MATHEMATICS (US)

Paper 0444/11
Paper 11 (Core)

There were too few candidates for a meaningful report to be produced.

MATHEMATICS (US)

Paper 0444/21
Paper 21 (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 candidates plenty of opportunity to display their skills, although many found the demand of the paper rather challenging. There was no evidence that candidates were short of time, as almost all attempted the last few questions. There were a number of occasions of non-response, however omissions appeared to be due to lack of familiarity with topics ,or to the difficulty of the question, rather than lack of time. Candidates showed most success in the fundamental skills assessed in **Questions 1(b)**, **2**, **3(b)**, **4**, **6(a)** and **9**. The most challenging questions were **Questions 7(b)**, **12(b), 14, 16** and **18** to **20**. Candidates were adept at showing their working and so, in the majority of cases, it was easier to award method marks when answers were not correct or were inaccurate. Some candidate lost marks due to misreading or not following the demands of a question, this was particularly evident in **Questions 11(a)**, **13, 15** and **18**.

Comments on specific questions

Question 1

In **part (a)** of the question candidates were asked to give the order of rotational symmetry of the diagram. The correct answer of 4 was the most common response seen. Incorrect answers were not uncommon however and included 2, 1 and listing possible angles of rotation 90°, 180°, etc.

Part (b) of the question was generally more successful for candidates, with most adding all four lines of symmetry. Some candidates were only able to identify some of the lines of symmetry, commonly these were the horizontal and vertical lines of symmetry. Only a small number of responses gained no credit.

Question 2

This was found to be one of the most accessible questions on the paper with most candidates giving the correct answer. Very few failed to subtract the given probability from 1.

Question 3

This question required interpretation of the box plot to find range, median and interquartile range. Candidates were generally able to interpret the box plots and find the required values. In **part (a)** the range proved slightly more challenging for some than identification of the median as there were sometimes errors in reading one of the two values. For **part (b)** the median was the most commonly correctly identified value. In **part (c)** interquartile range caused the most difficulty to candidates, but was still correctly identified in many cases.

Question 4

This was a very accessible question for candidates with many responses fully correct. A small number of candidates gave the answers to angles *b* and *c* the wrong way around and a handful assumed *b* was equal to *c* so had all as 60°.

Question 5

In **part (a)** of this question candidates were asked to add two vectors. A majority of answers for this were correct. Where incorrect answers were seen they in some cases appeared to be treating the vectors as fractions, attempting to find a common denominator and adding or finding the correct answer and then 'simplifying' to $\begin{pmatrix} 7 \\ -3 \end{pmatrix}$.

Part (b) of the question was to calculate a scalar multiple of a vector, and this also was generally done well with many candidates giving a fully correct answer.

In both **parts (a)** and **(b)** there were responses seen where the candidate had incorrectly included a fraction line within the vector. Candidates should be aware that this is not the correct notation for vectors.

Question 6

Part (a) was usually done correctly although a few candidates were unable to divide 300 by 4 accurately. Some treated 300 as a speed and so tried 300×4.

Part (b) was found more of a challenge although most appreciated that they needed to calculate $300 \div 90$ but not all calculated this correctly. After finding 3 hours the residue was often dealt with incorrectly. 3.33 was often interpreted as 3 hours 33 minutes and a remainder of 30 from the division calculation sometimes became 30 minutes.

Question 7

Part (a) was reasonably well done although a common error was to find two of the correct terms but include the term with either $n = 0$ or $n = 4$. Some used their previous term as a starting point for their n in the subsequent calculation (as though it were a term to term rule).

Part (b) was found much more challenging. Most candidates knew that the sequence was reducing by 7 but some found it difficult to express this in a general form; $n - 7$ was the most frequently offered incorrect answer. Whilst many got the correct expression, some produced $25 - 7n$, failing to find the 'zero term'. The expression $n^2 - 7n$ was also seen a few times.

Question 8

The majority of responses showed working, as was required by the question. Elimination was a more common approach than rearrangement and substitution when attempting to solve the system of equations. There was a sizable minority of fully correct answers with appropriate working shown. Where candidates were not successful this was commonly due to not multiplying one or both of the equations to match the coefficients of x or y in order to eliminate through subtraction or addition. For those who did multiply up equation(s) other common errors were arithmetical or inconsistent adding/subtracting when trying to eliminate (adding some terms and subtracting others).

