MATHEMATICS (US)

Paper 0444/11
Paper 1

General comments

To succeed in this paper, candidates need to have completed the full Core syllabus coverage, apply formulae and use a suitable level of accuracy. All working must be shown to enable candidates to access method marks in case the final answer is wrong. This will also help the candidates' checking of their own work. This is vital in 2-step problems, in particular with algebra. Candidates must check their work for sense and accuracy.

The questions that presented least difficulty were **Questions 2**, **3**, **9(a)**, **10(a)**, **12(c)**, **13(a)** and **20(a)**. Those that proved to be the most challenging were **Questions 7**, **8**, **14, 16, 17, 18** and **19(a)**. The questions or part questions where candidates did not give any answer were scattered throughout the paper or to whole questions suggesting that candidates were not confident with certain syllabus areas rather than having a lack of time to finish the paper. The questions that showed a high number of blank responses were **Question 7, 8, 9(b)**, **15(b), 19(a)** and all of **Questions 16**, **17**, **and 18**. In particular, these last three questions were on topics that were challenging for many candidates.

Comments on specific questions

Question 1

Most responses were correct but poor cancelling of fractions was the main cause of lost marks. A small minority gave their answer as a decimal, which although the value is identical, was not what was required.

Answer: $\frac{9}{20}$

Question 2

Some candidates attempted to form a calculation using the given numbers but made errors with minus signs so a response of –5 (the result of 3 – 8) was often seen. However, most candidates were able to answer correctly.

Answer: 11 or –11

Question 3

Whilst there were many correct answers seen, there were also a large variety of errors. Some candidates seemed confused by the order of operations, evaluating 16, subtracting it from 49 and then attempting to find √33. Others evaluated 7 and 16 correctly, but then worked out 16 – 7. A small number used the value –7, but most of these candidates arrived at the answer 23 rather than –23.

Answers: **(a)** – 9 or – 23

Question 4

This was the more difficult version of the ratio problem and many candidates did not realise they sh by dividing 84 by 7 not by the sum of the two parts. Candidates should first determine if the initial infor gives the overall total or the amount that relates to one part only. In the case of money or time such as t an answer that is not a whole number (or whole dollars or cents) is likely to be wrong. A variety of incorrec methods were seen, with 84 ÷ 13, 84 ÷ 13 × 6, 13 × 6 and 84 – 13 being seen particularly often.

Answer: 72

Question 5

There were some very good answers seen, but the main errors were due to making assumptions about the diagram. This diagram, on first sight, could be an isosceles triangle which caused many to find an answer of 115° but on closer inspection, there was nothing to support this. Candidates should not assume facts not given or indicated on diagrams. Others gave 75° as their answer but this was in fact one of the other angles in the triangle and the supplement of the correct answer. Many did not realise that this was a 2-stage problem so stopped their calculations once they reached 75°.

Answer: 105

Question 6

Most were able to interpret 1½ as $\frac{3}{2}$ but the method that followed was often incomplete. Many attempted to find a common denominator. Some candidates used the reciprocal of $\frac{3}{2}$ or reciprocals of both fractions. Incorrect attempts at dividing or multiplying numerators and denominators separately were also common. The answer $\frac{1}{8}$ was quite common.

Answer: 8

Question 7

There were very few correct answers seen for **part (a)**. Most answers were not in vector form. Those who showed some understanding of vectors often seemed confused about the placement of the digits. The minus sign was usually omitted. Fraction lines were seen quite commonly. A number of candidates offered an answer consisting of a 2×2 matrix made up of 2 pairs of coordinates. **Part (b)** was done well but the wrong answer of (0, 2) was seen.

Answer: **(a)** $\begin{pmatrix} 2 \\ 3 \end{pmatrix}$ **(b)** (– 1, 1)

Question 8

This was answered well by some candidates, although most were unable to complete the rearrangement entirely correctly. The division of the letter by 5 rather than the more usual multiplication did cause confusion. The most common error involved this division, with 5a + 9 = b and a + 45 = b being seen quite frequently. It was often difficult to give any credit at all because many candidates attempted the entire re-arrangement in one step. Others had obscured their result for the first step by adding working for the next step to their result, rather than starting a new line of working.

Answer: 5(a + 9) or 5a + 45

Question 9

Candidates did well at finding the next term. **Part (b)** caused significant difficulty for a large number of candidates. Answers showing the next term, the ninth term and n + 7 were all very common along with the term-to-term rule (+7).

Answers: **(a)** 32 **(b)** 7n – 3

Question 10

Most candidates were able to answer part **(a)** correctly. Many candidates did not realise that part **(** more complex version of the previous part. Here, there were two complications, that of converti fractions into sixteenths and that the required answer was only the numerator. The wrong answer 15 w very common as it is one less than 16 in the same was as 3 is one less than 4 and 7 is one less than 8. In some cases the denominators were ignored and 5 given as the number mid way between 3 and 7.

Answers: **(a)** – 6 **(b)** 13

Question 11

Many candidates were able to answer part **(a)** correctly. In part **(b)**, there were many answers with no method shown. Many answers for the number of matches did not make any sense as non-integers or integers greater than the total number of matches were quite common. Some gave 22 matches from assuming they had to use the probability of not winning any match from part **(a)**.

Answers: **(a)** 0.55 **(b)** 18

Question 12

In **part (a)**, the most common answer was rectangular prism with rectangle was the most common incorrect answer with cube seen quite frequently. Most could identify a pentagon in **part (b)**, but a variety of spellings were seen. Shape and polygon were also fairly common answers. In **part (c)**, most were able to answer obtuse although acute and reflex were seen.

Answers: **(a)** cuboid **(b)** pentagon **(c)** obtuse

Question 13

For **part (a)** the most common error was to give the answer as 14 and some tried to find the square root of 28. In **part (b)** a variety of problems were seen with some candidates unclear about how to find the volume and others making errors in the calculation. Most attempted to give units, but these were often incorrect, with cm and cm^2 being given.

Answers: **(a)** 7 **(b)** 37.5 cm^3

Question 14

This question caused considerable problems with only a very small number of completely correct answers. The vast majority of candidates attempted simple interest, with the answer 32 being seen very frequently. Some only calculated the interest for 1 year. Others attempted 400×1.04^2, but made errors when trying to evaluate the answer. Few candidates appeared to check whether their answers were reasonable within the context of the question – answers involving hundreds or thousands of dollars in interest were not uncommon.

Answer: 32.64

Question 15

In **part (a),** there were many correct answers, although some candidates made calculation errors. In **part (b)**, many candidates attempted the division, but were unable to evaluate the answer correctly. The most common error was to make errors when deciding on the place value of the digit 2. Attempts involving multiplication, either using the given numbers, or in a trial and improvement type approach, were quite common.

Answers: **(a)** 55(.00) **(b)** 200

Question 16

Many candidates did not attempt this question at all. When it was attempted, the answers we incorrect, with only the most able candidates showing any real understanding. In **part (a)**, answers tha coordinates were very common, as were the values –1 and 19. In **part (b)**, many candidates appeared to confused with the statistical term range. In **part (c)**, candidates did not realise the significance of discrete data. Answers involving numbers of children, or negative values were not uncommon.

