 12.3 and 12.5, 12 350 and 12 450, 11.9 and 12.9, 11.4 and 13.4, and 12.4 and 100.

Question 2

(a) (i) This part on finding the mode was generally well answered although common errors of 19, and 2.5 were seen.

(ii) This part on finding the range was reasonably well answered although many candidates found it much more challenging than finding the range given a set of values, and did not appreciate that the values to be used were 0, 1, 2, 3, 4 and 5. Common errors included $19 - 5 = 14$, $19 - 2 = 17$ and $5 - 1 = 4$.

(iii) Although a number of fully correct answers were seen, again many candidates found it more challenging than finding the mean from a given distribution table. Common errors included calculating $\sum f$ rather than $\sum fx$ and dividing by 6, or finding the total number of penalties, $\sum fx$, correctly but again dividing by 6, $\frac{110}{10}$, $\frac{15}{6}$ and $\frac{66}{5}$.

(b) (i) This part involving writing a number in words was generally very well answered.

(ii) This part involving writing a number correct to the nearest 100 was generally very well answered, although common errors of 11 600, 116.78 and 12 000 were seen.

(c) This part involving finding a percentage was generally very well answered, although common errors included 29 (from $\frac{4350}{15000} \times 100$), 40.85 (from $\frac{4350}{10650} \times 100$) and 140.8 (from $\frac{15000}{10650} \times 100$).

(d) This part involving the use of a given exchange rate was generally very well answered, although the common error of $20 \times 0.016 = 0.32$ was seen.

Question 3

(a) (i) This part involving the identification of an angle was generally very well answered, although common errors of reflex, acute and right were seen.

(ii) This part involving the measurement of an angle was generally very well answered, although common errors of 46, 226 and 130 were seen.

(b) (i) This part involving the identification of a polygon was generally very well answered, although common errors of hexagon, pentagon, hectogon and heptagon were seen.

(ii) This part on working out the size of the interior angle of a regular polygon proved to be a good discriminator. As the initial step, finding the sum of the interior angles, and finding an exterior angle, were equally popular approaches. Finding the exterior angle first generally proved a more successful method. Common errors included stopping after a correct first step of 15 or 3960 (although this did earn the method mark available), use of an incorrect formula to find the sum of the interior angles, and the incorrect use of 360 and/or 180.

(c)(i) This part involving finding the value of an unknown angle was generally reasonably well answered although significantly fewer candidates were able to give an acceptable reason. Common errors included 156 (180 – 24), 78 $\left(\frac{[180-24]}{2}\right)$, 48 ($2 \times 24$) and 90. The reason 'angles in a triangle add up to 180°' was not required and was not sufficient by itself.

(ii) This part again involving finding the value of an unknown angle was generally reasonably well answered although significantly fewer candidates were able to give an acceptable reason. Common errors included 107 (180 – 73), 34 ($180 - 2 \times 73$), and 24.

(iii) This part involving the drawing of a tangent was generally very well done, although common errors of extending *OA*, joining *AD* and joining *AE* were seen. A significant number were unable to attempt this part.

Question 4

(a) (i) This part involving finding the area of the given shape was generally well answered, although the calculation for the triangle proved more challenging. Common errors included 108 (from $9 \times 5 \times 2.4$), 66.6 (from 9×7.4), with a variety of incorrect formulas also seen.

(ii) This part involving finding a different area was again generally well answered, although a small yet significant number found the perimeter in error. Other common errors included 3.69 (from considering only one window) and 30.69 (from using 6×4.8 for the windows).

(iii) This part involving finding the resulting area to be painted was generally very well answered, particularly as a follow through was allowed.

(b) This problem solving part involving a multi-stage calculation to find the required cost proved challenging and demanding for many candidates, and was a good discriminator. The most successful method was $\frac{53}{4.5} = 11.777$ … litres, $\frac{11.777...}{2.5} = 4.7111...$ tins, 5 tins needed, $5 \times 24.75 = 123.75$. Many candidates did not show units in their calculations and this led to confusion as to litres or tins for their calculated values. The rounding up required to find 'the least number of tins' also caused problems with many using 4.7 or 4 in their final calculation.