Some candidates with errors in finding their first number were successful in finding a second number to reach a pair that satisfied one of the two equations given in the question. This gave them 1 mark for the special case.

Question 9

There was a high number of correct solutions with nearly all candidates appreciating the need to show full working as instructed. This was found to be one of the most successful questions for candidates. Those that did not change the mixed number into a fraction first sometimes had a problem dealing with their negative result of the calculation $\frac{3}{8} - \frac{5}{6}$. When a common denominator was the first thing to be dealt with $1\frac{9}{24} - \frac{20}{24}$ often wrongly became $1\frac{11}{24}$. Occasionally the cancellation to simplest form went astray. Other errors in the calculations included multiplying the numerator and denominator of the fractions by different numbers when attempting to write over common denominators, or subtracting numerators and denominators rather than writing over a common denominator.

Question 10

In **part (a)** whilst there were many correct midpoints seen there were also a number of incorrect answers. Some candidates did not understand the demand of the question, instead attempting to calculate a gradient and sometimes using the numerator and denominator of the resultant fraction as the coordinates. Other errors seen included averaging the *x* and *y* coordinates of each pair of coordinates to obtain two values.

Part (b) of the question was found more challenging, asking candidates to find the length of the line segment *AB*. More successful candidates were seen using Pythagoras' theorem to find the distance required. Errors in the method included omitting the squaring steps or incorrect subtraction of the –5.

Question 11

There were a number of creditable answers given to **part (a)**, although quite a few either omitted or had incorrect one or more of the required elements (most commonly the centre of rotation in **part (i)**, or the centre of enlargement in **part (ii)**). Describing the enlargement/dilation in **(ii)** was less successful than the rotation in **(i)** as many thought it had a scale factor of –3 rather than the correct $\frac{1}{3}$. Some used non-mathematical words when trying to describe the transformation, for example 'shrink'. Candidates do need to be reminded to use correct terminology when describing transformations. A number of candidates failed to gain credit in **part (a)** as they missed the clear demand in the question for a single transformation. This was the most common reason for a mark of 0.

Part (b) was quite well done by many candidates, although a few only moved the triangle correctly in one direction (often vertically), whilst others mixed up *x* and *y* attempting a translation of $\begin{pmatrix} 10 \\ 2 \end{pmatrix}$. A few of the translated triangles were a different size to the original indicating a need for more care.

Question 12

This question was found to be quite challenging by candidates. In **part (a)** a minority of candidates were able to correctly work with indices and write the expression in a simplified form. Common errors included only using the power 4 with one or two of the parts of the expression within the brackets to obtain answers such as $4ab^{20}$ and working incorrectly with indices to obtain $4ab^9$ or $16a^4b^9$.

In **part (b)** candidates were asked to find the value of p in $2p^{\frac{1}{3}} = 6$. This was the least successful part for them with few able to correctly find the answer 27. Common errors included incorrect inverse steps in calculations or attempting to deal with the power $\frac{1}{3}$ before dealing with the 2 leading to $2p = 6^3$ as an incorrect first step. Common incorrect answers seen were 1, 3, 9, 81 and 108.

Part (c) asked for the value of t in $81^2 \div 3^t = 9$. Correct answers for this were again in the minority. Where candidates answered this successfully it was generally following use of index laws, although others seemed to have used a trial and improvement approach trying out different values. A small number of candidates were able to begin the process of solving the equation by use of index laws but not find the correct final value, this led to the award of 1 mark. Incorrect answers generally involved incorrect manipulation of the indices.

Question 13

Quite often an increase in the investment was calculated incorrectly using simple Interest, so 1 per cent was found and added on twice, which was not correct. There was a good number of candidates who knew how to calculate the value of the investment after 2 years using 8000×1.01^2, but struggled to evaluate the calculation correctly without a calculator. Only a minority of candidates attempted to work out year by year, a method which was easier where a calculator is not available, but for those that did they were generally successful.

Question 14

This question proved very challenging and was one of the least successful on the paper for the majority of candidates – few correct answers were seen. The most common error was to use the scale factor given and multiply the area of the lake on the map by this leading to the incorrect answer 6.4. Some candidates went on to multiply by a power of 10 and gave answers such as 64, 6400. Candidates need to be aware that area scale factors are not the same as linear scale factors.