Answers: **(a)(i)** (p =) – 1 and (q =) 5 **(ii)** $1 \le f(x) \le 19$ **(b)** (0,) 1, 2, 3, 4

Question 17

Most candidates attempted **part (a)** of this question but a surprising number of answers were left blank – with a multiple choice like this candidates should put in an answer. More were successful at identifying diagram C than diagram D. Many seemed unclear about what was required in **part (b)**. Numerical answers were seen, but attempts involving function notation or algebraic expressions were also quite common. Many strong candidates gave the answer 2.

Answers: **(a)** C, D **(b)** – 2

Question 18

Many struggled with these constructions. In both parts, correct lines were often accompanied by incorrect or spurious arcs which appeared to have been added after the line had been drawn. A lot of candidates knew the meaning of angle bisector but the majority did not know how to construct it accurately. Some drew the arcs but then did not draw the lines while others just drew a line which looked correct. In part **(b)** some drew a line at right angles to *DE* but not at the centre point.

Answers: **(a)** correct ruled angle bisector with two pairs of correct arcs
(b) correct ruled perpendicular bisector with two pairs of correct arcs

Question 19

Few candidates were able to answer **part (a)** correctly. Most arrived at the digits 25, but this was seen as an integer or as the numerator and denominator of a fraction. Many candidates took the minus sign to mean that their answer would be a negative number, often –25. **Part (b)** was often correct, although some candidates seemed unclear as to whether they were expected to write $(0.5)^2$, or to evaluate the answer. With **part (c)(i)**, many candidates found it difficult to give the correct index with common wrong answers being a^{18} or a^3. If the answer to **part (c)(ii)** was incorrect, most scored 1 mark, usually for $4b^k$, with 4 being the most common incorrect value of k but 20 was also seen several times.

Answers: **(a)** $\frac{1}{25}$ **(b)** 0.25 **(c)(i)** a^9 **(ii)** $4b^{12}$

Question 20

Most candidates were able to attempt part **(a)**, although some gave answers of 5x + 3. Some candidates attempted to solve for *x*. In part **(b)**, the candidates who attempted to factorise were usually able to produce a reasonable attempt at the answer, but errors in algebraic manipulation were quite common. Partially correct answers that involved errors with factorising one of the two terms were quite common. A surprising number of candidates thought that removing a factor of *x* would leave ($12y - {}^2$). Many candidates seemed to have no real idea of what was required and attempted to simplify the given expression. Most were able to attempt part **(c)**, with many completely correct answers. The main error was to write $5x = 27$ as the first step. Confusion about the order of operations required to solve the equation was common, as were attempts where the first step was a subtraction. This echoes problems seen in the rearrangement needed for **Question 8**.

Answers: **(a)** 5x + 15 **(b)** 3x (4y – x) **(c)** 15

MATHEMATICS (US)

Paper 0444/21
Paper 2

Key message

It is important to show all necessary working in each question and not to cross any of it out unless it has been replaced by another solution.

General comments

The arithmetical skills demonstrated by most candidates were very good. However, on a non-calculator paper it is advisable to leave answers in surd form wherever possible. It is not the intention that candidates should be trying to put all their answers into decimal form, especially when the answer involves π or fractions such as $\frac{6}{7}$. It is important to read carefully the demand of the question as many responses were not given in required format or accuracy.

The manipulation of numerical and algebraic fractions needs to be learned thoroughly because many candidates demonstrated only superficial knowledge.

The questions that were found to be most accessible were 1, 3, 4 and 13, whilst the questions that were found to be the most challenging were 11, 12, 15, 16, 18, 21, 22, 23**(b)**, 24**(a)** and 25.

Comments on particular questions

Question 1

The majority of candidates answered this question correctly and the most common incorrect answer was 5 or –5 obtained from subtracting 3 and 8.

Answers: 11 or −11

Question 2

In some instances candidates gave the figures 216 but had the decimal point in the wrong place. However they were more often than not able to gain the second mark for following through on this. When a completely incorrect answer was seen in part **(a)**, the follow through mark was generally not awarded.

Answers: **(a)** 0.216 **(b)** 0.22

Question 3

This was well answered, the common errors were either an attempt to divide 84 by 13 and then multiply by 6, or divide 84 by 6 and multiply by 7.

Answer: 72

Question 4

There were a good number of correct answers. In the cases where the answer was not correct, candidates were often able to gain 1 mark because of the correct marking of 55 in the triangle or 180 – (50 +55) leading to 75. The most frequently seen incorrect answer was 125, obtained from 180 – 55.

Answer: 105

Question 5

There were a pleasing number of correctly set out and fully correct answers. A number of cand[idates] preferred to use $\frac{24}{16}$, or similar, leading to large values in the numerator and denominator of the fraction f[or] multiplication as cancellation was not commonly attempted. When candidates used $\frac{3}{2}$ they were usually able to complete the calculation correctly. A minority of candidates who got as far as $\frac{3}{2} \div \frac{3}{16}$ mistakenly 'flipped' the first fraction and obtained an answer of $\frac{1}{8}$ which was the most common incorrect answer. Some 'flipped' both fractions instead.

Answer: 8

Question 6

Some candidates were clearly confident at factorisation and correctly factorised the expression in a single step with a good number of reponses also showing evidence of multiplying out and checking their answer. Some correct partial factorisations were seen such as $3(4xy - x^2)$. For other candidates this question proved difficult and it was disappointing to see some answers which demonstrated a complete lack of understanding with $-12x^2y$ or similar seen as responses.

Answer: $3x(4y - x)$

Question 7

Many responses gave an acceptable line, which had possibly been measured with a protractor rather than using a correct construction, which was rarely seen.

Question 8

A surprising number of candidates were able to fully solve the inequality with the answer most commonly being seen as a decimal, such as $x \geq -0.375$. Some candidates made a good start to solving the inequality obtaining an inequality, or equation, such as -3 < 8x or more simply obtaining $-\frac{3}{8}$. However they struggled with the inequality signs generally due to not knowing how division by 8 or –8 would impact on the inequality.

Answer: $x \geq -\dfrac{3}{8}$ oe

Question 9

Many candidates were able to start and the $\sqrt{20}$ was usually written as $2\sqrt{5}$ although sometimes $4\sqrt{5}$ was seen. The main problem was $\sqrt{125}$ which was often written as $25\sqrt{5}$. Occasionally $2\sqrt{5} + 5\sqrt{5}$ was simplified to $10\sqrt{5}$.

Answer: $7\sqrt{5}$

Question 10

A large number of responses were totally correct but many started correctly and showed the partial factorisation, either $a(p - 2) + b(p - 2)$ or $p(a + b) - 2(a + b)$ and then they gave this as their answer. Some were confused by the negative sign and wrote the partial factorisation as $p(a + b) - 2(a - b)$ or $p(a + b) + 2(a - b)$ where the two brackets are not the same so further progress is not possible from this position.