Question 5

(a) (i)(a) This part involving the use of a linear graph was generally very well answered, although the common error of 10.4 was seen.

(i)(b) This part again involving the use of a linear graph was also generally very well answered, although the common errors of 0.35 and 35 were seen.

(i)(c) This part involving finding the equation of the given line proved demanding for many candidates, and was a good discriminator. Many did not appreciate that the statement that they had completed in the previous part – '*Saanvi's Taxis* cost $3.50 for each kilometre travelled' – was of use in this part. Many appeared not to realise that an equation is a simple statement, in this case $c = 3.5d$, and erroneously added symbols of $ and/or km or added words such as distance. Another common error was to use a different variable such as *c, x* or *n*. A small number of candidates did use $y = mx + c$ successfully.

(ii)(a) This part involving the use of given data to work out a cost was generally well answered, although a significant number simply gave the answer as 8 + 5 = 13 which was not an acceptable answer. As this was a show that question the full working of $2 \times 4 + 5$ or 2 + 2 + 2 + 2 + 5 was essential.

(ii)(b) This part involving finding the equation for this cost again proved demanding for many candidates, and was a good discriminator. Many did not appreciate that the statement that they had completed in the previous part, $2 \times 4 + 5$, would lead to $2 \times d + 5$, and then to the required equation of $c = 2d + 5$. The same comments from **part (a)(i)(c)** also apply here.

(ii)(c) This part on drawing a linear line was not answered well with only a minority able to draw the line correctly, although a small number were able to pick up one of the available method marks. The more successful candidates appeared to go back to the original statement given, and plotted (0, 5), (1, 7), (2, 9), (3, 11), (4, 13) up to (10, 25).

(ii)(d) This part required candidates to interpret the graph or the previously given data to give a reasoned answer to a given statement and this proved challenging for many. One valid explanation was to give a counter example, commonly for distances of 4 km or 10 km. Another was to appreciate the meaning of the intersection of the two lines on the graph. Common errors included comparing the values of 2 and 3.5, using gradients, using 3.5 and 3.25 as ‘average rates’ and stating that ‘there is a difference of $1’.

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

(ii) This part was generally answered very well.

(iii) Some very good solutions to the simultaneous equations were seen although less able candidates were often unable to use a valid method with a small number unable to attempt this part. The majority of candidates used the elimination method to solve their equations. The setting out was generally very clear with very few errors or arithmetic slips being made and only the rare candidate choosing the wrong operation for the elimination. On the rare occasion when candidates did choose to use the substitution method, most were able to rearrange one of the equations and correctly substitute into the other. However, this method did cause more candidates to make numerical and algebraic errors leading to incorrect final values for p and h.

Question 6

(a) (i)(a) Although a few candidates were able to correctly draw the required enlargement this part proved to be challenging for many candidates. Common errors included drawing an enlargement with an incorrect centre, vertices at (3, –1) or (3, –9), and drawing a shape a $\frac{1}{2}$ square bigger than the given kite.

(i)(b) The majority of candidates were able to correctly draw the required reflection although common errors include reflections in the x-axis or $x = -3$ or $y = -4$.

(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), (4, –4) and (4, 4) being common errors. The angle of rotation was sometimes omitted or incomplete, with 180° being the common error.

(b) (i) In this part and the next a significant number of candidates got the definitions for ‘congruent’ and ‘similar’ mixed up. This part was generally not answered well. The only congruent shape was J, with common errors being E or the inclusion of other shapes.

(ii) This part was again generally not answered well. The only similar shapes were F and H, with common errors being G, L, or the inclusion of other shapes.

Question 7

(a) (i) The majority of candidates were able to measure accurately at 9 cm and then use the given scale to correctly convert to give the actual distance required as 54 m. A very small number gave answers of 9 or $9 \times 100 = 900$ m.

