MATHEMATICS (US)

Paper 0444/11
Paper 1

Key Messages

To succeed in this paper candidates need to have completed full syllabus coverage, apply correct methods, remember all necessary formulae, show all necessary working clearly and use a suitable level of accuracy.

General comments

Candidates must check their work for sense and accuracy as it was very noticeable that there were many calculation errors that lost candidates marks. Candidates must show all working to enable method marks to be awarded. This is vital in 2-step problems, in particular with algebra where each step should be shown separately to maximise the chance of gaining marks, for example in **Questions 6**, **16**, **19** and **22**. This will also help candidates check their own work.

The questions that presented least difficulty were **Questions 1**, **3**, **6**, **13(b)**, **15(b)**, and **18(a)(i)**. Those that proved to be the most challenging were **Questions 4**, **5**, **9**, **11** and **22(b)**. This list includes questions on number, algebra and functions.

Comments on specific questions

Question 1

Most candidates gave the correct answer to this question which was expected to be a straightforward start to the paper. Occasionally, candidates gave answers that were not fully simplified, for example, the expression, 10 – 6. A number of candidates gave the incorrect response of 14 from (10 – 3) × 2 showing that the order of operations was not well understood.

Answer: 4

Question 2

The majority of candidates showed understanding of prime numbers. Some did not appear to have read the question carefully and gave examples that were outside the given range or included 21, 25 or 27. A small number wrote out the prime factors of 20 and or 30.

Answer: 23 29

Question 3

In **part (a)**, the most common errors were arithmetic rather than misunderstanding that angles around a point add to 360. Occasionally, the answer to **part (b)** was given as ‘acute’.

Answers: **(a)** 138 **(b)** obtuse

Question 4

This question caused significant difficulty for many candidates. There were two sources of confusi... first was the actual understanding of the number, which was commonly misunderstood to be 65... 5006000. There was even more confusion over the form it should take. In **part (a)**, a lot of candidates t... to use standard form or wrote 506 k or wrote their answer in words. For **part (b)**, forms other than standard form were seem. For those that did attempt standard form, common incorrect answers included 5.06×10^3, 5.06×10^6 and 506×10^3. It was possible for candidates to score a follow through mark in **part (b)** if their answer to **part (a)** was correctly written in standard form.

Answers: **(a)** 506 000 **(b)** 5.06×10^5

Question 5

Very few candidates were able to round all three of the numbers to one significant figure. Many attempts to round included numbers with 1 or more decimal places. Most candidates that did correctly round the numbers in the numerator, rounded the denominator to 17 instead of 20. The result of inappropriate rounding was that the majority of candidates were left with an extremely difficult calculation to do in **part (b)** but this did not cause them to reconsider their figures in **part (a)**.

Answers: **(a)** $\frac{5 \times 2}{20}$ **(b)** 0.5 or $\frac{1}{2}$

Question 6

Whilst many candidates arrived at the correct solution, few showed a correct algebraic method. The first step proved problematic for many. A common error was to start by adding 8 to 11. Those candidates who did start with the division by 2 often resulted in inappropriate multiplication, with $2n - 16 = 11$ and $2n - 16 = 22$ being seen quite frequently. It was difficult to award a method mark to those who did not produce the correct answer as working was often illogical, missed out steps or included many re-starts.

Answer: 30

Question 7

The most common errors were to omit the –4 or include the 3, but generally candidates seemed to understand what was required. Occasionally, the zero was missed out, maybe from a misunderstanding of the definition of an integer.

Answer: –4, –3, –2, –1, 0, 1, 2

Question 8

Most candidates gave a common factor rather than a common multiple of the given numbers. Many showed prime factorisation, but seemed unclear how to use this in order to arrive at the least common multiple.

Answer: 120

Question 9

Only a minority of candidates were able to answer this correctly. The conversion of the units proved problematic for many. The majority of candidates seemed not to realise that any conversion was required, giving answers such as $35n + 6s$.

Answer: $35n + 60s$

Question 10

Many candidates were able to substitute for *x* and *y* but handling the double negative signs cause problems. After this, candidates still had to combine the fractions and give the answer in the form aske

Answers: **(a)** $\frac{1}{4}$

Question 11

This was by far the question that caused candidates the most problems. Candidates may understand what a discrete domain or range for a function mean but would benefit from seeing more examples of where discrete values are seen in context, for example, the number of children in a family or shoe size. A number of candidates identified that there was a problem with the domain, but did not give any detail as to what this problem might be, making statements such as 'the domain is wrong'. Answers that contained an explanation in context such as, 'Julie must buy whole bottles not part bottles of cleaner', gained the mark. The majority of responses focused on Julie not knowing how much carpet she was cleaning or how much cleaner was required. Responses suggesting that incorrect inequality symbols had been used in the domain were quite common. A number of candidates ignored the instruction to explain why Julie is not correct and instead asserted that the function was in fact completely correct.

Answer: Domain should be discrete not continuous

Question 12

This was a twist on the standard volume question which many handled very well. However, many calculated 8×15 but then did not divide the volume by this value. Those who did not get to the answer usually used completely incorrect methods, for example, methods that involved subtraction or the use of Pythagoras' theorem. Many candidates used trial and error and these were generally unsuccessful.

Answer: 6

Question 13

Many candidates appeared to misinterpret the scatter graph as showing a time series. The answers 'decreasing' or 'temperature and rainfall' were seen frequently in **part (a)**. There were some very good answers to **part (b)**, but some candidates struggled to describe the relationship between the temperature and the rainfall. Answers that implied a change over time were very common. A few said 'the numbers were going up by 5' but this might be a comment on the scales used.

Answers: **(a)** negative **(b)** More rain suggests lower temperature

Question 14

The majority of candidates found this question challenging. The simplest approach was to read the graph at 24 miles and then multiply the number of kilometres by 3 to find the speed. The alternative approach was to find the number of miles travelled in one hour and then to use the graph to convert to the number of kilometres. The problem with this approach was that 72 miles does not appear on the graph so there is an extra layer of problem solving. Some candidates did read the graph to find 38 kilometres but then were unsure what to do next. A small number of candidates ignored the graph and used the approximation that 1 mile is 1.6 kilometres so 24 miles is 38.4 km and then multiplied by 3.

Answer: 114 to 117

Question 15

In **part (a)(i)** most candidates could identify the maximum and minimum temperatures but then either did not know how to handle the negative signs, producing an answer of 6.5, or made calculation errors. A wide variety of answers were seen in **part (a)(ii)** with June being the most common but numerical answers were also seen. **Part (b)** proved to be the most accessible part of this question as many correct solutions were seen. The answers $\frac{1}{12}$ and $\frac{7}{5}$ were the most common incorrect attempts at writing the probability.