Answer: $(a + b)(p - 2)$

Question 11

Candidates seemed to get part of the expression more often than the entire expression correct tended to be for obtaining $3x^k$ rather than those who could not deal with $27^{1/3}$.

Answer: $3x^4$

Question 12

There were few correct answers seen and the main problem was getting the periodicity correct, as some responses did demonstrate a correct amplitude.

Answer: cosine graph with amplitude 2 and period 720

Question 13

The majority of candidates recognised that they should calculate 200 × 2.038, but errors in calculation meant that not all were able to gain 2 marks for this. Occasionally a correct answer was seen which was given to an inappropriate accuracy usually 407.600 or 408. The most common incorrect answer seen was where candidates attempted to divide by 2.038 rather than multiply.

Answer: 407.6

Question 14

This was answered quite well. The most successful responses were those who were able to cancel effectively rather than rely on long arithmetic processes. The common error was to attempt square root to find the value of *r* rather than cube root.

Answer: 3

Question 15

Many candidates did not get started on this question and they did not realise that they already had the cross-sectional area and that they needed the volume for each second using volume = cross-sectional area × length. Some who did achieve 200 seconds then wrote their answer as 3.33 rather than leave the remainder as seconds.

Answer: 3 (min) 20 (sec)

Question 16

It was common to see the equation of the line in the form $y = mx + c$ where either the gradient or the intercept were correct. The most common errors were in calculating the gradient where 5 – -1 was often 4, and in the gradient calculation, the fraction was often the reciprocal, difference in *x* divided by difference in *y*. Sometimes the candidates mixed up the *x*'s and *y*'s and subtracted an '*x*' from a '*y*'. Many used the point (3, 5) to find the intercept when the other point would have given them the correct answer without the need for any calculation.

Answer: $y = 2x - 1$

Question 17

In part **(a)** many concentrated on the two end terms and so the responses included $(x - 6)(x + 5)$, $(x + 1)(x - 30)$, $(x - 1)(x + 30)$ and $(x + 3)(x - 10)$. Most of these did not give the middle term of the quadratic expression when expanded. Some then continued to give the solutions to this expression equalling zero. Therefore for many there was no possibility of cancellation in part **(b)**.

Answers: **(a)** $(x+6)(x-5)$ **(b)** $\dfrac{x+4}{x+6}$

Question 18

This question caused problems for a large number of candidates. A significant number did not kno deal with proportionality and therefore could not start. A reasonable number had some idea proportionality, but were not able to deal with it being inversely proportional to the square root of *u*. Ma treated it as direct proportionality, some with just *u* and many used the square of *u*. The correct responses to the question usually wrote down the equation $t = \frac{k}{\sqrt{u}}$ and then proceeded to work out the value of *k*.

Answers: $\frac{6}{7}$ or 0.857(1…)

Question 19

In both parts **(i)** and **(ii)** some wrote the answers using the vector bracket notation. Those who used the correct notation often gave the correct response, some gave double the answer so in **(i)** they wrote 2**p** + **r** and in **(ii)** 4**p** + 2**r**. In **(b)** many said it was the centre of the shape or the parallelogram or on the line QS.

Answers: **(a)** **(i)** **p** + $\frac{1}{2}$**r** **(ii)** 2**p** + **r** **(b)** Midpoint of *RQ*

Question 20

Fully correct answers were rarely seen in this question. The length 9π was often seen but candidates neglected to add on the 2 × 12 and here a quick check back to the question would have been beneficial. Common errors included use of area rather than circumference of the circle in the calculation or use of an incorrect fraction in calculating the length of the arc through the incorrect cancellation of the fraction.

Answer: $9\pi + 24$

Question 21

Many candidates knew what to do and usually the response started correctly with the correct two single brackets as the numerator and the correct double brackets as the denominator. However, then, many candidates started to either cancel the brackets or they expanded all the brackets and then they cancelled any common terms, such as the 5*x*. They did not realise that you can only cancel common factors and that this fraction does not have any. In the correct responses it was common for the denominator to be expanded which was unnecessary work.

Answer: $\frac{5x + 13}{(x + 3)(x + 2)}$

Question 22

A lot of candidates were not convinced that triangle AEC was right-angled and they also struggled to use Pythagoras' Theorem to find EA first because they did not recognise angle EBA as a right-angle either. There were some problems using the surd $\sqrt{40}$ in another Pythagorean expression. Once sides were found the trigonometry proved less demanding.

Answer: $\frac{3}{7}$

Question 23

In part **(a)** it was common to see the correct expression followed by inappropriate cancellation in the fraction. There were a small number of responses which combined the separate terms in a number of incorrect ways especially those who divided first. It is recommended that this approach should follow factorisation as a first step. Part **(b)** was found to be difficult and few correct answers were seen.

Answers: **(a)** $\frac{A - 2\pi r^2}{2\pi r}$ oe **(b)** $y = 2^{x+1}$ oe

Question 24

Part **(a)** generally elicited a response from candidates, but these generally did not include referen specific angles. Where angles were mentioned the notation was sometimes non-specific, for example 'an A' and therefore could not gain credit. Almost no responses gained full marks due to a lack of correctly given reasons. Some equated angles *ABX* and *DCX* for instance. Part **(b)** was answered much better and the main incorrect response was 8 from the use of a scale factor of 2.

Answers: **(a)** Any two of *ABX* = *CDX* and alternate, *BAX* = *DCX* and alternate, *AXB* = *CXD* and vertically opposite **(b)** 10

Question 25

Parts **(a)** and **(b)** were generally incorrectly answered by candidates. A minority of candidates gained credit in part **(a)** for writing $5n$, although it was more usual to see $n + 5$. There were few correct answers seen for part **(b)** and few knew how to attempt it. Some candidates gave the next term in each of the sequences and they needed to read the demand of the question more carefully.

Answers: **(a)** $13 – 5n$ **(b)** $n^2 – 1$

Question 26

A large number of candidates were able to give fully correct answers to this question. Many of the remaining candidates gained some marks for the question, often for calculation of the three easiest rectangles such as 4 × 15, 9 × 15, and 6 × 15 with their addition or for calculating the area of one of the trapeziums. The area of the trapezium was commonly calculated by splitting the shape into a triangle and a rectangle rather than by use of the area formula. Finding the length of the sloping face **(5)** was often missing or given an incorrect value, such as 15. A small number of candidates were confused between area and volume so they calculated the volume of the trapezoid.

Answer: 420

MATHEMATICS (US)

Paper 0444/31
Paper 3

Key Messages

To be successful in this paper, candidates had to demonstrate their knowledge and application of various areas of mathematics. Candidates who did well consistently showed their working out, formulas used and calculations performed to reach their answer. Areas which proved to be vital in gaining good marks on this paper were; using 24 hour clock times, correct rounding, knowledge of angle properties, understanding of bearings and trigonometry, properties of straight lines, forming and solving equations, transformations and accurate plotting of coordinates and points on graphs. Although this does not cover all areas examined on this paper, these are the areas that more successful candidates gained marks on.

