MATHEMATICS

Paper 0580/12
Paper 12 (Core)

Key messages

Answer precisely what is asked in the question.
Check that answers are sensible or possible for the context of the question.
Pay particular attention to specified accuracy or rubric for inexact answers.

General comments

The paper was tackled well by the vast majority of candidates.

Marks were often lost due to answers given to less than the required accuracy or loss of accuracy from rounding calculator values at a working stage of a problem.

Working was generally shown well although lack of structure and clarity of figures were evident in quite a number of scripts.

Some responses to certain questions were often totally unrealistic or not possible for the context. Specifically this was evident in **Questions 11**, **13**, **16**, **17**, **22** and **23** where candidates need to check carefully if their responses could possibly be correct.

Comments on specific questions

Question 1

The vast majority of candidates gained this mark with the decimal answer, 0.4, being the only significant error.

Answer: 40

Question 2

This was rather poorly answered with more ordered incorrectly than correctly. The fraction was often seen as the smallest and often when it was in the correct position the order was largest to smallest. There was not enough evidence of changing the fraction and percentage to decimals or to enough figures to compare correctly.

Answer: $54\frac{1}{2}\%$ $\frac{6}{11}$ 0.55

Question 3

Nearly all candidates gained this mark and 'negative' was rarely seen. Clearly some candidates did not know the types of correlation as there was a fair number of nil responses and words such as 'direct' seen.

Answer: Positive

Question 4

The probability was very well answered although a few candidates gave the same probability as the question. An arithmetic error led some to give 0.75 while others decided it had to be a fraction, not all of which were correct. Just a few candidates didn't seem to know that probability had to be less than 1.

Answer: 0.65

Question 5

Nearly all candidates understood how to write this small value in standard form. However, counting the places incorrectly led quite a number to an index of –6 (sometimes with 52.3) or even –7. Some gave an index of 5.

Answer: 5.23×10^{-5}

Question 6

A very straightforward rounding was done quite well but there were a considerable number of candidates not increasing the third figure. Some spoilt a correct solution by adding two zeros after the three figures. 6.9 and 6.817 were seen a few times.

Answer: 6.82

Question 7

(a) Many candidates did not know that the number of lines of symmetry for a regular polygon is equal to the number of sides. With the diagram of a regular pentagon shown many still just gave 1 as the answer, some showing the obvious vertical separation line. All other numbers less than 5 were seen but 2 was the other common error.

(b) Rotational symmetry was not well known and many did not answer this part. Again 2 was a very common response but also 4 and 5 were often seen.

Answers: **(a)** 5 **(b)** 1

Question 8

Many candidates divided 120 by 1 or 2, resulting in the common incorrect answer of 60 : 120.

Answer: 40 80

Question 9

(a) While many candidates gave a correct answer there were a significant number who did not follow the instruction to include all the numbers on their calculator, and specifically gave less than the minimum of seven figures required for the mark. A common incorrect answer of –72.997125… was the result of not bracketing or working out the calculation under the cube root.

(b) Some candidates changed the figures of part **(a)** but overall this part was well done, although many times from a follow through of an incorrect part **(a)**. Some did not round up the fourth decimal place but 5.8000 and 5.779 were also seen. Adding zeros to make the answer have the same number of figures as part **(a)** spoilt an otherwise correct answer.

Answers: **(a)** –5.779266… **(b)** –5.7793

Question 10

(a) Nearly all candidates gave the correct pair of brackets but (3×10) and $(5 + 3)$ were seen a number of times. A significant number of candidates did not attempt either part of the question.

(b) Again this was well done but some included the minus sign before the 4. A significant number of candidates also bracketed 3×2 when the question asked for one pair. However, as this did not affect a correct calculation it was not penalised.

Answers: **(a)** $5 + 3 \times (10 - 1) = 32$ **(b)** $3 \times 2 - (4 - 7) = 9$

Question 11

This was poorly answered with many candidates clearly not aware that the intended method was to count squares, complete and partial, to estimate. A variety of calculations were attempted with the most common $\pi \times 3.5^2$, even though the shape was clearly not a circle. Of those who were clearly counting squares, the tendency was to miss out some of the smaller parts which gave an area just too small.

Answer: 26 to 29

Question 12

(a) It was extremely rare to find an incorrect response to this question although 5 and 5^2 were seen occasionally.

(b) Again this was correctly answered by the vast majority of candidates. Some gave the index 7 and others just gave 10 from 5×2.