(ii) This part on the working out of a reverse bearing was not generally answered well, with few candidates using either method of 164 + 180 or 360 – 16. A small number used a sketch diagram to help them, with a smaller number drawing a scale drawing although this was rarely accurate. Common errors included 180 – 164 = 16 and 360 – 164 = 196.

(iii) This part was generally answered well with the most successful candidates drawing the two given bearing lines to identify their intersection as the position of *T*. The bearing of 337° proved to be the more challenging bearing line to draw.

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

(ii) This part was generally answered very well.

Question 8

(a) This part was generally answered well with the majority of candidates able to draw the next diagram in the sequence, although not all were ruled, included the internal lines or showed the necessary shading.

(b) This part was generally answered well although not all candidates appreciated that the term to term rule required was simply ‘add 2’. A significant number gave a worded explanation to describe the pattern. Other common errors included $n + 2$ and $2n + 1$.

(c) This part was generally answered well with the vast majority of candidates able to complete the table for Diagram number 4, although the algebraic values required for Diagram number *n* caused more problems for less able candidates.

(d) This part was generally answered well.

(e) This part was generally answered well particularly by those candidates who had $(n + 1)^2$ in their table, rather than the equivalent $n^2 + 2n + 1$, and were able to solve $(n + 1)^2 = 900$. A small but significant number used a trial and improvement method or continued the sequence. A common error was to use an incorrect ratio method such as using Diagram number 1 to obtain $\frac{900}{4} = 225$.

(f) This problem-solving part involving a two-stage calculation to find the required value proved challenging for many candidates, and was a good discriminator. A follow through from their table in **part (c)** did allow a number to score method marks. Common errors included completing the first stage only and giving the answer as 21, $2 \times 43 + 1 = 87$, and $43 + 21 = 64$. A significant number of incorrect answers were seen with no working shown and thus could not be awarded any method marks.

Question 9

(a) (i) This part was generally answered well although common errors included the omission of 1 and/or 14.

(ii) This part was generally answered well although common errors included the omission of 2 and/or the inclusion of 1.

(iii)(a) This part was generally answered reasonably well particularly on a follow through basis. Common errors included the inclusion of some elements, often 2 and/or 7, in more than one region, and the complete omission of the elements 4, 6, 8, 9, 10 and 12.

(iii)(b) This part proved to be challenging for many candidates with the notation used in the question not fully understood. A very common error was to write down the actual elements rather than the number of elements, often the elements 2 and 7 rather than the value of 2.

(iii)(c) Again this part proved to be challenging for many candidates with the notation used not fully understood, although a good number did give a fraction with a denominator of 14.

(b) This part was generally answered well although common errors included 3, 5, 13 and 39×5.

MATHEMATICS

Paper 0580/42
Paper 42 (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 and only the final answer rounded to the appropriate level of accuracy.

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

General comments

The paper proved accessible for almost all candidates. Candidates appeared to have sufficient time to complete the paper and any omissions were due to lack of familiarity with the topic or difficulty with the question rather than lack of time. The presentation in most cases was very good with methods clearly shown.

Most candidates followed the rubric instructions but there were a significant number of candidates of all abilities either making premature approximations in the middle of a calculation or by not giving answers correct to the required degree of accuracy. This was particularly obvious in questions involving trigonometry and Pythagoras' theorem. Candidates generally performed well on algebra questions, although some omitted necessary brackets or made errors with directed numbers. Many candidates found the probability questions challenging, particularly the conditional probability.

This was the first exam involving some new topic areas and these were tackled well by the most able candidates but for some others there was a lack of familiarity with the content and skills required.

The topics that caused most difficulty were, maintaining accuracy in calculations with time, using scale accurately when calculating a gradient of a line, subtraction of algebraic fractions, expansion of three brackets, calculating probability for more than one event, Venn diagrams and related probabilities and questions where candidates were asked to show a particular result or to provide reasons, ensuring that each step was shown with no omissions.

Comments on specific Questions

Question 1

(a) (i) Almost all candidates obtained the correct total mass.