Answers: **(a)(i)** 40.3 **(ii)** August **(b)** $\frac{7}{12}$

Question 16

Most were able to start this correctly by multiplying 1.5 and 80 and so gained a mark, although many errors in this calculation, often with place value or when multiplying a digit by 0. The majority went on subtract 88, but most then multiplied by 1.6. Those who attempted a division often confused the order, attempting 1.6 ÷ 32 as their final step.

Answer: 20

Question 17

This was answered well by many candidates. However although some candidates showed calculations, most didn't associate their results with any of the angles on the diagram and consequently relatively few candidates gained the method mark for partially correct attempts at this question. Calculation errors were quite common. A follow through mark was available in **part (b)** if both answers totalled 127.

Answers: **(a)** 74 **(b)** 53

Question 18

Although there were many good answers seen, the incorrect answers showed misunderstandings of the rules of indices. In **part (c)**, incorrect answers of 9 or h^4 were common.

Answers: **(a)(i)** p^{10} **(ii)** f^3 **(b)** 4

Question 19

Candidates who attempted elimination methods were usually able to make some progress and often reached a solution although there was very little evidence of checking their answers. The most common errors involved not multiplying all of the given terms correctly. Many candidates attempted substitution methods that were rarely successful. Some candidates did not know how to start and made various attempts at manipulation of the equations. A few tried guessing one value and using this to calculate the other.

Answer: (x =) –1 (y =) 2

Question 20

In **part (a)**, some candidates had problems dealing with the whole number part of the mixed numbers. Other candidates seemed able to deal with the issue of a common denominator but there were calculation errors evident in the numerators. Candidates were more successful with **part (b)** as many candidates knew how to start by inverting the second fraction. Many then multiplied the fractions and then simplified their answer when it was more straightforward to cancel first.

Answers: **(a)** $\frac{23}{40}$ **(b)** $1\frac{12}{23}$ **or** $\frac{35}{23}$

Question 21

Finding the number of hours for each day proved challenging for many as 19 and 12 were seen frequently. Those who reached the answers 18 and 11 usually went on to arrive at a correct answer for **part (a)(i)**. A few candidates assumed the bus company was open for the same amount of time every day. In the next part, the most common error was to omit the pm.
Many candidates showed little working in **part (b),** some giving answers that did not make sense within the context of the question, such as 2 days 63 hours.

Answers: **(a)(i)** 119 **(ii)** 1 pm **(b)** 2 (days) 15 (hours)

Question 22

Most candidates knew what to do for **part (a)** but the signs caused difficulties. Most candidates wer multiply out the brackets correctly. Any problems were associated with dealing with the signs to simpl expression. Many arrived at the correct x term, but made errors with signs that resulted in an incorre term. Incorrect answers often included $29x$ or $+3y$. **Part (b)** was more challenging as many candidates were uncertain what was required. Some identified one factor but were unable to express their final answer correctly.

Answers: **(a)** $x - 13y$ **(b)** $5y(2xy + 3)$

MATHEMATICS (US)

Paper 0444/21
Paper 2

Key message

To succeed in this paper candidates need to have completed full syllabus coverage, apply correct methods, remember all necessary formulae, show all necessary working clearly and use a suitable level of accuracy.

General comments

The candidates' knowledge of some mathematical processes was very good but their competence in others was poor. In number work there is still a confusion of when to multiply and when to divide. Some candidates find it difficult to use and simplify surds and, although the rules of indices are known, candidates find it difficult to apply them with fractional indices. In algebra many could not expand a single bracket by a single multiplier outside. In rearranging equations there is a tendency to expand brackets which is often unnecessary. In finding angles the higher rules for a circle are often known and correctly applied but the lower skills of identifying an isosceles triangle are not.

Comments on particular questions

Question 1

Many correctly found the square root of $\frac{9}{16}$ as $\frac{3}{4}$ but then they tried to find the square root of $\frac{3}{4}$. Others thought that 2^{-1} was -2.

Answer: $1\frac{1}{4}$

Question 2

Some candidates could not square 0.1 and often came up with 0.1 as the answer. The attempts at 0.1 ÷ 2 were better but still many gave 0.5 rather than 0.05.

Answers: 0.06

Question 3

Some candidates added the 8 first and thus made an error in the order of the operations whilst others subtracted 8 after multiplying by 2.

Answer: 30

Question 4

The demand for this question in **part (a)** asked that the three numbers be written to 1 significant figure and many did not do this. The numerator was often correct with 5 and 2 seen but the denominator was more often 17 or even 20.0 rather than the 20 required. Thus in **part (b)** many were unable to get the desired result of 0.5 which is the correct estimate.

Answer: **(a)** $\frac{5\times 2}{20}$ **(b)** 0.5

Question 5

In **part (a)** some candidates did not know what the square root of 2 squared was even after writing but not being able to simplify it. In **part (b)** many tried to reduce the two square roots to roots of 2 or 3 than to the root of 6.

Answer: **(a)** 18 **(b)** $5\sqrt{6}$

Question 6

The usual method was to correctly multiply 80 by 1.50 and most achieved 120. Many would then subtract 88 from 120 and 42 as well as 32 were the usual results. In the next step candidates tended to multiply their 32 by 1.6 rather than divide. Those who divided encountered problems with division by 1.6 and few adjusted the two numbers to ensure that the divisor was a whole number.

Answer: 20

Question 7

A common error was to try to multiply out the brackets as this creates two terms in x. Those who started correctly with $y - 6 = (x - 4)^2$ would then often take the square root correctly but then they would add 4 to the -6 and not to the root itself.

Answers: $4 \pm \sqrt{y-6}$

Question 8

Many knew to multiply the top and bottom of each fraction by the same expression and cross multiplying was a common method seen. However in the numerator, $2(x + 1)$ was often expanded as $2x + 1$ and not $2x + 2$. It was quite common to see the 2 in the numerator and the 2 in the denominator wrongly cancelled.

Answer: $\frac{2}{x(x+1)}$

Question 9

Part (a) was usually correctly answered; sometimes the time intervals were wrongly calculated by counting the ends as well so 19 and 12 were seen. Also 6 × 18 was sometimes calculated incorrectly. In **part (b)** most gave the answer of 1 00 but many omitted the pm.

Answers: **(a)** 119 **(b)** 1 pm

Question 10

Part (a) was answered quite well though many left their expressions only partly factorised and gave $a(x + y) + b(x + y)$ as their final answer. However in **part (b)** fewer candidates knew how to factorise this expression. It was usual to see a quadratic as the answer and often it was the correct one, $3x^2 - 5x + 2$. The question asks for this expression to be factorised which some did manage to achieve successfully.

Answer: **(a)** $(a + b)(x + y)$ **(b)** $(x - 1)(3x - 2)$

Question 11

Some candidates considered the possibility of bag *A* with the probability $\frac{1}{4} \times \frac{2}{6}$ but few drew a tree diagram or correctly considered the possibility of a white bead from bag *B*. Some candidates just added $\frac{1}{6}$ and $\frac{2}{6}$ to get $\frac{1}{2}$.