General Comments

This paper gave all candidates an opportunity to demonstrate their knowledge and application of mathematics. Most candidates were able to complete the paper in the allotted time, and most were able to make an attempt at most questions. Few candidates omitted part or whole questions. The standard of presentation was generally good, however a large proportion of candidates did not have access to or chose not to use a ruler for lines of best fit, lines of symmetry and straight line graphs, which lost some candidates potential marks. There were occasions where candidates did not show clear workings and so did not gain the method marks available. Centres should continue to encourage candidates to show formulas used, substitutions made and calculations performed. Attention should be paid to the degree of accuracy required in each question and candidates should be encouraged to avoid premature rounding in workings. This was particularly important in questions which required the use of π. Clear instructions are given on the front of the paper that candidates must use the calculator value for π or 3.142. However, many candidates continued to use 3.14 or 22/7 which led to inaccurate answers. Candidates should also be encouraged to fully process calculations and to read questions again once they have reached a solution so that they provide the answer in the format being asked for and answer the question set. A large number of candidates chose to attempt arithmetic calculations without a calculator and despite following a correct method, had inaccurate answers. Trigonometry proved too difficult for the vast majority of candidates, with a third not attempting it at all. Bearings was also poorly attempted with evidence that many candidates did not understand the term.

Comments on Specific Questions

Question 1

This question proved challenging to many candidates. All candidates made an attempt at some parts of the question but identifying prime numbers and cube numbers proved most difficult. Candidates should be reminded that to be successful on this paper they must know how to find factors, multiples, prime numbers, square and cube numbers. Only the best candidates could write a number in standard form correctly.

(a) (i) Most candidates attempted this question and the vast majority were able to gain a part mark as they identified 3 of the 4 factors of 22. However it was very common for candidates to forget 1 or 22 from their list of factors.

(ii) This was the least attempted part of the question. The more able candidates correctly identified 39 as the required multiple, however a large number wrote a list of multiples or gave other multiples outside of the range. Candidates should be encouraged to reread the question to check they have satisfied the criteria set.

(b) (i) This part proved the most difficult to all candidates. A large number of candidates co one prime number and wrote a long list of values from those given. Most sho understanding of prime numbers by correctly identifying one or two, however a su percentage of the candidates thought 1 was a prime number and therefore lost both marks identifying all three correct prime numbers also.

(ii) Candidates were slightly more successful in identifying a cube number from the list, however more than half of those that attempted it gave an incorrect answer. A very large proportion of candidates believed that 9 was a cube number, showing a misunderstanding between cube and square numbers.

Both standard form questions were answered well by the best candidates. Weaker candidates did not show that they understood the form required, with a large number choosing not to attempt this part of the question.

(c) (i) The most common error was to give a positive power instead of a negative power. A number of candidates used a negative power but started their answer with 35 instead of 3.5.

(ii) Similarly to part **(i)**, candidates found it difficult to express their answer in the correct form and only the best candidates gained full marks. Many candidates used their calculators correctly to get the answer of 42000 but then were unable to express it in standard form correctly – common mistakes being 42×10^3 or 4.2×10^3. A number of candidates simply copied the answer from the calculator, e.g. 4.2E4, not showing understanding of standard form.

Answers: **(a)(i)** 1, 2, 11, 22 **(a) (ii)** 39 **(b) (i)** 2, 17, 19 **(b) (ii)** 1 or 27
(c)(i) 3.5×10^{-3} **(c) (ii)** 4.2×10^4

Question 2

The correct use of 24 hour clock times was vital in successfully answering this question. Only the very best candidates were able to give times in the correct form in **(b)(i)** and to use time given in hours to calculate speed in **(c)(ii)**. All candidates attempted some parts of this question but a large number found rounding to the nearest 10 or 100 difficult.

(a) (i) This part was the best answered of this question, with the vast majority completing a correct subtraction sum. A small number of candidates chose to answer without a calculator and made errors in their arithmetic.

(ii) Despite answering part **(a)(i)** correctly candidates found using their value from part **(i)** very difficult. Many candidates correctly identified that they had to divide by 100 but then added instead of subtracting. An equally common mistake was to divide the original height of Hillibar Station (1047m) by 100, to reach an answer of 10.47 or 10.5. A large number of candidates gave no response for this part.

(iii) Both rounding questions were attempted by nearly all candidates, however a surprisingly large number of wrong answers were seen. In this part the most common mistake was to move the decimal point and give answers of 2.97 or 29.7.

(iv) The rounding in part **(iv)** was found to be more difficult with a large number of candidates rounding to the nearest 10 instead of 100, or again moving the decimal point to give answers of 104.7 or 10.47. Rounding to the nearest 10 or 100 or to a number of decimal places are areas that Centres should remind candidates are essential mathematical skills to gain good marks on this paper.

(b) (i) Nearly all candidates understood that the question required a time 27 minutes after 12 35. Most candidates attempted this question but only a small number gained the mark, as only the best candidates remembered to give their time as a 24 hour clock time or use pm as required. The most common incorrect answer was 1:02 instead of 1302 or 1:02pm. Candidates must be encouraged to give times in the format used in the question.

(ii) This question was answered correctly by the majority of candidates as, unlike part **(i)**, the answer is the same in 24 and 12 hour times.

(c) (i) Most candidates were able to identify a correct period of time from the table, however they were not as successful at using it to find the time of arrival. Candidates did show a variety of working around the table to gain a part mark, however a number of weaker candidates did n that there are 60 minutes in one hour and performed calculations which used 100 mi hour. This led to answers such as 1:76.

(ii) Calculation of speed proved difficult for the vast majority of candidates. A large number quote correct formula but could not gain a mark as they used an incorrect time in their calculation. Some candidates gained a method mark by using 1.36hr or 96mins, however very few used the correct value of 1.6hr to gain the full marks. Weaker candidates showed little or no working, and did not show how they had found the time which they used. This question highlighted the importance of candidates showing their working as some candidates could have gained marks if they had shown their workings.

(iii) This question proved difficult to most candidates who chose to add the time they had calculated in the previous part to 1148 instead of using the timetable to see the time of the next train. Candidates should be encouraged to reread the question once they have found their answer to make sure it makes sense.

Answers: **(a)(i)** 750 **(a)(ii)** 11, 11.5 or 12 **(a)(iii)** 300 **(a)(iv)** 1000
(b)(i) 13 02 **(b)(ii)** 10 26 **(c)(i)** 16 24 **(c)(ii)** 40 **(c)(iii)** 12 32

Question 3

This question examined candidates' ability to find missing angles in geometric problems. Most candidates attempted this question, however part **(e)** proved most difficult with many weaker candidates not giving a response.

(a) The majority of candidates were able to identify the missing angle as 29 degrees. The most common mistake was to add the angles to make 200 degrees, or to make arithmetic errors in calculations not performed on a calculator.

(b) This was the best answered part of the question with most candidates correctly identifying the missing angle as 42 degrees. This showed good understanding of angles at a point must add to 360 degrees. Common mistakes came from errors in arithmetic.