Question 15

This question was generally either fully correctly answered or completely incorrect. Only a minority of candidates were fully correct. Those who began with $y = k \times \sqrt{x-3}$ usually succeeded, although their working was not always clear. There were a number of candidates who did not work with a constant, whilst quite often the square root was ignored by others. Some misread the question and seemed to be looking for inverse proportion whilst a few used squaring rather than square root.

Question 16

Rearranging the formula to make *h* the subject proved challenging for most of the candidates. A large number of the responses gained 1 mark for a correct first step of either expanding brackets or division by *g*. Those expanding first tended to be more successful, as division by *g* first resulted in a fraction that they then found it hard to deal with. Some candidates isolated an *h* as necessary but had *h* remaining in the other side too (e.g. $h = -\frac{2mh}{g}$). It was very common to see incorrect steps in attempts to collect terms or cancel terms. Candidates need to be aware that in such a question where the new subject appears twice, there is always a need to collect terms with the new subject and factorise.

Question 17

In **part (a)** the easiest coordinates to use to find the slope/gradient were (0, 2) and (4, – 1), leading to the exact answer of $-\frac{3}{4}$, but a method mark was available if using other points leading to an inaccurate answer. A common error seen was not recognising that the gradient should be negative. Some candidates did not understand the demand of this question, sometimes giving coordinates as their answer.

Part (b) was successful for many candidates where follow through of their gradient from **part (a)** was allowed, suggesting that the form $y = mx + b$ is well understood. The most common fault by a few candidates was to omit the *x* from their equation.

Part (c) was found more difficult with most not appreciating that the slope/gradient of the perpendicular was the negative reciprocal of their gradient from **part (a)**. Many offered little or no working and of those that did the *x* was sometimes omitted from the equation. Where a sensible attempt was made to follow through on the gradient from **(a)** the calculation to find the constant term (by substituting the given coordinates) was rarely shown making it difficult to assess if that had been attempted correctly.

Question 18

The demand of this question (or the method to solve it) was not understood well by candidates with many scoring no marks. The few correct answers were sometimes accompanied by a tree diagram and sometimes the candidate had identified the appropriate probabilities to multiply and add without the use of a tree diagram. A small proportion of responses were awarded 1 mark for one or both of the correct products, but subsequent working was incorrect. Common incorrect answers were $\frac{13}{16}$ and $\frac{13}{32}$.

Question 19

This question on vectors was found to be one of the most challenging questions on the paper, with very few correct solutions seen. Candidates should be encouraged to show a correct route (e.g. $\vec{\mathbf{OP}} + \vec{\mathbf{PS}}$), as those who did gained a method mark. Often however they then were not successful in expressing it terms of <u>a</u> and

b. Many did not seem to appreciate that PS was $\frac{4}{9}$ of PQ or SQ was $\frac{5}{9}$ of PQ, although some labelled the diagram with 4 and 5 but were unable to use it as few realised that finding $\overrightarrow{PQ}$ = b – a was an important step.

Question 20

In **part (a)** of the question the candidates were asked to sketch the graph of $y = \sin x$. Many did not attempt the sketch and, of those who did attempt a response, there were only a minority of curves which were sinusoidal in shape. A small proportion of answers were awarded 1 mark for a sine curve, with a very small number gaining full marks for correct shape and correct points of intersection with the *x*-axis.

Part (b) of the question asked for candidates to solve $2\sin x = 1$. This was the most challenging question on the paper with extremely few partially correct or fully correct answers to this part of the question. Some candidates were able to rearrange to reach $\sin x = \frac{1}{2}$ but did not know the angle which had a sine of $\frac{1}{2}$. Candidates need to be aware that results for standard angles such as 30° should be known.

MATHEMATICS (US)

Paper 0444/31
Paper 31 (Core)

There were too few candidates for a meaningful report to be produced.

MATHEMATICS (US)

Paper 0444/41
Paper 41 (Extended)

Key messages

Candidates sitting this paper need to ensure that they have a good understanding and knowledge of all of the topics on the extended syllabus.

There were many scripts with incorrect answers written on the answer line but with no method or working. The answers often implied that some method marks could have been earned if this method had been shown.

Unless directed otherwise, candidates should give answers to at least 3 significant figure accuracy. This often requires candidates to retain numbers in their working that are more accurate than 3 significant figures otherwise premature approximation is likely.

General comments

There were some excellent scores on this paper and many candidates demonstrated that they had a clear understanding across the wide range of topics examined. The majority of candidates attempted most questions on the paper.