Answer: $\frac{5}{24}$

Question 12

In **part (a)** 20×10^9 was seen but then this was written as the answer even though it was not in form. Other errors generally were from the multiplication of the indices to give 10^{20}. In **part (b)** many the fraction upside down and hence answers of 8 or equivalent were seen. Many others reached 0.125 or 8 but could not write their answer in standard form. A common answer was 125×10^{-3}.

Answers: **(a)** 2×10^{10} **(b)** 1.25×10^{-1}

Question 13

It was clear that some candidates did not understand the angle notation and gave the answer in **part (a)** of 116°, angle *AOC*. Some having correctly written 116 in the correct place in the diagram did not realise that the triangle *OAC* is isosceles and therefore they were unable to complete the solution. In **part (b)** fewer knew that the angles *CDA* and *CBA* added together to give 180°. Some thought that angle *CDA* was 116° and proceeded from there to 41°.

Answer: **(a)** 32 **(b)** 35

Question 14

Few candidates found the middle point of *AB* possibly because they did not know the meaning of the word ‘bisector’. So those who knew the equation of the line was of the form $y = \frac{2}{3}x + k$ were therefore unable to find the correct value of *k*. They often used the co-ordinates of *A* or *B*. Other candidates assumed they had to use the rule $m_1 \times m_2 = -1$ to obtain the gradient of the line which they found to be $-1\frac{1}{2}$ - this was the gradient of line *AB* however.

Answer: $y = \frac{2}{3}x - 2$

Question 15

An initial error seen was writing $5(x + 1)$ as $5x + 1$. However, generally the rearrangement of their expressions was correct more often than not even though some had equal signs rather than inequalities. A common answer was $x < 4$ and then some included 4 in their solution set. However many left their answer as an inequality and did not answer the question asked.

Answers: 1, 2, 3

Question 16

In **part (a)** many found the square root of 2^{24} to be 2^{12} but then they tried to find the fourth root of 2^{12} and were unable to do so. In **part (b)** many reached the stage of showing $\frac{2q^2}{q^{\frac{1}{2}}}$ but were unable to combine the powers of q using a rule of indices.

Answers: **(a)** 8 **(b)** $2q^{\frac{3}{2}}$

Question 17

In **part (a)** candidates often used 120 in their working and argument, despite the question asking that the angle of 120 needed to be shown. Generally in questions like this candidates need to find the value requested by using the other values in the problem. In **part (b)** they couldn’t use the fact that the angle for Hong Kong is 180 – 150 because they are not told that these two angles form a straight line; they have to show this first. The correct method should have found the angle for Singapore and Hong Kong combined by using the other values and then applying the ratio given.

Answer: **(b)** 6

Question 18

In **part (a)** it was a common approach to work out both volumes using the values given and then them and show that one is $\frac{1}{8}$ of the other one. This is not the correct method because they are using values they are trying to demonstrate. The correct method which few were able to use, takes the volume scale factor of $\frac{1}{8}$ and finds the length scale factor which is the cube root of this and hence it is $\frac{1}{2}$. In **part (b)** the correct method was to find the two volumes and subtract them. Many thought that the remaining solid was a cone and they used the formula with height of 6cm.

Answers: **(b)** 56

Question 19

The main problem for candidates with this question was that most did not know the surd form of sine and cosine for angles 30° and 60°. Thus they found it difficult to find the lengths *BC* and *DC* and could only find the arc length *DB*. Some candidates found it difficult to simplify the expression even when they wrote it down correctly.

Answers: $12 - 4\sqrt{3} + \frac{4}{3}\pi$

MATHEMATICS (US)

Paper 0444/31
Paper 3

Key Messages

To succeed in this paper candidates need to have completed full syllabus coverage, remember necessary formula, show all working clearly and use a suitable level of accuracy.

General Comments

This paper gave all candidates an opportunity to demonstrate their knowledge and application of mathematics. The vast majority of candidates were able to complete the paper in the allotted time, and most were able to make an attempt at all questions. Few candidates omitted part or whole questions. The standard of presentation was generally good. 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. This was made clear when candidates were asked to show a solution, part of a ratio, mean of a group of data and interpreting a pie chart. These questions asked candidates to show why a value was true and more successful candidates gave thorough and accurate solutions. 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 number of candidates did not use a ruler to draw straight line graphs which is essential to gain full marks. Centres should continue to remind candidates that when correcting a solution they should re-write their answer rather than overwriting.

Comments on Specific Questions

Question 1

The first two parts of this sequence question were well answered. The parts involving algebra proved more challenging for candidates, particularly as the *n*th term was a negative.

(a) (i) The majority of candidates who attempted this question were able to gain full marks. Most candidates successfully identified the next two terms of the sequence and the best solutions followed this with a worded explanation of how to find the next term. The most common mistake was to attempt to give the rule as an *n*th term, e.g. $n-9$.

(ii) Again candidates were successful in identifying the next 2 terms of the sequence but as in part **(i)** found writing the rule more difficult. Candidates who wrote a worded answer were generally correct. However again those that attempted to give the *n*th term lost this mark, e.g. $3n$, nx3 etc.

(b) (i) Finding the *n*th term for the sequence proved to be the most difficult part of this question. Very few candidates correctly identified $-9n$, because the sequence decreased by 9, with a common mistake being $9n+75$. The most common wrong answer was $n-9$, where candidates had used the term to term rule instead of the *n*th term.

(ii) Many candidates were able to gain full marks despite getting part **(i)** wrong. Most successful candidates subtracted 9 repeatedly to arrive at the 21st term of -96. This was done very accurately by the majority who attempted this method. Some however subtracted nine 21 times from 84 and reached a common wrong answer of -105. A number of follow through marks were awarded for candidates correctly substituting into their *n*th term in part **(i).**

Answers: **(a)(i)** 48, 39, subtract 9 **(a)(ii)** 162, 486, multiply by 3 **(b)(i)** $93 - 9n$ **(b)(ii)** -96

Question 2

This question tested candidates understanding of transformations. Successful candidates were accurately reflect, rotate and enlarge a shape and to describe fully a transformation. Candidates we required to calculate the area of a parallelogram.

(a) (i) Most candidates attempted this question with the correct answer of 'parallelogram' seen often. A very common answer was 'quadrilateral'. Although not wrong this was not a specific enough description of the shape as the type of quadrilateral was required. Common other incorrect answers were trapezoid and rhombus.

(ii) Most candidates attempted this question however there was clear confusion between lines of symmetry and rotational symmetry by many candidates. More able candidates gave the correct value of zero however less able candidates often gave 2 (or 4) as their answer, confusing rotation and reflection symmetry.

(b) Good solutions to this question were seen. A few more able candidates also identified the other possible transformation of 'rotation' through '180 degrees' with 'centre (1.5,0)'. Many candidates correctly gave the transformation as a translation but were unable to describe the vector correctly, often writing it as a co-ordinate or missing it out completely. Candidates need to be reminded what constitutes a fully described transformation; a translation must be accompanied with a column vector.