(c) Most candidates correctly identified the two missing angles, with the weakest candidates making errors, such as subtracting 66 from 200 to get 134 instead of 114 or thinking r was also 48 and therefore making s=132. In both cases they were still able to gain part marks.

(d) Most candidates correctly identified the missing angle as 50 degrees. This showed good understanding of angles in parallel lines. The most common error was to give the answer as 130.

(e) This part proved to be the most difficult of this question with a large proportion of candidates not making an attempt. Very few identified the two 90 degree angles in the diagram or in a calculation however some were able to gain full marks by subtracting 124 from 180. The most common mistake was to half 124 to gain an answer of 62 degrees.

Answers: **(a)** 29 **(b)** 42 **(c)** 66 and 114 **(d)** 50 **(e)** 56

Question 4

All candidates were able to attempt some parts of this question. Candidates were able to identify lines of symmetry, however most candidates found drawing and describing transformations difficult. The most common mistakes were made in describing the single transformation in part **(d)**, where many candidates wrote two transformations instead of one only. Candidates should also be encouraged to use a ruler when drawing lines of symmetry and mathematical diagrams.

(a) (i) The vast majority of candidates identified the correct line of symmetry, however some lines were not straight and would have benefitted from the use of a ruler.

(ii) Most candidates identified correctly the two required lines of symmetry; again the use of a ruler would have improved a number of responses. The most common mistake was to draw 4 lines or to write that there were an infinite number of lines, mistaking the shape for a circle. Only a very small number of candidates did not attempt part **(a)**.

(b) The majority of candidates who attempted this question shaded the correct square number did not give a response or shaded the wrong square.

Most candidates found drawing the result of a transformation difficult or did not make an attempt.

(c) (i) A large number of candidates reflected the shape in the *x*-axis instead of the line $x=4$.

(ii) This part was left unanswered by a quarter of the candidates and of those that attempted it, very few moved the shape the correct number of squares in any direction. A very large proportion of candidates counted incorrectly the number of squares left or down to move the shape.

(iii) This part was the least successful of the transformation questions, with a quarter of the candidates leaving it unanswered. Of those that did answer it, many were able to rotate the shape 180 degrees, however many candidates assumed the centre of rotation was (0,0) and positioned their answer in the wrong place.

(d) (i) This part was the most difficult with candidates often giving more than one transformation or using the word 'flip' instead of rotated or rotation. Often candidates gained some marks but rarely all three marks as they did not know how to fully describe a rotation. Most forgot the centre of rotation.

(ii) This description was much better attempted with a number of candidates using the correct terminology, 'translation'. A large proportion of candidates used the term 'slide' or 'glide' which candidates should be reminded is not the correct term used to describe a transformation of this type. Many attempted a vector however a large number wrote it as a co-ordinate or missed brackets. A large proportion attempted to describe the vector in words. This proved more successful for weaker candidates as those that attempted the vector generally made mistakes.

Answers: **(d)(i)** rotation, (0,0), 90° **(d)(ii)** translation, $\begin{pmatrix}-6\\3\end{pmatrix}$

Question 5

This statistics question was attempted by all candidates. Both parts proved successful for most candidates. It was evident that candidates were able to use protractors to construct the pie chart, however a number of were drawn without a ruler and candidates should be reminded that rulers should be used to draw any mathematical diagram. Few candidates used the wrong measure of average and most used a fraction to describe a probability.

(a) (i) Most candidates found two angles which added to make 240 degrees, however only slightly more than half found the correct two angles.

(ii) Nearly all candidates who had answered part **(i)** attempted to draw the pie chart but a number did not use a ruler and their angles were inaccurate. Most candidates demonstrated good use of protractors and the vast majority of candidates remembered to label the parts of the pie chart correctly.

(b) (i) The majority of candidates knew that the range was the difference between the largest and smallest values. However many candidates did not give the correct answer of 40, but left it as a range i.e. 16-56.

(ii) Most candidates correctly showed that they understood how to calculate the mean by adding the values and dividing by 12. A small number of candidates made mistakes in adding the values however still gained a mark by showing their addition and division by 12. A number of candidates, however, showed no working out and an incorrect answer meant they could not gain any marks. Candidates should be encouraged to show all workings out.

(iii) Most candidates gave their answers as a fraction which is an improvement on previo... most common mistake seen was careless counting of the total number of values. A la... of candidates did go on further and attempt to write their fraction as a percentage or... however this was not penalised if they had given the correct fraction.

Answers: **(a)(i)** 140, 100 **(b)(i)** 40 **(b)(ii)** 29.5 **(b)(iii)** $\frac{7}{12}$

Question 6

This question on scatter graphs was attempted by all candidates. Candidates were more accurate in plotting points than previous sessions, however most candidates made attempts to describe the correlation in a sentence instead of using the correct terminology. Candidates should also be reminded to use a ruler to draw a line of best fit and that points are not joined together in a scatter graph.

(a) Most candidates were able to plot some of the points with most candidates gaining at least one mark for plotting three correctly.

(b) Describing the correlation was the most difficult part of this question. The most common incorrect answers were ‘decreasing’ or ‘reducing’ or candidates attempted to describe the correlation as a sentence instead of the correct terminology of ‘negative’.

(c) Less than half of the candidates who attempted this question were able to gain the mark as most did not use a ruler or joined all the points together.

(d) Most candidates correctly identified a value from their line of best fit, either in the correct range or gained a follow through mark by correctly using their line of best fit. The candidates who did not gain the mark generally read the scale on the vertical axis incorrectly, using one square as 0.1 instead of 0.2.

Answers: **(b)** negative **(d)** 22.4 – 22.8

Question 7

This question proved to be the most difficult on the paper with only the very best candidates able to gain marks. Part **(a)** was the most difficult for all candidates as the second part could only be solved if they had correctly identified the expressions in part **(i)**. Many candidates did not use algebra to solve the problem and therefore tried many numerical methods which ultimately did not work. The simultaneous equation in part **(b)** was only solved by the best candidates.

(a) (i) A large proportion of the candidates did not attempt this part of the question. Completing the table was very challenging to all candidates with most only gaining one mark for x–34. Many candidates read on to part **(ii)** before completing the table and therefore became confused trying to fill in the rest of the table. The candidates had all the required information in part **(i)** to complete the table.

(ii) This part proved difficult for nearly all candidates, especially those who had made mistakes in part **(i)**. The question challenged the candidates to form an equation from the information given in parts **(i)** and **(ii)**, however very few candidates did form an equation, with the majority of candidates who attempted the question attempting a numerical solution, usually trial and error, which ultimately did not work.

(b) The simultaneous equation challenged the very best candidates. The majority of candidates were able to gain one of the three marks for a partially correct solution, using the elimination method. However most made mistakes in this method and were unable to find either of the correct solutions. The very best candidates used the substitution method which led most to the correct two solutions and gained full marks.