Answers: **(a)** 25 **(b)** x^{10}

Question 13

Many candidates confused LCM with HCF producing the very common incorrect response of 7. Some used a factor method and others a list of multiples but there was quite a good response from those who did know what a multiple was. It was quite common to lose a mark by giving a multiple of the LCM.

Answer: 140

Question 14

The factorising was well done with the majority of candidates achieving the two marks. A partial factorisation for one mark was only awarded a small number of times. The main error was to take the letter *d* as a factor but a few left 9 as the second term in the bracket.

Answer: $3e(2d^2 - 3e)$

Question 15

This was a very demanding question on what is usually quite a challenging topic. It was poorly answered with the vast majority of candidates unable to cope with the bounds for 78.5 to the nearest half metre. While there were a wide variety of incorrect attempts, the most common were 78.45 with 78.55 and 78 with 79. However, many candidates showed some clear working to halve the half metre and adding to and subtracting from 78.5 to reach the correct answer.

Answer: 78.25 78.75

Question 16

Finding the total number of days hired was quite well done with most showing clear solutions. Many did not use the method of subtracting 25 and then dividing by 9 but wrote an addition sum of 25 plus a series of 9's. Many lost a mark due to forgetting to include the first day and just count up the seven 9's. Noting the context of the question it should have been clear that the answer was going to be a whole number of days and reasonably small. Some unrealistic responses were given by some candidates.

Answer: 8

Question 17

While many candidates found the correct answer for the number of cakes there were a lot of answers which weren't realistic at all. The context made it clear that the answer must be a whole number as did the number of cakes going into the hotel and the supermarket. Many found 18% correctly but then subtracted it from 600 and found two-thirds of 492 instead of 600, as clearly stated in the question. Of those who found both 108 and 400, some left the answer as the total number of cakes while others subtracted these to get an answer of 292.

Answer: 92

Question 18

Only a few candidates used simple interest instead of compound which of course did not score. Most candidates did know the formula for compound interest and used it correctly. Some then didn't work out the formula correctly or reversed the positions of time and rate in the formula. Quite a significant number of candidates worked out a correct answer but then added the principal since they presumably thought they had found the interest or subtracted the principal as they interpreted the question as finding the interest. Answers were accepted to three or more significant figures but incorrect rounding meant a mark lost for quite a number of otherwise correct responses.

Answer: 5384.45

Question 19

The fractions question was probably one of the most straightforward examples on the topic and was answered well overall even though some did not attempt it. Many candidates left the answer as $\frac{25}{24}$ or a decimal, ignoring or not understanding what a mixed number was. A common denominator from adding 8 and 6 was seen a number of times.

Answer: $1\frac{1}{24}$

Question 20

Most candidates found the angles correctly but 58° was common for angle *a*, due to the assumption that it was an isosceles triangle. The reasons were not so well answered with often just a reference to parallel lines or the incorrect alternate angles to justify angle *a*. For angle *b*, many explanations were incomplete. It was necessary to make clear that it wasn't simply a triangle that added to 180° or that the angles added to 180°. Many reasons omitted one of the words triangle or angles or even 180.

Answers: 63, 59

Question 21

(a) Most candidates managed to draw a correct circle but quite a few used a radius of 7 cm or significantly less than 3.5 cm.

(b) A chord was expected to be drawn not going outside the circle. Again most, if attempted, had a correct chord.

(c) While the vast majority of candidates gave the correct formula for the circumference, most just quoted the given answer. The second mark required an answer to at least one more figure as proof of the calculation process taking place. There were a lot of nil responses to this part as candidates seemed to be confused by having the answer given in the question.

Question 22

Most candidates who attempted this question gained a mark for changing 165 euros to rupees. However, many multiplied 180 by 0.0152 for dollars to rupees, producing a totally unrealistic value for a comparison. Many did make good progress but ignored the question 'by how many rupees' and simply gave the answer to the blue jacket rupees in the answer space. Some did everything correctly other than choose grey, rather than blue for the answer. There were, however, many responses well worked out and completely correct.

Answer: Blue 706

Question 23

(a) While the vast majority of candidates knew Pythagoras' theorem had to be applied, some squared and subtracted producing an answer less than 2.8 for the obviously longest side of the triangle. Some candidates lost a mark by only giving a two significant figure answer.

(b) Some candidates clearly were not familiar with trigonometry but most applied one of the ratios. Those choosing sine or cosine with their answer to part **(a)** usually lost the accuracy required. Many did not score in this part simply because they assumed the required angle was on the more usual base line at point *C*, rather than point *A*.