(c) (i) Candidates showed good understanding of reflection with the vast majority gaining full marks for reflecting the shape in the correct axis. Candidates should be reminded to draw their shapes with a ruler and pencil as many scribbled out pen drawings were seen and in some cases it proved difficult to identify the correct shape.

(ii) The rotation of shape *S* proved to be more challenging than the reflection although many candidates were able to gain one of the two marks for a correct rotation but from the wrong centre.

(d) The enlargement of shape *S* was the most challenging transformation with a large number of candidates not attempting this question. The best solutions used lines drawn from point *P* on the grid to the desired image, through shape *S*. A number of candidates correctly drew the enlarged shape *E* but had not taken into consideration the centre of enlargement *P* and drew it in the wrong position. The most common incorrect drawing was to have the correct base and height (6 and 4) but the corner at the top being only one square across from the bottom corner, instead of 2.

(e) (i) More able candidates used the formula for the area of a parallelogram to calculate the area by multiplying 3 and 2. Less able candidates often counted the squares but still achieved full marks with an answer of 6 cm². However many incorrect answers came from using the diagonal side of the parallelogram and multiplying 3 and 2.5 cm.

(ii) This question proved challenging as it relied on the candidate's correct drawing of the enlargement in part **(d)**, which many candidates had not answered or done incorrectly. Candidates who had gained marks in part **(d)** generally were able to identify the enlargement being 4 times the size of the original shape *S*. A few more able candidates who had not drawn an enlargement still gave the correct answer from an understanding of scale factors and area. Less able candidates however often missed this part out or gave the answer of 2, following a scale factor of 2.

(iii) Although parts **(e)(i)** and **(ii)** were written to assist candidates to answer part **(iii)** many did not use their previous two answers to help. Many candidates who had correct answers to parts **(i)** and **(ii)** chose not to attempt this question, with a very large proportion of candidates leaving this part blank. A follow through was available for candidates who had drawn their enlargement incorrectly but still found the correct area of their *E*, or candidates who multiplied parts **(i)** and **(ii)** together.

Answers: **(a)(i)** Parallelogram **(a)(ii)** 0 **(b)** Translation $\begin{pmatrix} 9 \\ -6 \end{pmatrix}$ **(e)(i)** 6 **(e)(ii)** 4 **(e)(iii)** 24

Question 3

This question gave candidates the chance to show their understanding of averages, mo percentages. Part **(c)(iii)** about percentage profit proved to be one of the most challenging questions o whole paper. Less able candidates however were able to gain marks calculating the mode, median, me and range in part **(a)**. An improvement in the number of candidates correctly identifying which calculation to use for each measure of average was seen this year.

(a) (i) The vast majority of candidates were able to identify the mode as 25. Only a very small number of candidates did not attempt this question.

(ii) Most candidates attempted this question and applied the correct method. However many candidates did not give the correct answer of 26, but left it as a range i.e. 34 – 8.

(iii) Nearly all candidates attempted this question in the correct manner. Good solutions had an ordered list of all 15 values and the middle value clearly identified. The most common mistake was to omit one value from the list and find the middle two values to be 19 and 21 and give the answer of 20. This however still gained the candidate one method mark.

(iv) Most candidates correctly showed that they understood how to calculate the mean by adding the values and dividing by 15. A small number of candidates made mistakes in adding the values but still gained a method mark by showing their addition and division by 15. 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.

(b) Most candidates made an attempt at this question with the best solutions using 0.96 x 800. Many candidates need to take more time to read the question as only calculating the 4% which was damaged (32) did not gain any marks. Candidates needed to calculate the number of tomatoes which are not damaged, as clearly shown in the question with the word 'not' in bold. Candidates should be reminded to reread the question once they have found their solution to check it has answered the question set. Another common incorrect answer was to use 4% as 0.4 instead of 0.04.

(c) (i) Most candidates made an attempt at this question with the majority able to gain a mark for the correct figures of 495 seen. Candidates who gave the best solutions recognised that 1 kg=1000g and divided their solution by 1000 or used the mean mass of 0.066 in their original calculation. The most common error was to use 1 kg=100g or 10g and to divide or multiply by 10 or 100. Many candidates did not convert, leaving their answer as 49500.

(ii) Candidates found this part difficult. Many candidates believed that they had to multiply the 750 by \$1.40 and gained an incorrect answer of \$1050. More able candidates understood that they had to use their previous answer, which was in kg, and multiply this by \$1.40 to find the answer. Candidates who had not gained full marks in part **(i)** often gained full marks in part **(ii)** as a follow through mark was available. Candidates again must be reminded to reread questions and check they have actually answered the question set with their solution.

(iii) A large proportion of candidates did not attempt this part. However there were some good solutions seen, with the more able candidates showing their working out in full. Many candidates were able to gain one mark for the first correct step, subtracting the cost of \$33 from their answer in part **(ii)**. However many candidates had very large values in part **(ii)**, such as 1050 or 69300, so when calculating the percentage profit many candidates answers were in the 1000's. The correct answer of 110% was rarely seen even from more able candidates, as answers over 100% are less often used. Candidates should be reminded that when calculating percentage profit they must divide by the original cost not the selling price.

Answers: **(a)(i)** 25 **(a)(ii)** 26 **(a)(iii)** 21 **(a)(iv)** 20 **(b)** 768 **(c)(i)** 49.5 **(c)(ii)** 69.3 **(c)(iii)** 110

Question 4

This question tested candidate's abilities to construct diagrams using compasses and a ruler. The of candidates used the correct equipment, however a number of candidates wrote on their script that th not have compasses. Centres should remind candidates of the equipment required for the exam.

(a) The best solutions showed the use of compasses to construct the remaining two sides of the farm boundary, with candidates leaving their construction arcs as instructed in the question. A significant number of correct positions for vertex *F* were seen but did not use compasses and were drawn using a ruler only. These only gained one of the two available marks.

(b) This was the best answered part of this question. Most candidates identified the shape to be a hexagon, even when they had not completed part **(i)** correctly or at all. A number of poor spellings were used which made the answer ambiguous, e.g. hectagon, which were not accepted as correct answers. The answer of 'polygon' was offered on a number of occasions which was not specific enough to gain the mark.

(c) (i) Most candidates showed some understanding of a perpendicular bisector with most candidates gaining one of the two available marks. The best solutions showed both sets of required arcs either side of the line *CD*, and joined with a straight line. However many candidates had drawn an accurate perpendicular bisector with only one set of arcs inside the hexagon, so only gained one mark. Candidates need to be reminded that they must show all construction arcs and the minimum number required to gain full marks on construction questions. It was evident that some candidates had drawn in their arcs freehand without a compass, after they had drawn their line, and in these cases could not gain full marks.