Answers: **(a)(i)** $x + 12$, $x - 34$, $x - 22$ **(a)(ii)** 39 **(b)** 8, –3

Question 8

This question discriminated well between candidates of differing abilities. It gave more able candi opportunity to demonstrate their knowledge of trigonometry but also gave less able candidate opportunity to demonstrate their understanding of Pythagoras' theorem and area. Only the most a candidates were able to gain full marks on part **(c)**. All candidates found the questions about bearings difficult.

(a) Only the more able candidates identified the need to use Pythagoras' Theorem in this part and many candidates lost potential marks by not showing a full method, or by rounding incorrectly, giving 86 as their answer which is not to three significant figures. Candidates should be reminded to read the instructions on the front of the exam paper regarding the level of accuracy required. A number of candidates did not square root so left their answer as 7453 which scored no marks. A large number of weaker candidates added the sides and got the answer of 109.

(b) Very few candidates showed understanding of bearings in this question. The majority believed they had to use their answer to part **(a)** or did not give a response. Some candidates did give an answer of 90 but failed to gain marks as it was not in the required form of a three figure bearing. This question proved to be one of the most difficult questions on the whole paper.

(c) (i) This question gave the most able candidates the opportunity to demonstrate their understanding of trigonometry. Of those that attempted the question, nearly a third of the candidates did not give a response, most did not use a trigonometric method and failed to gain any marks. A large number of candidates were able to quote SOHCAHTOA but could go no further. Very few candidates used a trigonometric ratio, and those that did often chose the incorrect one. Trigonometry proved to be an area of mathematics that most candidates did not understand.

(ii) Most candidates found the calculation of the bearing challenging. Common misunderstanding was to subtract the previous answer from 360˚ instead of 180˚. A large proportion of candidates did not attempt this question showing a common misunderstanding of the word 'bearing'. This question was the most difficult of the whole paper.

(d) (i) This part of the question was more accessible to all candidates, most showing a good understanding of area. Many candidates gained full marks with only a small number forgetting to half their multiplication sum.

(ii) Again this question was answered by most candidates who had answered part **(i)** correctly. Those candidates who had made mistakes in part **(i)** were still able to gain full marks by multiplying their previous answer by 8400 in this part.

Answers: **(a)** 86.3 **(b)** 090 **(c)(i)** 71.8 **(c)(ii)** 108.2 or 108
(d)(i) 1107 **(d)(ii)** 9 298 800

Question 9

Candidates attempted most parts of this question. Weaker candidates found the ratio part difficult and many candidates were confused with the way part **(d)(ii)** was worded. Most candidates showed the ability to calculate a percentage of an amount.

(a) The best candidates answered this ratio question well, however less able candidates did not divide by 7, dividing by 2 or 5 instead. A large number of candidates chose not to use their calculator for this part of the question and therefore commonly made arithmetic mistakes.

(b) This question not attempted by a large proportion of the candidates. Those that did make an attempt were able to calculate the correct increase of 1800 over 3 years. However a substantial proportion then did not add this on to the original amount so only gained one of the three marks available. Again candidates should be encouraged to reread the question once they have found their answer to check they have answered the question set. A small number of candidates calculated compound interest instead of simple interest.

(c) Most candidates who attempted this question showed understanding of percentages and how to calculate a percentage of an amount. The most common incorrect method was to divide by 14.

(d) (i) Candidates generally found this question straight forward with the majority of correct a without any working out. However a number of weaker candidates could not follow th structure and forgot to add the 600 at the end.

(ii) This part proved more difficult to the candidates with a large proportion misreading the sente given. Many candidates read it as 100 + 4 for every 10km, hence calculating 104 x 3200, instead of the required calculation of 100 + (4 x 3200). Again many candidates gave an answer only with no working out, which could have gained some method marks if shown. Candidates need to be encouraged to show all their calculations and working out.

Answers: **(a)** 31 200 **(b)** 16 800 **(c)** 63 **(d)(i)** 11 800 **(d)(ii)** 12 900

Question 10

Candidates found this question challenging, especially the calculation of the gradient and forming the equation of the straight line in the form *y*=m*x*+c. Candidates were more confident calculating the missing values in the table but many did not plot the points on the graph.

(a) (i) Candidates who attempted this part answered it well with the majority of candidates correctly calculating 2 of the 3 missing values. Candidates found calculating the value for *x*=–2 most difficult with *y*=–6 being a common mistake, from $–(2)^2$ instead of $(–2)^2$.

(ii) Over one third of the candidates did not attempt this part despite filling in the table in part **(i)**. Those that did generally plotted their coordinates correctly but a large proportion did not then join them up with a curve. The curves that were drawn were of varying quality. Many incorrectly joined them with straight lines or used very thick feathered lines. A large number had 'flat bottoms'. Candidates need to be reminded what the requirements of a smooth curve are.

(iii) The line *y*=10 was drawn well by those that attempted it. Again, one third of the candidates did not attempt this part. A large number of candidates still continue to draw straight line graphs free hand without a ruler and so lost a mark which they could have earned.

(iv) This part of the question was the least attempted question on the whole paper, due to the few candidates who completed parts **(ii)** and **(iii)**.

(b) (i) Many candidates did not know the difference between gradient and *y*-intercept in an equation of the form *y*=m*x*+c. A large proportion of candidates gave the answer of –5 instead of 2/3.

(ii) Candidates who had been unable to answer part **(i)** found this part equally as difficult and many did not give a response. A number of good candidates who had shown understanding of gradient in part **(i)** missed out on a mark in this part as they omitted the *y*= in their answer.

(c) The question on calculating the gradient remains challenging for many candidates. Very few candidates used coordinates and the formula for the gradient between two points and most candidates used a triangle or simply spotted the correct gradient. Those candidates who found a gradient went on to give the correct equation, however some weaker candidates did gain a mark for identifying the *y*-intercept and used it correctly in an equation of the correct form. A large proportion of candidates however did not know how to start this question and gave no response.

Answers: **(a)(i)** 2, 2, 12 **(a)(iv)** 2.6 – 2.8 **(b)(i)** $\frac{2}{3}$ **(b)(ii)** $y = \frac{2}{3}x + c$ **(c)** $2x – 3$

Question 11

This question was challenging for all candidates, however most were able to gain some marks. Knowledge of the area of a circle was required, which some candidates mixed up with the formula for the circumference of a circle, and the ability to apply this to a problem. Some excellent solutions and working was seen from some candidates, however a large number of candidates did not show their workings and lost out on potential method marks.

(a) Most candidates attempted to calculate the area of the circle. A number of candidates used the formula for the circumference instead of the area and some used 6 instead of 3 in the correct formula. However the majority of candidates were able to gain some marks on this q... use of 3.14 was seen on a number of occasions and candidates should be reminded tha... use the π button on their calculators or 3.142.

(b) Some excellent methods and solutions were given to this question. Most candidates were able... gain some marks for the area of 6 circles or the area of the rectangle and most showed their methods clearly. However a number of candidates did not show a method and gave an incorrect answer so lost out on a potential three method marks. Candidates should be encouraged to show their workings throughout the paper. A small number of candidates chose to show their working out arithmetically instead of using a calculator which generally led to errors and therefore not gaining full marks.