(ii) This part was almost always answered correctly.

(b) The correct answer of 11 cm was seen in only a minority of cases with many candidates giving 72 cm, the total distance travelled by the train. A common error involved candidates adding the distance travelled to the length of the train. Other errors involved a variety of incorrect calculations using the three numbers given.

(c) Most candidates were able to calculate the cost in rupees. Many of these rounded the cost correctly but a significant number either rounded incorrectly, e.g. to the nearest 100 rupees, or did not round at all. A small number calculated the exchange rate for $1, rounding the number of rupees to three significant figures before multiplying by 64, resulting in an inaccurate total.

(d) Many correct answers were seen to this percentage question. The most common error involved reducing $2.70 by 12.5% instead of recognising that $2.70 is 112.5% of the original cost.

(e) Many candidates were able to give the correct ratio although some struggled to cope with time. Some were able to calculate the correct time spent playing with the railway. In some cases, this was written as a time in hours, often with too few significant figures, or with some treating it as 4.25 hours. Others found the difference between the given times as 0465, treating this as 4.65 hours or as 4 h 65 min.

(f) Most candidates set up a correct first step, $736 = 550\left(1+\frac{r}{100}\right)^5$. Those that did usually then wrote down $\sqrt[5]{\frac{736}{550}}$ but it was common to see errors such as $736 - 550$, $\sqrt[5]{\frac{736}{550}-1}$ and $1+\frac{r^5}{100^5}$. Although many did go on to obtain the correct answer, several evaluated the expression incorrectly or rounded values prematurely. A few candidates treated the overall increase as a series of five equal annual percentage increases.

Question 2

(a) (i) Almost all candidates completed the table of values correctly.

(ii) The points were correctly plotted in almost all cases, although there were occasional errors in using the scale on either axis. One point that was incorrectly plotted by a number of candidates was the point at (−0.5, 1.75) which was often incorrectly plotted at (−0.5, −1.75). Most candidates gained full credit for drawing smooth curves using pencils that were not too thick. A few ruled the two end sections of the curve which, in addition to being incorrect, often affected their answers in **part(a)(iii)**.

(iii) A majority of candidates were able to read off all three values correctly at $x = 1.5$. Most errors involved misreading the horizontal scale.

(iv) A majority of candidates gave one of the correct values for k. Errors usually involved giving a positive or decimal value of k.

(b) (i) Many acceptable tangents were seen. Common errors included drawing a tangent at (0, 1), tangents where the point of contact was not accurate enough at (1, 3) and vertical lines drawn at $x = 1$.

(ii) Having drawn a tangent at $x = 1$ or elsewhere, most candidates were able to make an attempt at the gradient and many correct answers were seen. In some calculations, candidates used two points that were too close together, for example at $x = 1$ and $x = 1.1$. This led to slight inaccuracies in the values used with the result that the gradient was just not accurate enough. Candidates would be well advised to choose two points that are easy to read at a reasonable distance apart to minimise the effect of inaccuracies when reading off their values.

(iii) Almost all candidates realised the significance of the values of m and c in the equation of the line. They used their gradient from the previous part and attempted to find the y-intercept, usually by substituting a known point on the tangent into the equation. Relatively few used the simpler method of reading the intercept from their drawn line, even when it crossed the y-axis.

Question 3

(a) The vast majority of candidates had no difficulty in reducing 220 by 15%. Where errors were seen they were usually the result of giving the reduction instead of the reduced value and only occasionally the result of a numerical slip.

(b) A number of fully correct answers were seen in this part. However, a significant number of candidates did not appreciate that they needed to cube root the scale factor for the capacities of the bottles and so 8.8 cm was a common incorrect answer. In other cases, some candidates used the square root of the scale factor and some used the cube of the scale factor for the capacities of the bottles.

(c) This question proved more challenging and fewer correct answers were seen. The conversion of units required added to the difficulty for the candidates. In many cases no attempt was made to convert from litres to cubic centimetres, but when an attempt was seen it was usually correct. A few candidates attempted to convert the dimensions to metres but this proved unsuccessful. Several candidates misinterpreted the question and presumed that the tank initially contained 12 litres and calculated the corresponding depth. The calculation was repeated when the tank contained 84 litres and the two depths subtracted to calculate the increase.