(ii) Candidates again showed they understood what an angle bisector should look like but lost marks because they did not show all the construction arcs. Good full solutions had two sets of arcs, one on the lines *AB* and *BC* and an intersecting pair inside the hexagon. Many candidates incorrectly used the points *A* and *C* because the lines *AB* and *BC* are not equal in length. Many candidates had a correct angle bisector drawn but only gained one of the two available marks because they only had one set of arcs or no arcs and had used a protractor. Candidates should be reminded that they must not use a protractor to construct an angle bisector.

(d) (i) Most candidates attempted this question with the best solutions made by candidates who were able to correctly use the formula for the area of a semi-circle and give their answer to two decimal places. Many candidates however made one or more of the following errors: used 12 m for the radius of the circle instead of the correct 6 m, did not divide the area of the circle by 2 or used the formula for the circumference of a circle instead of the area formula. Many good solutions did not gain the full marks as candidates had not read the instructions at the beginning of the question to give their answers to two decimal places. Candidates should be reminded to read fully the question before and after they have reached a solution to check they have given their answer in the correct format. More candidates are using the pi button on their calculator or 3.142 (as instructed on the front cover of the exam paper) than in previous years, with very few using 3.14 or $\frac{22}{7}$.

(ii) Candidates found this part more difficult to gain full marks. However good solutions again gave clear workings out and remembered to round to two decimal places. More candidates were able to correctly calculate the circumference of a full circle by using the diameter of 12 m, however many of these solutions were incomplete as they did not divide by 2 or add the 12 m to their answer. Again many candidates' good solutions did not gain full marks as answers were given to more than two decimal places. As in part **(i)** more candidates used the pi button or 3.142 than in previous years.

Answers: **(b)** Hexagon **(d)(i)** 56.55 or 56.56 **(d)(ii)** 30.85

Question 5

This question gave candidates the opportunity to demonstrate their ability to calculate missing va draw a quadratic curve. Candidates continue to improve at plotting points and drawing smooth curves. **(c)** proved most difficult as most candidates did not realise they could use their graph and straight line solve the equation with many attempting to solve it algebraically with little success.

(a) (i) Candidates answered this part well with the majority of candidates correctly calculating all 6 missing values. A large number of candidates simply halved each *x* value but then correctly plotted these in part **(ii)**.

(ii) Candidates plotted their values from the table well with the majority of candidates scoring 3 marks for plotting the correct or follow through points. The quality of curves drawn has improved again this year with very few straight lines drawn and very few with very thick lines or broken lines drawn. A significant number of candidates correctly plotted all 8 points but then did not attempt to join them up with any type of line. Candidates need to be reminded what the requirements of a smooth curve are.

(iii) Candidates found giving the order of rotational symmetry more difficult. Few correct answers of 2 were seen, with many candidates giving a worded description instead, e.g. rotate 180˚ clockwise.

(b) (i) Completing the table for the straight line proved to be the most successful question on the whole paper. Nearly all candidates who attempted the question were able to give the correct 3 missing points.

(ii) Despite getting the table of points correct many candidates did not then go on to plot the points on the graph paper. A large number of candidates plotted the points correctly but then again did not join them up with a straight line and lost the mark. Candidates need to be reminded that straight line graphs need to be joined with a ruler as a number of freehand lines were seen.

(c) Candidates were instructed to use their graph to solve the equation. The best solutions were given by candidates who had drawn accurate curves and lines in parts **(a)** and **(b)** and identified the intersection of their curve and straight line and correctly used the scale on the *x*-axis. A very large proportion of candidates did not attempt this part as they had not drawn a curve or straight line in the previous parts. Co-ordinates were given as solutions by a number of candidates. Candidates should be reminded to read the question carefully as only the *x* values were required and giving the co-ordinate meant they lost both marks. Some candidates attempted to solve the equation algebraically with little success.

(d) More able candidates could identify the gradient of the line from the equation and give the answer as 1.5. Many less able candidates used a variety of methods to attempt to find the gradient, not using the $y=mx+c$ form of the equation. Some used a rise/run approach from the graph. Some candidates attempted to use the equation but gave their answer as 1.5x instead of 1.5.

Answers: **(a)(i)** −1, −4, −8, 8, 4, 1 **(a)(iii)** 2 **(b)(i)** −3, 0, 6 **(c)** 1.4 to 1.6 and −3.6 to −3.4 **(d)** 1.5

Question 6

Most candidates made a good attempt at this question. It was vital for candidates to read the question fully and to give integers between 50 and 100. A good understanding of factors, multiples and square numbers was required to gain marks, which most candidates showed.

(a) (i) This part was well answered by the majority of candidates. Some candidates misread the question and gave an answer of 43, outside the given range, or made no attempt.

(ii) Again this part was well answered with most candidates showing a good understanding of factors. Most common errors were to give factors outside the given range e.g. 3, 5 or 33, or give an answer of 82.5 which was simply halving 165.

(iii) Candidates had a good understanding of square numbers with the majority of candidates who attempted the question giving a square number. Again candidates lost this mark for commonly giving a square number outside of the range e.g. 25 or 49, or even square numbers e.g. 64 or 100.

(iv) Many candidates found this question more challenging with a large number choosing ... it. Candidates commonly gave a square number answer showing their understanding ... numbers is sound, but few were able to give the correct answer of 64, showing less unde... of the meaning of a cube number. Answers of 81 or 100 were commonly seen.

(b) Some excellent rearranging and methods were shown, so even if errors were made candidates were able to gain one of the marks for the correct first step. Candidates should be reminded to always show their working out and methods used fully.

Answers: **(a)(i)** 86 **(a)(ii)** 55 **(a)(iii)** 81 **(a)(iv)** 64 **(b)** $\frac{y+1}{3}$

Question 7

Candidates were required to interpret a pie chart. The 'show that' question in part **(a**) again proved the most challenging. In part **(b)** candidates had to form an equation from worded information and then to solve it.

(a) (i) As in previous questions the 'show that' part proved to be the most difficult. Candidates were asked to show that 45 people travel by car from the information given in the pie chart. The most common response was to use the 45 given in the question and show that the angle of the pie chart was 135˚. As with previous 'show that' questions candidates who start using the 45 did not gain any marks. In good solutions candidates first measured the angle from the pie chart and then used the information to derive the fact that 45 people travel by car. Candidates should be reminded that in a 'show that' question where 45 must be obtained that it cannot be used in their calculations.

(ii) Many more able candidates were able to identify the fraction $\frac{2}{3}$ immediately with no or little working out. Candidates who measured the angles often went wrong when trying to convert these values to the number of people. Some good solutions were left unfinished when correct fractions for bus and car were found separately but then not added together. Many less able candidates did not attempt this question.