Answers: **(a)** 113 **(b)** 185

MATHEMATICS (US)

Paper 0444/41
Paper 4

General comments

Whilst many scripts were well presented, some showed a lack of working, with presentation of work that was often haphazard and difficult to follow. making it difficult to award method marks when the answer was incorrect. It was not uncommon to see all working scribbled out once a solution was found. This made it difficult to award method marks when the final answer was incorrect.

As a general point, some candidates are working in pencil and then overwriting in pen. This makes the responses difficult to read, and may not be the best use of the candidates' time.

There was no evidence to suggest that candidates were short of time on this paper although weaker candidates made no attempt at some questions.

Comments on specific questions

Question 1

(a) It was common to see the centre omitted and when given it was usually quoted as the origin. If an incorrect transformation was given it was usually stretch or shear.

(b) (i) Many candidates coped well with this part of the question on transformations and earned both marks. Common errors included the wrong translation $\begin{pmatrix} 4 \\ 5 \end{pmatrix}$ or a slip in one of the two components.

(ii) Candidates fared slightly better with this reflection. Common errors included reflection in a vertical line other than $x = 2$, quite often the y-axis and sometimes the line $y = 2$.

(iii) Although more able candidates earned both marks, many of the rest struggled to rotate the shape. In many cases the shape was simply reflected (about a variety of lines) or simply translated.

Answers: **(a)** Enlargement, (–3, 4), factor 3 **(b)** **(i)** Image at (1,5), (4,5), (4,6), (1,7)

(ii) Image at (5,1), (8,1), (8,3), (5,2) **(iii)** Image at (–4,3), (–4,5), (–7,5), (–7,4)

Question 2

In more than one part of this question on time and measures the working shown was often insufficient to gain credit, as the operators of arithmetic were often left out and replaced by tables or ratios. In 'show that' questions it is essential that candidates clearly show the steps required to obtain the answer.

(a) (i) A large majority gave the correct time. A few added on 27 minutes to the starting time to obtain 07 75 but then failed to convert to the correct time.

(ii) A majority earned both marks by showing a calculation to find the walking speed. Some struggled with the units and got no further than 1.8 ÷ 27.

(b) (i) The combination of this question and part **(ii)** caused a lot of confusion for candidates. A significant number had working reversed in the two parts. A minority obtained the correct answer. Some picked up a mark for a partial method or for calculating the cycling speed as a percentage of the walking speed, ignoring the increase. Another common error was calculating as a percentage of the wrong speed.

(ii) Candidates were least successful on this part of the question. Some had correct meth the final mark because of inaccurate answers. A significant number picked up a calculating the cycling time as a percentage of the walking time, ignoring any decrease.

(iii) Many correct answers were seen. Apart from the occasional rounding error by approximating 10 ÷ 36 the most common error was 0.36 × 9.

Answers: **(a)(i)** 08 15 **(ii)** $\frac{1.8}{27} \times 60$ **(b)(i)** 275 **(ii)** 73.3 **(iii)** 25

Question 3

(a) The large majority of candidates earned all three marks in this part question on substituting values into a function. Any loss of marks resulted from giving 0.3 in the table and from slips with one or more values.

(b) Most candidates were able to pick up some marks on this question. Plotting points caused the most difficulty, especially for the exponential curve. Although a large majority attempted a curve, too many used line segments throughout or between the extreme points.

(c) (i) About half of candidates obtained an answer within an acceptable range. The most common mistake was calculating f(0) = 3.

(ii) A similar comment to **(i)** with some candidates attempting to calculate g(4) and with others giving answers outside of an acceptable range.

(iii) A similar comment to the two previous parts although candidates fared less well on this part.

(d) The quality of the tangents was generally poor, sometimes with gaps between the tangent and curve, sometimes crossing over the curve, often at points other than $x = 0.5$ and sometimes applied to the wrong curve. Some candidates with a correct tangent showed no working for the tangent and possibly lost a method mark when their gradient was incorrect. Candidates would be well advised to show the coordinates of the points they are using to find the gradient.

Answers: **(a)** 3, 0.33, 1 **(c)(i)** $1.2 < x < 4$ **(ii)** $1.2 < x < 1.35$ **(iii)** $0.55 < x < 0.7$ **(d)** $-2.5 < x < -1.5$

Question 4

This question on cumulative frequency was generally well answered. In **(a)**, the most common error involved misreading of the scale. Many candidates did not mark up their graphs when attempting to read off values.

(a) (i) A large majority earned this mark.

(ii) Candidates were slightly less successful in this part.

(ii) A small majority earned this mark.

(iv) A large majority earned this mark. Common errors included giving the number of candidates with estimates of 7g or more.

(b) (i) Many candidates completed the table correctly. There were occasional slips with the arithmetic but the most common error was giving the cumulative frequencies.

(ii) This proved more of a challenge and discriminated between the candidates as less able candidates struggled to obtain a frequency from the given probability. Some obtained a frequency of 60 but failed to realise that 60 candidates estimated greater than *M*. Consequently 2.4 was a common wrong answer.

Answers: **(a)(i)** 3.2 **(ii)** 4.2 **(iii)** 4.6 **(iv)** 196 **(b)(i)** 100, 46, 12 **(ii)** 4

Question 5

(a) The hint in this data handling question helped many to make progress and a majority were obtain the correct mean. Common errors included the mean of the mid-interval values occasionally a division of a correct total by 4.

(b) A majority obtained the correct interval but $165 < h \le 180$ and occasionally $150 < h \le 160$ were the common errors.

(c) Most attempts involved bars with the correct widths. The last bar was usually correct as candidates often used the scale as frequency for the bars.

Answers: **(a)** 171.25 **(b)** $160 \le h \le 165$ **(c)** Blocks with heights 1.8, 1.2, 1 and correct widths

Question 6

This question on probability challenged most candidates.

(a) The information given in the equation generated a lot of confusion amongst candidates. Weaker candidates attempted to solve the problem using trial and improvement, sometimes successfully. For those that attempted to write two equations, W + R = 114.5 and R = 2.5W were common errors. Those that obtained two simultaneous equations were able to eliminate one variable and earn some credit. Equations in one variable were very rare.

(b) (i) Fraction work proved a challenge to many, even with a calculator. Candidates obtained the correct individual probabilities but often omitted the arithmetic operation, making it difficult to award marks when the answer was incorrect.

(ii) The symmetry of the "one white and one red" selection was missed by candidates, even those that had the first part correct. The reverse combination rarely appeared and $\frac{35}{132}$ was a common answer. Incorrect denominators were common, often 142 and 121.

Answers: **(a)** W = 8.5, R = 11 **(b)(i)** $\frac{42}{132}$ **(ii)** $\frac{70}{132}$

Question 7

(a) Almost all candidates attempted this question on trigonometry with the majority obtaining all three marks. A few obtained an implicit statement for BC but were unable to rearrange this into an explicit form. The majority of the rest often used incorrect trigonometry and in some cases Pythagoras.