Question 4

(a) Many fully correct responses were seen. The most common error was finding only the curved surface area of the cone. A few did not use the slant height for the area of the curved surface but calculated the vertical height of the cone and used this in the formula. These candidates often swapped the slant height and vertical height in **parts (b)** and **(c)(i)** also. A very small number of candidates incorrectly used either $2\pi r(l + r)$ for the surface area or $2\pi r$ for the area of the base.

(b) Most candidates gained full credit, with some using a less efficient method by calculating the vertical height and using the sine or tangent ratios. In most cases, these longer methods were successful but premature rounding sometimes resulted in inaccurate answers. Other errors included calculating the semi-vertical angle of the cone or using an incorrect value for the radius, usually 3.3 or 0.825.

(c) (i) Many correct answers were seen in this part. The most common error was using the slant height of 4.7 instead of calculating the vertical height. Some of those attempting Pythagoras' theorem mistakenly added $4.7^2 + 1.65^2$ instead of subtracting.

(ii) This part was well answered and the majority earned full credit. Most candidates with an incorrect answer in **part (c)(i)** were able to demonstrate a correct method in this part, rounding their decimal answer down correctly. Some candidates gave an incorrect integer answer without showing the decimal answer from which it had been derived. A few rounded their decimal answers up rather than down.

Question 5

(a) A small number of candidates earned full credit in this part with many of the rest earning partial credit for setting up a single fraction with a common denominator. At the first stage, the omission of brackets around the expansion of $-[(x-2)(x-3)]$ almost always led to sign errors in the numerator. Some candidates began with either the partial expansion of $x(x+2)+3(x+2)-x(x-3)-2(x-3)$ or with $x+3(x+2)-x-2(x-3)$ in the numerator, again almost always leading to sign errors in the expansion. Nearly all candidates found the correct common denominator. A few made a slip when collecting correct terms. In addition, candidates should be careful not to spoil their solutions by miscopying from line to line.

(b) A majority of candidates found the correct value for k. Errors usually occurred with the first step of the solution and it was common to see $12 - \frac{k}{2} = 32$ or $2^{\frac{k}{2}} = 32 \times 2^{12}$. A few that started correctly with $12 - \frac{k}{2} = 5$ made errors in solving their equation. Other errors included dividing powers rather than subtracting powers and errors in rearranging equations. Some candidates did not know how to approach this question using algebra but were successful in finding the answer using trials.

(c) A significant number of candidates scored full credit on this question and had clearly learnt the method for multiplying out three brackets and completed the process accurately. Some candidates multiplied out the brackets correctly but then made slips when collecting like terms such as $-24y + y$ giving $-25y$. Other candidates were awarded partial credit for multiplying out a pair of brackets correctly but then did not know how to deal with the third bracket, with a number attempting to multiply out all three of the brackets in pairs.

(d) This part was generally well answered with the majority scoring full credit. Nearly all the rest earned some credit for a correct first step, $xy = 3 + x$. Many did not realise that the next step should be to isolate the x terms, so it was common to see, e.g. $xy - 3 = x$ followed by $y - 3 = \frac{x}{x}$. A few reached $xy - x = 3$ but did not realise they needed to factorise. This often led to $x - x = \frac{3}{y}$ or similar.

Question 6

(a) (i) Most candidates gave a correct probability, usually $\frac{1}{3}$ and occasionally $\frac{2}{6}$. The most common errors were answers of $\frac{1}{6}$ or $\frac{1}{36}$.

(ii) Almost all candidates used their probability from **part (a)(i)** correctly to find the expected number.

(b) (i) Many candidates identified that there were four outcomes giving a sum of 5 and they often used this to calculate the correct probability. Some listed the four options but could not find the correct probabilities for these outcomes. It was common for candidates not to consider the reverse cases, so an answer of $\frac{1}{15}$ was common resulting from consideration of 1 and 4 and 2 and 3 only.