(b) (i) Candidates found forming an equation from the information given in the table difficult. Good solutions found an algebraic term for each of the 4 modes of travelling to work and wrote them added together on the answer line. Some able candidates attempted to simplify their terms without any working out; if they made one small error they were unable to access any of the 3 marks available. Candidates should be reminded to show all working out. Most candidates were able to write an algebraic equation which contained at least one of the required elements (x+17 or 2x). However a large number of candidates missed out the x for people who walk to work. Many less able candidates tried to give numerical answers in this part and without an equation scored no marks.

(ii) Candidates who had successfully given the correct equation in part **(i)** generally were able to solve their equation and get full marks in this part. Candidates who gave an incorrect equation in part **(i)** generally gained two follow through marks. Some candidates restarted the question and used trial and improvement to find the correct solution. However some common simplification errors led candidates to wrong solutions, e.g. $17 + x = 17x$ or $x + 2x = 2x^2$.

Answers: **(a)(ii)** $\frac{2}{3}$ **(b)(i)** $x+31+x+17+21$ **(b)(ii)** 18

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 circle theorems. Only the m able candidates were able to gain marks on parts **(d), (e)** and **(f)** or make an attempt**.**

(a) The correct answer of 'tangent' was seen by many candidates, however common wrong answers were 'chord' or 'segment'. Many candidates chose not to attempt this question.

(b) Despite the majority of candidates attempting this question very few were able to give enough detail to gain the mark. To fully explain why angle *PQO* was 90˚ candidates had to quote the correct circle theorem and use the correct terms of 'tangent' and 'radius'. Many candidates were able to describe why it was 90˚ but did not use the correct terminology, often giving diameter instead of radius. Many less able candidates measured it or said it was a right-angled triangle.

(c) The best solutions to this problem recognised the need to use Pythagoras' theorem with the right-angled triangle identified in part **(b)**. Candidates who drew a triangle or marked the right angle on the diagram generally used Pythagoras' theorem correctly, giving well presented answers and gained full marks. Many correct and incorrect answers were given with no working and candidates should be reminded to show all workings out.

(d) This 'show that' question again proved very difficult to all candidates with only the most able gaining marks for this part. Trigonometry again proved a very difficult topic for most of the candidates with the majority of answers not using any of the trigonometric ratios. Candidates who did use trigonometry generally gave the correct ratio and trigonometric function but did not give enough detail in their solution to gain full marks. Candidates had to show that the trigonometric equation gave an answer of 28.07.. or 28.1 which rounds to 28 to the nearest degree.

(e) Only the most able candidates could find the correct angle and only a very few candidates gave the desired accuracy in their reasons. Many candidates explained their numeric method but did not give geometric reasons for each step of their calculation. The most common reason seen was; 'angles in a triangle add to 180' however 'vertically opposite' and 'isosceles' were very rare.

(f) The most able candidates again recognised the need for trigonometry. This part required the answers found in parts **(c)** and **(e)**, which the majority of candidates had not attempted. The few correct answers seen gave full solutions, quoting the correct trigonometric ratio, calculation of *RM* and then doubling to find *RS*. The most common incorrect answer was 8, where candidates had incorrectly assumed that triangle *ROS* was equilateral and that *RS* was the same length as the radius.

Answers: **(a)** Tangent **(c)** 8 **(e)** 31 **(f)** 8.24

Question 9

This question assessed candidates' knowledge and ability of ratios and use of a protractor to con accurate triangle. Successful candidates were also able to calculate the area of a triangle using a fo and give the correct units of measurement.

(a) (i) This question required the candidate to show that the smallest angle of a triangle is 36˚, given the ratio 3:4:8. The most successful candidates only used the ratio and the fact that the angles in a triangle add up to 180˚ to give a full and accurate answer. Candidates must be reminded that if asked to show 36˚ then they must not use or start with the 36˚ as this scores zero marks. Many candidates gave the 3 correct angles, using the multiplier of 12 but did not show where the 12 came from or used the 36˚ to derive it.

(ii) This question was well answered with the majority of candidates gaining full or part marks. Many candidates had already worked out the two angles in part **(a)(i)** although scoring no marks in part **(i)** were able to gain full marks in this part. Many candidates were able to gain one out of the two marks by giving a pair of angles which added to 144˚, the most common pairs being: 90˚ and 54˚ or 72˚ and 72˚.

(b) (i) The majority of candidates showed an ability to accurately use a protractor and ruler to construct the two angles. Very few candidates reversed the position of the angles, although this still gained one mark if completed accurately. A very small number of candidates did not use a ruler or chose not to attempt this question.

(ii) This part proved to be the most successful of this question. Candidates were able to gain full marks for an accurate measurement even if their triangle was incorrectly drawn. The vast majority of candidates who attempted the question measured accurately although a number of less able candidates gave measurements to the nearest whole centimetre and therefore could not gain the mark for accuracy.

(c) Most candidates showed an understanding of calculating the area of a triangle, with the best solutions quoting a formula, substituting in the values for height and base and giving their answer with correct units. The answer space confused some candidates because they had not read the question properly and had not remembered that they had to give the correct units of measurement, thinking the second dotted line in the answer space was for the decimal part of their answer, rather than the units of measurement. The correct answer of 19.6 was often given but not followed by any units of measurement or the incorrect ones (often cm or cm^3).

Answers: **(a)(ii)** 48, 96 **(b)(ii)** 4.45 to 4.85 **(c)(i)** 19.6 cm^2

MATHEMATICS (US)

Paper 0444/41
Paper 4

Key Messages

Candidates who performed well on this paper consistently showed their working out, formulas used and the calculations performed in obtaining their answer. Attention should be paid to the degree of accuracy required in each question and, in order to avoid unnecessary loss of accuracy marks, candidates should be encouraged to avoid premature rounding in workings.

General comments

As always a large proportion of the paper was accessible to many of the candidates although some questions proved more challenging. The presentation of work was generally good with some scripts showing working that was clearly set out. For some candidates, working was often haphazard and difficult to follow making it difficult to award method marks when the answer was incorrect. There was no evidence to suggest that candidates were short of time on this paper although less able candidates made no attempt at some questions.

Comments on specific questions

Question 1

This question was generally well answered. Dealing with time and conversion of units gave rise to the greatest number of errors.

(a) A large majority of candidates gave the correct answer. Some gained one mark for using a correct method for speed but incorrect conversion of 1h 30mins into hours meant that the accuracy mark was lost. Some less able candidates misread the scale and a few attempted to calculate the area under the graph.

(b) Those that were successful in part **(a)** usually gained full marks on this part. Some candidates misread the scale, often as 35, obtained an answer that rounded to 12 but did not appear to go on and check their working. A small number attempted to calculate the average speed for each section of the journey and average their answers. As in part **(a)** some attempted to calculate the area under the graph.

(c) Although a majority gave the correct answer many of the others struggled with the conversion of the units. It was not rare to see 12 multiplied by 10 or 100. Some went on to multiply their speed in metres per hour by 60.