Candidates should make sure they read the questions carefully. For example, in **Question 2**, the question talked about the total surface area, not just the curved surface area. In **Question 8**, the diagram said NOT TO SCALE so the angles should not be measured. In **Question 9(a)(i)**, the stem said there were 50 children so the cumulative frequency table should end in 50. In **Question 12(d)** and **(e)**, candidates were asked to draw suitable lines to estimate the slope and to solve the equation, not just calculate the solutions.

The stronger candidates should try to use the most efficient method to solving a question. For example in **Question 2(a)**, the π can be cancelled out on both sides which avoids rounding errors. In **Question 6** candidates should select the cosine or sine method according to which leads more efficiently to the required information.

Questions that ask candidates to 'show' results require candidates to start with the given information and arrive at the value that is asked to be shown. Reverse methods do not usually score. For example, in **Question 1(a)(ii)**, candidates should not start with the 2 hours but start with the 100 km and $98 and work towards the 2 hours.

In probability questions, if the question is given with fractions then it is usually best to stay working in fractions rather than working in decimals which will not necessarily be exact. For example, **Question 9(a)(iv)**.

For questions involving algebra, candidates are advised to complete each step on separate lines, rather than trying to do more than one step on the same line. For example, **Questions 4(c)**, **5(b)**, **7(b)**, **7(c)** and **11(d)**. Marks in algebra are generally awarded for individual steps clearly seen.

Comments on specific questions

Question 1

(a) (i) Almost every candidate answered this part correctly.

(ii) Many candidates made a good attempt at this and showed clear working. Marks were lost by candidates who did not show full working such as just writing 50 instead of 100×0.5. The reverse method, starting from 2 hours, was not accepted but one mark could have been earned for 100×0.5.

(b) Most candidates scored full marks in this question. The errors seen usually came from adding 5 + 2 + 7 incorrectly.

(c) The majority of candidates answered this question correctly. The most common error seen was to subtract 45 per cent of \$84.1 from \$84.1 rather than recognising that the \$84.1 represented $1.45 \times$ the cost before midnight.

Question 2

(a) It was clear that most candidates were able to use the given formulae to correctly work out the curved surface area of the cone. However, the majority of candidates omitted the flat circular parts of the surface areas in either or both of the solids. Other errors included finding the curved surface area of a sphere rather than a hemisphere or making algebraic errors when combining $\frac{4\pi R^2}{2} + \pi R^2$.

(b) Most candidates were able to work out the correct volume of the larger cone. Finding the volume of the remaining solid proved more challenging with most candidates taking the approach of trying to find and subtract the volume of the small cone that had been removed. Of those finding the volume of the small cone, many did not use the correct radius or height with few candidates recognising that the radius of the small cone was $\frac{1}{4} \times 7.6$. Wrong calculations, such as $\frac{1}{3}\pi \times 7.6^2 \times 12$, were frequently seen.

Question 3

(a) (i) The majority of candidates correctly divided by 1.142 with only a minority of candidates incorrectly multiplying by 1.142. A common error was to overlook the requirement to give the answer correct to the nearest euro.

(ii) The majority of candidates correctly converted the euros to dollars and subtracted. A small number successfully used a longer method of converting to dollars to euros and then converting back to dollars. Some candidates did not use any conversions and merely subtracted 275 from 329.

(b) Few errors were seen. The most common error seen was to find $\frac{3}{8}$ of \$5.25 rather than recognising that the \$5.25 should be multiplied by $\frac{8}{3}$ to find the money saved during the month.

(c) The majority of candidates attempted compound interest and correctly set up the implicit equation, $6130 \times (1 + \frac{r}{100})^5 = 6669$. Errors included failing to take the 5th root, dealing incorrectly with $1 + \frac{r}{100}$ and premature rounding leading to inaccurate answers. A few candidates used trial and improvement to find the correct answer and a sizeable minority used simple interest.

Question 4

(a) (i) Many candidates gave the correct answer. The common errors were to omit the '10' and write 3.07^{-3} or to put the wrong sign with the index and write 3.07×10^3

(ii) Candidates needed to first recognise that the given numbers are too big for scientific calculators. Common errors included adding or multiplying the 2 indices. Some made errors in converting the two numbers to the same index but earned B1 for figures 858. Wrong answers of the form 1.56×10^n were also frequently seen. Others tried to work the answer out on their calculator but not got further than writing 'calculator error'. Consequently, few earned full marks and many failed to score.