(ii) Candidates found this part challenging. Some were able to identify the correct outcomes, usually by calculating the probability of two square numbers, square, not square and not square, square.

Few used the more efficient calculation 1 – not square, not square. Many candidates showed sums of multiple products of $\frac{1}{6} \times \frac{1}{5}$ without identifying what these probabilities represented. Some candidates misinterpreted the question and found the probability that both numbers were square. Some only identified one square number on the cards, usually 4, leading to the answer of $\frac{1}{3}$. Only a small number of candidates calculated probabilities with replacement. Very few attempted a probability space diagram which would have simplified the problem and helped identify the required outcomes.

Question 7

(a) Many candidates wrote correct expressions for the number of marbles for each person and many of them set up and solved a correct inequality. Having solved the inequality correctly some gave an answer of 25 rather than $n > 25$. A significant number of candidates used an incorrect inequality symbol, either $<$ or $\geqslant$ and some set up an equation rather than an inequality. Most showed a correct method to solve their inequality or equation.

(b) Most candidates set up a correct equation to represent the relationship, $y = \frac{k}{x^2}$, and used the given values to reach the correct answer. Some correctly found $k = 120$, but then did not square the 5 when substituting to find y, leading to the incorrect answer of 24.

(c) (i) Most candidates were able to find the nth term of this linear sequence. The most common error involved using a difference of 2 rather than –2 in the expression $4 + 2(n - 1)$ leading to the answer $2n + 2$ rather than $-2n + 6$.

(ii) Many candidates found a correct expression for the nth term of this quadratic sequence. Most started by showing the second difference as 4 or reached a quadratic expression so gained partial credit. Some candidates used long methods involving setting up simultaneous equations which did not always lead to the correct answer.

Question 8

(a) (i) Many correct answers were seen but a significant number of candidates didn't earn the accuracy mark by giving 2.66 or 2.7 as their most accurate answer. A number of errors were seen that resulted from candidates using sine values to two decimal places. In such cases, method marks cannot be awarded unless the method is clearly written.

(ii) Although this was very well answered, some candidates didn't earn the accuracy mark by giving 4.1 as their most accurate answer. Following a correct start the incorrect simplification to 1.96 cos(34) was rarely seen. For others, a variety of method errors were seen. Some assumed opposite angles were supplementary and used the sine rule, some assumed angle *PSQ* was a right angle and used Pythagoras' theorem and some attempted to use the cosine rule but could not recall the correct formula to use.

(iii) Many correct answers were seen. Several candidates attempted to use less efficient methods such as calculating *RS* or calculating perpendicular heights. These alternatives usually led to an answer being out of range.

(b)(i) This problem involving use of Pythagoras' theorem in three dimensions was usually done in two stages with many using a rounded value in the second stage. Again, this often resulted in the most accurate answer being out of the acceptable range. Almost all candidates with an acceptable value for the length of *AG* went on to earn full credit.

(ii) The more able candidates answered this well but others were less successful in this part of the question. Some were unable to identify the correct angle and so inappropriate triangles were used, in particular triangle *AGB*. A number of candidates incorrectly identified angle *BAG* and attempted to calculate the two angles *CAG* and *BAC*.

Question 9

(a) Only a minority of candidates earned full credit for the Venn diagram. Many misinterpreted the given data, for example, treating $n(P \cap T) = 8$ as meaning $n(P \cap T \cap B') = 8$. Almost all candidates that identified two students using all three modes of transport usually went on to complete the diagram correctly.

(b) This part was often correctly answered.

(c) Many correct responses were seen in this part. Some stated that it was the empty set or the null set, neither of which was acceptable as the question was testing set notation. Common incorrect answers included 0 and $\{0\}$. Other symbols such as those for subset and universal set were sometimes seen.

(d) Many correct responses were seen in this part. Common errors included $\frac{7}{40} \times \frac{7}{40}$, treating the problem as with replacement, and to a lesser extent $\frac{7}{40} \times \frac{6}{39} \times 2$.