(b) A majority were able to make a good start but lost out on the final mark by failing to obtain the answer (48.573) that rounded to 48.57. Most of these just gave the given answer. Some attempted to use the answer to show that terms in the sine rule were equal but this could not earn full marks. Many of the rest failed to make any progress either by using incorrect trigonometry or Pythagoras.

(c) (i) Although many candidates gained both marks, almost as many lost marks by rounding prematurely and not obtaining an answer that rounded to 40.6.

(ii) Stronger candidates were able to apply the cosine rule correctly. A few lost the final accuracy mark by rounding numbers prematurely. Of the rest many struggled with the method, evaluating the terms out of sequence and often treating the triangle as right angled and so the use of Pythagoras and simple trigonometry were common.

(d) Another question that proved to be a good a discriminator of the candidates. Many simply made no attempt but for others there were errors in applying the area formula. Some preferred to use ½bh but rarely showed any method for calculation of the perpendicular heights. In most cases no marks could be awarded for an incorrect answer as the method was incomplete.

Answers: **(a)** 31.4 **(b)** working and 48.573 **(c)(i)** working and 40.57
(ii) 15.3 or 15.27 to 15.28 **(d)** 466 or 466.34 to 466.5

Question 8

This question on angles proved challenging with only the strongest candidates scoring well.

(a) (i) Surprisingly, a large minority of candidates did not know that the sum of the angles in a pentagon was 540, nor did they show any attempts to work it out. Most used 360 as the total. Those that knew of 540 usually obtained the correct answer.

(ii) Candidates were more familiar with angles in an isosceles triangle and a majority were able to earn this mark, either for the correct answer of for a correct follow through from their wrong answer.

(iii) Candidates were less successful than in previous parts. Many did not earn the follow through mark as answers were often greater than 84

(b) This proved to be the most challenging question on the paper with correct answers very rare. This was evidenced by the high number of candidates making no attempt at all. In the vast majority of cases there was no reference to any of the circle theorems. Common misconceptions included that opposite angles of quadrilateral OABC add to 360, or add to 180 or are equal. Something a little closer to the correct approach was to give $3y = 2(4y + 4)$. Those that appreciated that the reflex angle at O was the angle at the centre generally went on to obtain a correct answer. A small number of candidates drew an angle in the opposite segment and used opposite angles in a cyclic quadrilateral successfully.

(c) (i) It was common to see references to angles adding to 180, sometimes related to a triangle, sometimes a line, but it was rare to see a mention of opposite angles. Many candidates made no attempt.

(ii) Many candidates were able to obtain a value of 168 using the ratio. That said, there were a significant number of candidates who simply made both parts 51°. Most then struggled to see the connection between angle PQS and angle PRS and in many cases PQS was given as 78°. Again many candidates made no attempt.

(d) Although many candidates attempted this part on areas of similar shapes, many of them simply worked with linear scale factors, giving 4.79 as the most common answer. Some appreciated the need for different factors but then cubed the volume factor to obtain a 'linear factor'.

Answers: **(a)(i)** 118 **(ii)** 31 **(iii)** 22 **(b)** 32 **(c)(i)** opposite angles add to 180 **(ii)** 68 **(d)** 5.75

Question 9

(a) Almost all of the stronger candidates earned all four marks in this question on functions. Less able candidates tended to make more errors with the substitution or the presentation of their formula. Commonly $-b$ was written separately from the rest of the formula. Some were able to recover. Slips with the arithmetic led to some obtaining incorrect solutions and in other cases solutions were not given to the required degree of accuracy.

(b) A minority earned all three marks for finding p, q and r. Others picked up one or two marks for a correct substitution or for a correct expansion of the square term. A common error involved attempts to simplify $p(2x + 7)^2 + q(2x + 7) + r$ or $f(x).g(x)$. A significant number made no attempt.

(c) Candidates generally were more successful finding the inverse function and many earned both marks. Common errors included leaving answers in terms of y, or slipping up with the rearrangement following a correct start.

(d) A majority were able to find the correct value of x. The most common error was to calculate h(2).

(e) All levels of ability found this a more challenging end to the question and many weak struggled to make any progress. Some candidates laid out calculations step by step usually successful. Others were confused by the order of operations and answers base 8^{27} were seen. Others worked on $2^3 = 8$ then cubed 8 followed by the cube of 512. A sign number made no attempt to correct their answer to four significant figures.

(f) This was found to be challenging by all candidates and as such it was rare to see a completely correct solution. Many solutions involved reflections or translations. Many made no attempt at all

Answers: **(a)** –2.30 and 1.30 **(b)** 4, 30, 53 **(c)** $\frac{x-7}{2}$ **(d)** –2 **(e)** 1.158×10^{77}
(f) Stretch, *x*-axis invariant, factor 2

Question 10

(a) This question on number patterns and sequences was well answered by most candidates. Some candidates were caught out by the jump from Star 5 to Star 7 and '60, 61' was often seen. A majority were able to find the algebraic expressions but weaker candidates experienced more difficulty with answers such n and $10 + n$.

(b) (i) A large majority of candidates were able to find the correct number of dots with the occasional arithmetic slip for some others.

(ii) Most of the more able candidates could obtain the correct formula. However, weaker candidates struggled, tending to give numerical values for the number of dots. Other candidates started off correctly but often made slips with the simplification.

(iii) A similar comment to that of part **(ii)**, although overall candidates were slightly less successful.

(c) (i) Candidates fared better on this part and many earned both marks. A number of candidates evaluated the given expression but then did not show the number of dots to be correct by using an alternative approach.

(ii) Yet again, most candidates were able to calculate the correct number of dots.

(d) A good discriminator of candidates. It was nice to see some well laid out solutions starting from $5n^2 + 6n + 10(n + 1) + 1$ and working through appropriate steps to reach $5(n + 1)^2 + 6(n + 1)$. Unfortunately they were given by a minority of candidates. Others attempted to work from both ends and work towards the middle but this required the separate expressions equated or linked with a conclusion for full marks. Some others picked up one or two marks for working towards a solution. Re-arrangement of the terms seemed beyond all but the most able. Many weaker candidates gave no response at all.

Answers: **(a)** 50, 70 $10n$, 51, 71, $10n + 1$ **(b)(i)** 212 **(ii)** $20n + 12$ **(iii)** $20n + 152$
(c)(i) $5 \times 32 + 6 \times 3 = 63$, $11 + 21 + 31 = 63$ **(ii)** 560

Question 11

This question on algebra and trigonometry challenged most candidates. Many struggled to make a start on this part of the question. Many calculated the angles but in general this did not help. Some replaced the sine value by a decimal, usually rounded, which allowed the candidates to pick up some early marks while losing out on the accuracy mark. Many of the rest went straight to Pythagoras which allowed them to pick up some marks if correctly applied. Many introduced a second variable by using the sine formula or used x for the length of BC which spoiled their equations. A third starting point was to use 9 and 16 as the sides, especially the weaker candidates, and this allowed them to pick up one mark if used correctly.

Answer: 6.61