(d) Those with a good understanding gained both marks, rarely losing marks for any inaccuracies in the completion of the graph. Common errors usually involved the omission of Ali's stay at his grandmother's house. As no information was given other than the timings, candidates were free to draw any graph for the return journey. Most had Ali returning in one journey but a few included a rest period at the same location as on the outward journey.

Answers: **(a)** 8 **(b)** $36 \div 3$ **(c)** 200

Question 2

It is important that candidates check the validity of their answers, particularly in questions involving a

(a) Although a large majority gained two marks, some candidates multiplied by 5 (not realising that labour costs should not be greater than the total running cost) and others just divided by 5.

(b) Whilst this was fairly well answered, the lack of clear working was very noticeable. Quite a number of candidates based their percentage on the 2013 profit. Some attempted a trial and improvement method but these attempts rarely led to the correct answer.

(c) Only a minority of candidates were able to apply the reverse percentage process correctly. For many others, calculation of 7% of the 2012 profit and subtracting was by far the most common incorrect method.

(d) (i) In general only more able candidates gained all three marks. There was a significant number using an incorrect formula for the volume, ranging from formulae for the surface area of a cylinder to the volume of a cone or sphere. Other errors tended to revolve around confusion between radius and diameter and, more often, premature rounding errors leading to the loss of the final mark.

(ii)(a) Many were able to convert from millimetres into centimetres. Obvious errors included division by 100 and 1000.

(ii)(b) Those candidates with the previous answers correct usually went on to gain 3 or 4 marks. The majority tackled the question using the volume of a single sheet. In some cases, candidates reverted to the given thickness instead of using their answer to the previous part. Yet again, the answers varied considerably, from answers lower than 10 to answers in the millions. Candidates must be prepared to check whether their answer is suitable in the context of the question.

(iii) It was quite rare to award full marks for this part. Very few worked with the dimensions of the rolls and the container to find the number of rolls that would fit along the length and width and height. Some that did simply added the results. By far the most common approach was to divide the volume of the container by the volume of one roll, not realising that there would be space between the rolls.

Answers: **(a)** 62705 **(b)** 10.9 **(c)** 127000 **(d)(i)** 59100 **(ii)(a)** 0.0125 **(ii)(b)** 7580 **(iii)** 0.63

Question 3

(a) (i) Many candidates had the correct answer but it was evident that a few candidates had used a protractor.

(ii) Most candidates tackled this question by attempting to complete the diagram. Those that used a protractor in part **(i)** tended to start this part by measuring angle *BCE*. This did not lose all the marks and those that showed some evidence of further work gained some marks. Many who obtained the reflex angle *AED* did not go on to find the obtuse angle.

(b) A significant number of candidates made no attempt at this part and those that did struggled to make much headway. Very few attempted to formally list the pairs of sides and the angles that were equal, and even when they were seen it was rare to see any reasons. Throughout this part it was common to see 'congruent' used for equal, for example, *AP* is congruent to *PB*.

(c) (i) Just as many struggled to explain why the triangles were similar. Those that apprecia required were able to recognise the pairs of equal angles, although the reasons were o or incorrect. Yet again, mathematical language was misused and statements such as 'a similar to angle *C*' were common.

(ii) Candidates were far more successful on this part and the majority gained both marks. Some les able candidates attempted to use Pythagoras' theorem along with trigonometry.

(iii) The understanding of similarity and scale factor did not extend to area scale factor in many cases. Consequently, 12*k* was a very common wrong answer.

Answers: **(a) (i)** 120 **(ii)** 151 **(c) (ii)** 6 **(iii)** 8*k*

Question 4

(a) Many candidates seemed unfamiliar with the formula $\frac{1}{2}ab\sin C$ and these candidates tended to draw a perpendicular from *B* to *AC* to calculate the height of the triangle. This tended to lead to rounding errors and the final accuracy mark was lost. Less able candidates assumed the perpendicular cut *AC* in half and the use of 9.5 tan40 was a common incorrect calculation for the height.

(b) Those candidates drawing a perpendicular in part **(a)** tended to continue with the same approach, calculating the distance from *A* to the foot of the perpendicular and using this to calculate the distance from the perpendicular to *C*. At this point the use of Pythagoras' theorem to calculate *BC* was common. The correct use of the cosine rule did not bring guaranteed success as misapplication of BIDMAS often led to 16 cos40.

(c) (i) The vast majority of candidates struggled to make much progress and correct answers for the obtuse angle were seldom seen. As in many other questions, premature rounding of values often led to inaccuracies with the angles calculated. The acute angle was far more common as an answer than the correct one. Many assumed the triangle was right-angled and the use of simple trigonometry was common.

Answers: **(a)** 91.6 **(b)** 12.2 **(c)** 97.8

Question 5

(a) (i) A large majority of candidates gained both marks by adding the correct pair of probabilities. A few candidates multiplied the correct probabilities and some chose the wrong pair of probabilities.

(ii) Many correct answers were seen although an answer of $\frac{1500}{5000}$ lost the mark.

(iii) Candidates were less successful in this part. Some candidates added instead of multiplied and there were several answers of $0.1 \times 0.3 = 0.3$. In this part, and in part **(i)**, a significant number of candidates attempted to convert their probabilities into fractions or percentages. Providing a correct decimal had been seen they did not lose a mark if this was carried out incorrectly.

(b) Attempts at tree diagrams were seen, many of which were correctly labelled. The probability of at least one red appeared to cause some confusion. Some multiplied one pair of probabilities, others two pairs and in a minority of cases three probabilities. Only a few approached the problem as 1 – probability of no reds. Choosing a disc with replacement was seen but was not too common. When the correct three probabilities or an acceptable pair were chosen some struggled to cope with the multiplication of the fractions.

Answers: **(a)(i)** 0.6 **(ii)** 1500 **(iii)** 0.03 **(b)** $\frac{112}{132}$

Question 6

(a) (i) Many candidates were able to draw the image after the translation. As always a few ca translated *A* correctly, either horizontally or vertically, earning just one mark and some tran by $\begin{pmatrix} -4 \\ -6 \end{pmatrix}$ earning no marks at all.

(ii) Slightly fewer candidates gained the marks for the rotation. Common errors included rotation about (1, 1) and less frequently *A* was rotated anticlockwise. In addition there were a number of rotations about random points.

(b) (i) Many candidates ignored the word 'single' and didn't gain any marks as a result. Some candidates didn't appreciate that for three marks the name of the transformation was required along with two aspects. Several answers involved some of the three aspects but full marks were rarely awarded.

(ii) This was answered less well than the enlargement with only a few picking up some of the marks. As in part **(i)** many lost all the marks by giving more than one transformation.

Answers: **(b) (i)** Enlargement, scale factor 3, centre (3,3) **(ii)** Stretch, factor 3, invariant line *y*-axis

Question 7

(a) Most candidates completed the table correctly. Some errors arose by using x^2 rather than x^3 in the equation.