Answers: **(a)** 3.22 **(b)** 60.3

Question 24

(a) The standard bisecting of a line was well known and accurately done with the required two pairs of arcs in most cases. A few candidates lost a mark by measuring the mid-point and just showing one pair of arcs.

(b) Bisecting an angle was also done well by those familiar with the construction. However, a significant number of candidates used the ends of the arms of the angle, *A* and *C* as centres for their arcs. While this produced a line within the limits for the bisector, it did not gain the construction mark.

MATHEMATICS

Paper 0580/22
Paper 22 (Extended)

Key messages

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

General comments

The level of the paper was such that all candidates were able to demonstrate their knowledge and ability. There was no evidence that candidates were short of time, as all attempted the last few questions. It was rare to see any questions unanswered on the paper. Candidates occasionally had problems with rounding. There was some premature rounding part way through a calculation evident in **Questions 8** and **17** and over rounding of the answers to less than three significant figures was evident in **Questions 3** and **16(b)**. Candidates were very good at showing their working and it was very rare to see any candidates showing just the answers so more method marks were awarded as a consequence. There were quite a few arithmetic errors which lost marks, for example, not knowing the 7, 8 or 9 times tables in **Questions 10**, **12** and **21(b)** as well as careless adding and subtraction errors in **Question 21**. Some candidates also lost marks because they did not read the questions carefully enough, for example, increasing the population in **Question 8** rather than decreasing it; finding 18% of the cakes and then $\frac{2}{3}$ of the remaining cakes rather than the original 600 cakes in **Question 11**; and not giving answers to two decimal places in **Question 17**. Questions that the candidates found the most challenging were **5(a)**, **7**, **14(b)**, **19(a)(i)** and **19(c)**.

Comments on specific questions

Question 1

The majority of candidates could recall the correct term required to describe correlation. Some thought it was negative but the majority of marks were lost by those stating either direct or direct proportion with no reference to the type of correlation.

Answer: Positive

Question 2

This was answered correctly by most candidates; the common incorrect answers were usually the incorrect index or the answer not in standard form e.g. 5.23×10^{-4}, 52.3×10^{-6}, 523×10^{-7}.

Answer: 5.23×10^{-5}

Question 3

This question was very well answered by nearly all candidates. On the few occasions when the mark was not earned, it was almost always because of a rounding error or over rounding with 2.293, 2.3 and 2.30 being the most common incorrect responses. A few candidates did not perform the entire calculation in one on their calculator and rounded the two individual values, usually to 4.219 and 1.93, which led in some cases to answers such as 2.289. A significant number either missed out a digit when giving the answer or reversed digits after the decimal point as 2.92 was seen several times.

Answer: 2.29

Question 4

Most candidates wrote out full working for this question and gave the correct answer. Common incorrect answers included $\frac{8}{10}$ and $\frac{4}{5}$. In these instances there was usually no working and it may be that the candidate did not understand the significance of the dot above the 8. Other answers showed the candidates just taking a few 8s after the decimal point, for example, $\frac{88}{100}$ or $\frac{888}{1000}$ or simplified versions of these.

Answer: $\frac{8}{9}$

Question 5

There were many fully correct answers in both parts of this question. However this question, particularly part **(a)**, proved to be quite challenging for a significant proportion of candidates. The most common errors seen in part **(a)** were answers of 1 or 3 for the number of lines of symmetry of a regular pentagon. The most common errors in part **(b)** were answers of 2 or 4 for the order of rotational symmetry of the kite. 0 or 'none' were also often seen in part **(b)**.

Answer: **(a)** 5 **(b)** 1

Question 6

Nearly all candidates were able to identify the complete common factor and factorise correctly. It was quite rare for it to be partially factorised. There were occasional errors in the powers inside the brackets. The most common misconception was to factorise each term separately, for example $3k(5km) - 5(4m^4)$ and often this was then combined into two sets of brackets, so in this case to $(3k - 5)(5km - 4m^4)$.

Answer: $5m\left(3k^2 - 4m^3\right)$

Question 7

This question was one of the more challenging questions on the paper. Many used $\overrightarrow{CB} + \overrightarrow{BA}$ but they could not work out $\overrightarrow{BA}$. Common incorrect answers were $\mathbf{p} + \mathbf{q}$ or $2\mathbf{q}$ from using $\overrightarrow{BA}$ as either $\mathbf{p}$ or $\mathbf{q}$. Some did try using $\overrightarrow{CD} + \overrightarrow{DE} + \overrightarrow{EF} + \overrightarrow{FA}$ but these were less successful.