(b) Many candidates gave the correct answer and a number gave a multiple of 720. The most common methods used were factor trees and tables. Some made lists of multiples but could not select the correct answer. The most common error was to give the highest common factor (HCF), 6.

(c) There were very few correct answers. Candidates frequently failed to square $a\sqrt{3}$ correctly, writing 3*a* in many cases. Squaring only the first and last term and giving the answer '$3a^2 + 18$' was seen often.

(d) Good candidates showed the two surds before adding them, but it was evident that calculators were being used with no working seen. Some reached the correct answer but then wrote 39.69 on the answer line and others simply calculated the two square roots in decimal form and added them.

Question 5

(a) (i) There were many confused responses where they did not use the variable 'x' given or any alternative letter. The answer $-1 < 5$ or similar was often seen. It was clear that many candidates did not understand the difference between < and > signs. The putting together of a two ended inequality was also difficult for them and some attempts mixed up the x with the numbers to obtain things such as $-1x < 5$, or $-1<x>5$. The concept of the open and closed circles showing equality was lost on all but the best candidates, with a few of these attempts being the wrong way round.

(ii) Whereas most candidates understood that they needed to give integer answers, zero was often omitted. Some candidates ignored their inequality and were successful by using the diagram number line. There was again confusion with the use of open and closed circles and their meaning.

(b) Many candidates found the algebraic manipulation required by this question challenging. The order of operations was often incorrect or incomplete with candidates not performing the operation on all of the terms in the inequality. When the first step $3x - 2 > 4 \times 2x$ was seen, it failed to become $8x$ before $+2$ or $-3x$ or a divide by 3 appeared, which then introduced errors. The more able candidates managed to get to $-2 > 5x$ but then the answer often became $x < -\frac{5}{2}$ or $x > -\frac{2}{5}$. We did see $x < -0.4$ but some candidates wrote this as $x < -.4$ omitting the leading zero.

(c) There were some excellent answers here, but these were rare. Some of the best candidates correctly drew the four lines with a ruler, but selected the incorrect region. The line $x + y = 5$ proved the hardest to draw with $x + y = 6$ often seen. The line $y = x$ was omitted by many or drawn poorly, missing the diagonals of the squares. The lines $x = 5$ and $y = 1$ were often correct, but $x = 1$ and $y = 5$ were also seen. Drawing the lines without a ruler was common and often so poor that marks were lost. Some drew dashed lines but these were often un-ruled and inaccurate. Some shaded the unwanted regions so heavily that their lines were difficult to see. The weaker candidates often tried to work through the problem one grid coordinate at a time but they were rarely able to score.

Question 6

(a) The angle *AXC* = 102° was often seen. Those who knew to use the cosine rule usually reached the correct answer. Some attempted longer methods such as first using the sine rule to find other sides or angles as part of their method, and whilst some were successful, most lost accuracy by premature rounding along the way. A common error when using the cosine rule was to evaluate $(6.4^2 + 10.6^2 - 2 \times 6.4 \times 10.6)\cos 102°$ rather than $6.4^2 + 10.6^2 - (2 \times 6.4 \times 10.6 \cos 102°)$.

(b) Those who correctly found angle *BAX* = 44° and used the sine rule, frequently reached the correct answer. Only a few candidates made errors in their rearranging of the sine rule. Again some candidates found other sides, such as *AB*, as part of their method and whilst some went on to find *BX* there were often errors in accuracy, usually from premature rounding,

(c) A small number of candidates correctly calculated the height of triangle *ABC* and used $\frac{1}{2}$ *x* base *x* height. The majority calculated the two triangles separately using the 78° and 102°. Those who attempted to use the whole triangle first calculated angle *ACB* or the side *AB*. This often led to premature rounding inaccuracy. The most common error was to use 10.6 as the perpendicular height rather than, for example, $10.6 \times \text{Sin}78°$.

Question 7

(a) Whilst some candidates were able to factor this expression, others were not sure how to deal with it only having either one lot of $(3x-1)$ or one lot of $(-1-y)$. Candidates often wrote down expressions such as $3x-1+y(3x-1)$, which scored one mark, but could proceed no further. Many did not understand the instruction 'factor' and attempts at solving were seen.