(b) Some good graphs were seen with relatively few drawn using line segments. Marks that were lost usually resulted from incorrect points from part **(a)** or plotting incorrectly on the graph, usually from misreading the scale on the *y*-axis.

(c) 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 $x = 2$. Some candidates with a correct tangent showed no working for the gradient and possibly lost a method mark when their answer was incorrect. Candidates would be well advised to show the co-ordinates of the points they are using to find the gradient.

(d) Only a minority were able to earn some marks for the solutions to the equation. Some did earn one of the marks by giving two correct solutions; usually 0 was the missing or incorrect solution.

(e) Many found this a challenging part of the question. Although a minority gave a correct pair of values, many simply gave the largest and smallest values of *y* from their graphs, not appreciating the need for the equation to have three solutions.

Answers: **(a)** 2.125, 2.375 **(c)** 7.8 to 10.2 **(d)** –1.75 to –1.65, 0, 1.65 to 1.75
(e) –1.2 to –0.8 < *k* < 2.8 to 3.2

Question 8

(a) (i) This was well answered by many candidates. Most errors resulted from misreading the graph and occasionally giving the frequency of 40 as the median.

(ii) Candidates were generally less successful in finding the inter-quartile range with only a small majority gaining both marks. Some gained a mark for a correct lower quartile or upper quartile (usually the lower quartile) but some candidates either misread the scales or had little idea of what was required.

(iii) Those that were successful with the inter-quartile range usually coped with the 70th percentile. Less able candidates simply read off the time with a cumulative frequency of 70 and so 46 and 47 were common incorrect answers. A small number gained a mark for a cumulative frequency of 56 but then read incorrectly from the graph.

(b) (i) Able candidates had no trouble in calculating the mean of the grouped data, occasional slip resulting in the loss of a mark. Other candidates had some idea of required but a variety of errors resulted in the loss of some marks. Instead of using the midpoints some used either the upper or lower boundaries whilst others used the interval w Some correctly divided their totals by 80 but others divided by 4.

(ii) Those with an understanding of frequency density had little trouble in drawing the histogram, sometimes with an occasional slip when drawing one bar or using incorrect widths resulting in the loss of marks. Some candidates drew a frequency polygon. A significant number made no attempt at all.

Answers: **(a)(i)** 34 to 34.5 **(ii)** 18 **(iii)** 41 to 42 **(b) (i)** 31.8

Question 9

(**a**) **(i)** Most candidates gained the mark for a correct substitution.

(ii) Several candidates misinterpreted f(h(–1)) as f(–1).h(–1). Some of those with some understanding of composite functions struggled to get from 3^{-1} to $\frac{1}{3}$. Some attempted to work with decimals but often lost the accuracy mark because of answers such as –2.34.

(iii) Candidates were generally less successful in finding the inverse. Those with a correct answer usually started with $y = 2x - 3$ or with $x = 2y - 3$, although those using the first option sometimes forgot to switch the y to x. Reverse flowcharts were few and far between. Common misconceptions that were often seen were $f^{-1}(x) = \frac{1}{f(x)}$ and $f^{-1}(x) = -f(x)$.

(iv) A small majority were able to write the composite function ff(x) in its simplest form. As in part **(ii)**, a significant number treated f(f(x)) as f(x).f(x) and answers of $(2x - 3)^2$ expanded and simplified were common.

(v) As in all 'show that' questions it is important for candidates to set out their working using correct mathematics, showing all the stages leading to the required answer. Earning the first mark proved difficult for many candidates, frequently omitting brackets from around the terms to be multiplied, for example $2x - 3(x + 1)$. These candidates were allowed to recover and gain one mark for the correct expansion of their intended $(2x - 3)(x + 1)$. Eliminating the fractions led to many errors and $(2x - 3)(x + 1) = 1 + 2$ was another common error.

(vi) This part proved slightly more accessible than the previous part with many of the successful candidates correctly using the quadratic formula. Very few using completing the square obtained all four marks. As always in this type of question, some candidates take little care with their presentation and errors creep in. Writing $(-3)^2$ as -3^2 was common but not all went on to evaluate it as 9. Some divide only the root by the $2a$ term in the denominator. Poor use of the calculator also led to some errors.

(b) A minority of candidates displayed a sound understanding of this type of algebra and had little trouble in simplifying the expression. For others attempting to factorise, errors with the signs was a common source of error. Less able candidates had a tendency to cancel individual terms without any attempt at factorising first.

Answers: **(a) (i)** 5 **(ii)** $-2\frac{1}{3}$ **(iii)** $\frac{x+3}{2}$ **(iv)** $4x - 9$ **(vi)** 2.64 and –1.14 **(b)** $\frac{x-1}{x+5}$.

Question 10

(a) (i) A significant number of candidates gained the mark for the correct co-ordinates of Q showed no working but slips with the directed numbers were often seen. A common inc answer was $\begin{pmatrix} -1 \\ 1 \end{pmatrix}$ obtained from the subtraction of vector *PQ* and the position vector for *P*.

(ii) There weren't many successful attempts at this part of the question. It would appear that many were unfamiliar with the idea of magnitude of a vector and 5 was rarely seen.

(b) (i)(a) Only the most able candidates made much headway with this question, showing clear steps leading to a correct answer. Some others gained a mark for defining a vector path for *ON* but dealing with the ratios involved often led to errors. It was not uncommon to see thirds being used rather than fifths.

(i)(b) Those successful in part **(i)(a)** were usually successful in this part with similar errors in evidence.

(ii) Many of those with correct answers in part **(i)** were able to write down two conclusions although some lost one or both marks by referring to vectors rather than the line segments.

Answers: **(a)(i)** (–5, 7) **(ii)** 5 **(b)(i)(a)** $\frac{3}{5}\mathbf{a} + \frac{2}{5}\mathbf{b}$ **(i)(b)** $\frac{2}{5}\mathbf{a}$, **(ii)** $NY = \frac{2}{5}BC$, *NY* is parallel to *BC* .

Question 11

This was a topic with which candidates seemed unfamiliar.

(a) (i) Correct solutions were rare. Some were able to obtain $(x - \frac{3}{2})$ but the constant term proved too challenging for almost all of those attempting the question. Attempts at expanding $(x - a)^2 + b$ and equating coefficients were almost never seen.

(ii) Many who had struggled with part **(i)** made no attempt at the minimum point of the graph. A few were able to pick up a mark for a correct coordinate following on from an expression of the correct form in the previous part.

(b) Attempts to set up a pair of simultaneous equations were seen but, in many cases, slips with the signs for point *A*, usually -1^2 instead of $(-1)^2$, resulted in many losing some marks. Candidates with two correct equations usually went on to obtain correct values for *p* and *q*.

Answers: **(a)(i)** $(x - \frac{3}{2})^2 - 1.25$ **(ii)** (1.5, –1.25) **(b)** $p = -2$, $q = -6$