(e) Candidates were less successful than in the previous part. The most common error involved an incorrect total number of students, usually 40 rather than the total number travelling by train. Other errors either involved using probabilities with replacement or using the number that travelled by plane and train only.

Question 10

(a) (i) The majority of candidates were able to express $f(x-3)$ correctly in its simplest form. Common errors usually came from either $-12-1=-11$ or from $4(x-3)=4x-3$ or from $f(x)-3$ to give $4x-4$.

(ii) Again, most candidates obtained the correct simplified answer. However, incorrect final answers such as $5x^2$, and to a lesser extent, $25x$ were seen.

(b) Finding the inverse of the linear function was very well answered. There were a few sign errors when rearranging the terms, particularly from less able candidates. Other occasional errors included leaving an otherwise correct answer in terms of y or giving the answer as the reciprocal of $4x-1$.

(c) Many correct answers were seen in this part. Common errors included finding $3^{\frac{1}{3}}$ (the most common error), not giving the final answer correctly to 4 significant figures (e.g. 0.693, 0.6933) or rounding prematurely and evaluating $3^{-0.3}$ or $3^{-0.33}$.

(d) (i) Whilst a number of candidates did provide adequate working to lead to the given result, many attempts did not show sufficient detail and/or contained errors. Some candidates incorrectly gave $h(-3)$ as 3^{-3}. A variety of errors were seen in candidates' expansions of $(3x-2)^2$, e.g. $3x^2-12x+4$, $9x^2+4$, $9x^2+12x+4$.

(ii) A number of candidates were able to use the quadratic formula correctly to solve the given equation, giving their final answers correctly to 2 decimal places, as required. However, many errors were seen. These included sign errors when substituting into the formula, not drawing either the division line or the square root sign long enough, not giving final answers to the required degree of accuracy and incorrect attempts at rounding to two decimal places. Sometimes the correct final answers were given without explicit substitution into the quadratic formula. Candidates who simply use their calculators and do not show correct working will only score partial marks.

(e) Many candidates were successful in this part and those that did not have the correct answer could at least determine that $243=3^{-x}$ to score a method mark. The common error was to give the answer 5.

Question 11

(a) Many candidates were able to find both stationary points correctly and many more correctly differentiated $y=x^3-3x+4$ to get $3x^2-3$ and continued to equate this to 0. From here, $3x^2-3$ was frequently factorised incorrectly to $3x(x-1)$. Candidates who correctly reached $x^2=1$ often neglected the solution $x=-1$. Having found a correct value of x most candidates substituted this value into $y=x^3-3x+4$ to find the corresponding y value. Of the candidates who only had partial success at differentiating $y=x^3-3x+4$, the common errors included $2x^2-3$, $3x^2-3x$, $3x^2-3+4$, $3x^2-x$ and $3x^2-3x^{-1}$. Some candidates did not recognise that finding the derivative of the curve would give the stationary points.

(b) To earn full credit, candidates were required to identify the maximum point and the minimum point with a valid reason. The most common and most successful approach was evaluating the second derivative although a few errors were seen mainly in incomplete reasoning. A valid reason involved substitution and correct evaluation of an appropriate value of x into the second derivative of $6x$, commenting whether the result was positive or negative and identifying the point as a maximum or minimum as a result. Not all commented on the results being positive or negative. Some that did make the comment then spoiled their answer by statements referring to the x-values rather than the values of the second derivative. Other methods were seen but all to a lesser extent than the second derivative. Another method involved correctly calculating the gradient on each side of a stationary point and showing a change of sign in the gradient. Another option involved correctly calculating the y-coordinate on each side of a stationary point and reasoning they were both greater than (or less than) the y-coordinate at the stationary point. A reasonable accurate sketch with appropriate comments was also an acceptable approach. Few candidates drew or referred to sketches, although where seen, most were reasonably drawn. Occasionally, incorrect conclusions were drawn from correct working.