(b) Candidates who recognised that the numerator and denominator should be first factorised to create products were frequently successful. However, a common wrong approach was to merely cancel the x^2 in the first step with $\frac{x^2-25}{x^2-x-20} = \frac{-25}{-x-20} = \frac{5}{x+4}$, or similar, commonly seen.

(c) The majority obtained a common denominator and successfully expanded the brackets with only a few attempting to further simplify and introducing errors. A notable number of candidates did not know how to deal with the denominators when adding fractions with a common wrong approach to add the numerators and denominators separately as $\frac{x+5}{x} + \frac{x+8}{x-1} = \frac{2x+13}{2x-1}$.

Question 8

(a) (i) There were a lot of fully correct and well-presented answers with many candidates recognising that using Pythagoras' theorem in triangle *ABC* was the necessary starting point. With those finding BC correctly, common errors including omitting to include the area of one of the 3 rectangles or assuming that some or all of the rectangles had the same area. Common method errors included calculating $20^2 + 13^2$ to obtain *BC*, forgetting to divide by 2 when finding the area of a triangle, assuming the triangle *ABC* had angles of 45° or measuring the angles of the triangle and using trigonometry despite the diagram being labelled NOT TO SCALE.

(ii) Whilst some candidates answered this correctly, there were a wide variety of incorrect methods seen including using the wrong triangle area or merely calculating $13 \times 20 \times 24$ or using methods involving π.

(b) Only a minority of candidates answered this question correctly. The errors seen included forgetting to add on the two radii or calculating one of $2\pi r$, the area of the sector or the area of a triangle as $0.5 \times 6^2 \sin 50$.

Question 9

(a) (i) Most candidates correctly completed the table, with only a few slips in arithmetic seen. Because the stem of the question said there were 50 children, candidates who had, for example, 3, 21, 42, 47, 49 could have expected to obtain 50 in the last box and been able to correct their error. Nevertheless, these candidates were awarded one mark. A significant number of candidates did not score because they had either merely copied the frequencies from the given table, gave the class widths or had multiplied or divided the class widths or mid-interval values by the frequencies.

(ii) The plotting of the numbers from their tables was well done and at the upper bounds. Some lost a mark because their curve did not go through their 5 plotted points. Some candidates drew blocks and a curve, which was not necessarily in the correct position in the intervals. A few candidates drew a line of best fit through the points.

(iii) If the curve was drawn correctly the answer was in range. Small errors in plotting usually led to an unacceptable value.

(iv) To answer this question, candidates ideally needed to go back to the original table(s) to find that 22 children have a mass 25 kg or less and 28 children have a mass of 25 kg or more. Few candidates used these numbers. Of those using 22 and 28, common errors included having both denominators as 50, adding the fractions or omitting to multiply $\frac{22}{50} \times \frac{28}{49}$ by 2.

(b) There were some excellent answers to this part, but they were rare. Most candidates did not know how to find the frequency within each bar, with some just using 300, 250 and 200. Others did not find and use the midpoints of the 3 bars. Some candidates merely added up all of the numbers on the height axis and divided these by 8, taking no account of the weighting of the 3 bars. The most common error was to quote 1.15 or similar as an answer in the middle of the range of values on the axis.

Question 10

(a) The most efficient method for finding the exterior angle is $\frac{360}{18}$ = 20 and those using this were frequently successful. Many candidates, however, used longer methods such as $180 - \frac{(18-2)\times 180}{18}$ and they too were often successful. It was common however for candidates to obtain 20 but spoil their method by adding to or subtracting from 180. The most common method errors included $\frac{180}{18}$, and $360 - \frac{(18-2)\times 180}{18}$.

(b) Whilst some candidates clearly understood that multipliers were involved in this question, not all used $\frac{5.2}{5.2+2.6}$ with errors including $\frac{2.6}{5.2+2.6}$ and $\frac{2.6}{5.2}$ often used. Many other candidates used addition rather than multiplication with 6.75 – 2.6 = 4.15 being a very common wrong answer.

(c) A minority of candidates answered this part question correctly, recognising that $\frac{780}{32}$ gave the volume scale factor and that the cube root was required to find the linear scale factor of the heights. The majority of candidates did not cube root the volume scale factor but merely calculated 2 × $\frac{780}{32}$ = 48.75.

(d) It was rare for any candidate to adequately explain why the two triangles were congruent. Equal angles were often identified but acceptable reasons were not given. Candidates needed to use correct wording such as alternate angles or vertically opposite angles. Wording such as alt, z angles, alternative, alternate segment theorem were not accepted. In addition, angles needed to be named unambiguously, so, for example angle *N* was not accepted for angle *SNR*. Only a few candidates gave a final conclusion of congruency stating, for example, *ASA*.

Question 11

(a) Almost every candidate answered this correctly. The most common error seen was 7 rather than –7.

(b) Candidates answered this part well with many scoring full marks. The most common errors included misunderstanding the function notation and evaluating f(5)j(5) for f(j(5)) or slips with arithmetic and signs.

(c) The most common error seen was to deal with the negative sign incorrectly and expand $3-2(3-2x)$ wrongly as $3-6-4x$. In addition many candidates did not use the correct order of operations and subtracted $3-2$ before expanding the bracket, to $3-2x$.

(d) The majority of candidates were able to arrive at a 3 term quadratic such as $x^2+2x-5=0$ but it was rare for candidates to solve this correctly. It was common to see candidates trying to make one or other of the x's the subject of the formula rather than completing the square or using the quadratic formula. Those using the quadratic formula more often than not made errors when assigning the values of a, b and c because they started from, for example, $x^2-5+2x=0$. A number of candidates scored no marks for either not simplifying $x^2+5=3-2x+7$ or for merely writing $\mathrm{g}(x)=3-2x+7$.

(e) (i) Again, this part was well answered with many scoring full marks and others scoring 1 mark for writing $x=3-2y$ by evidencing the correct changing of the x and y or for a correct first step in rearranging, usually to, $y-3=-2x$. The most common misconception was seen by those who did not understand inverse function notation and stated either $\mathrm{f}^{-1}(x)=\dfrac{1}{\mathrm{f}(x)}=\dfrac{1}{3-2x}$ or $\mathrm{f}^{-1}(\mathrm{x})=-\mathrm{f}(\mathrm{x})=-3+2x$.

(ii) Again, whilst a few candidates answered this part correctly, many did not understand the meaning of the notation $\mathrm{f(x)}^{-1}$ with answers such x^{-3} and $-x^3$ commonly seen. In addition, candidates need to ensure that they understand the distinction between $\sqrt[3]{x}$ and $3\sqrt{x}$ as those writing the latter did not score.

(f) As with **part (e)**, the notation was often not understood and a correct answer was only occasionally seen. Those who approached this by first writing $x=\mathrm{j}(-2)$ followed by 3^{-2} were usually successful. Candidates who tried to find $\mathrm{j}^{-1}(x)$ in terms of x or who attempted trial and improvement methods rarely scored. Whilst $\dfrac{1}{9}$ was the preferred answer, candidates who gave 0.111, or better, were rewarded.

Question 12

(a) Most candidates completed the table correctly. Any errors seen were usually with the y values at $x=-0.5$ and $x=4.5$ where the most common error was to give $y=1.25$ at $x=-0.5$ from an error in the order of operations when evaluating $3+4\times(-0.5)-(-0.5)^2$.

(b) The quality of the curve drawing was very high with curves seen passing through the correct points. Candidates read the scales carefully and plotted the non-integer values of y generally very accurately. The most common errors seen were the miss-plotting of either $(-0.5, 0.75)$ or $(4.5, 0.75)$. Candidates who used a ruler or whose curves had double lines or were not smooth were deducted one mark. Using a rubber to remove attempts that candidates wish to be disregarded would enable more candidates to score full marks.

(c) A number of candidates correctly gave 8 as a value of k for which the equation had no solutions. However a variety of other responses were seen indicating that many candidates had not understood the question.

(d) A few candidates drew ruled and accurate tangents, touching the curve at $x=3$. Others did not use a ruler in their attempt, or missed the curve at $x = 3$ or drew the line $x=3$. A few candidates found the gradient of the tangent within the required range but more often than not, candidates either omitted the negative sign or misread the scale and gave the gradient as -1.

(e) Although there were a small number of correct lines and answers given, this part proved difficult. Various strategies were seen for finding the solution, but only those who found the solutions after drawing the straight line graph, $y = 4 - 0.5x$, as required by the question, could score full marks.

Candidates who showed no method or who drew the graph $y = -1 + \frac{9}{2}x - x^2$ or who used the quadratic formula to obtain the correct solutions were only awarded one mark. Wrong methods included equating the original quadratic to the new quadratic or reading off the y values rather than the x values or reading off the x values where the original curve cut the x axis.