Answer: $2\mathbf{q} + \mathbf{p}$

Question 8

The majority of candidates used the most efficient method of using the formula to find the correct answer which was usually given as either 21434 or 21400. Some chose to use a step by step method and in a few cases lost accuracy during the process. Incorrect methods which were seen frequently were using exponential growth giving an answer of 24656; finding a decrease without using the compound formula giving an answer of 21390; or a combination method of finding the exponential increase and then subtracting it from 23000 (23000 – (24656 – 23000)) giving an answer of 21344.

Answer: 21400

Question 9

This was generally well answered, with the most able candidates starting with the working $\frac{1}{\left(2^3\right)^4}$.

Occasionally this was incorrectly followed by a final answer of 2^{-12}, rather than just the power, or 12, forgetting the negative. Those who started to multiply out the powers often became confused and did not get the correct answer usually stopping at $2^p = \frac{1}{4096}$ and being unsure how to proceed from here or following this with an answer such as 4098 from the working $8^4 + 2$ or 0.0002441 from evaluating $1 \div 4096$.

Answer: –12

Question 10

The vast majority of candidates produced fully correct solutions to this question. A small number of candidates took x as directly, rather than inversely, proportional to y, and there was the occasional arithmetic slip, but very few errors were seen.

Answer: 12

Question 11

Nearly all candidates solved this problem correctly and understood the steps required. Most dealt with the percentage and the fraction separately; some tried to combine them by changing $\frac{2}{3}$ into a percentage, but premature rounding led to errors with accuracy. The most common error in this question was to find $\frac{2}{3}$ of the remaining cakes, once 18% had already been taken away, leading to an answer of 164.

Answer: 92

Question 12

This was answered very well with nearly all candidates scoring at least two marks. 48 was used as a common denominator almost as often as 24. The main error was the correct answer being left as an improper fraction rather than a mixed number or not fully simplifying the answer, e.g. $\frac{25}{24}$ and $1\frac{2}{48}$ were the most common incorrect answers.

Answer: $1\frac{1}{24}$

Question 13

Nearly all candidates were able to solve the simultaneous equations correctly and showed correct working. The most common method by far was equating coefficients although substitution and the method of determinants were both occasionally seen. In those cases where full marks were not scored the usual reason was either an arithmetic slip or a methodical error such as adding two terms but subtracting the third. Very few scored no marks as the special case mark for a pair of values satisfying one of the original equations was usually scored after an earlier error. Answers with no method shown were extremely rare.

Answer: $x = 7$, $y = -2$

Question 14

Part **(a)** was usually correct although there were a number of incorrect words used, commons ones being parallel, corresponding, congruent, equal, proportional and opposite. Part **(b)** proved to be a challenge for many candidates. It was common to see the answers 15.7 or 13.122 arising from forgetting to square root and using the area scale factor with 8.6 or 7.2 respectively. Another very common incorrect answer was 9.72 where the candidate correctly found the linear scale factor but incorrectly used 7.2 instead of 8.6. Some candidates only square rooted the area of the triangle, showing they had some idea of the concept, but not a complete one. Some squared instead of finding the square root of the area scale factor.

Answer: **(a)** similar **(b)** 11.61

Question 15

Values given for the angles *a* and *b* were almost always correct. Many good explanations for these answers were seen, but some lacked the necessary precision. For example, when explaining why angle $a = 63°$, some candidates did not mention 'corresponding angles', but simply wrote 'the two triangles are similar' or 'the angles are on parallel lines'. Some candidates incorrectly described corresponding angles as either 'alternate' or 'complementary' angles. Similarly, when explaining why angle $b = 59°$, some candidates wrote, for example, 'because triangles have a sum of 180', without mentioning the word 'angles' and a common incomplete reason seen very regularly for *b* was 'angle sum property'.

Answer: $a = 63$, $b = 59$

Question 16

Almost all candidates could find the area of the triangle in part **(a)** with just the occasional omission of multiplying by $\frac{1}{2}$. Most used the efficient method of $\frac{1}{2} \times$ base $\times$ height but occasionally the $\frac{1}{2}ab\sin C$ formula was used. Similarly in part **(b)**, the correct application of Pythagoras' theorem was widely demonstrated with very few errors seen. Occasionally the values were subtracted or square rooting was forgotten. Sometimes the cosine rule was seen with some unnecessary working. Candidates should also remember to give values to three significant figures unless told otherwise, as some gave an answer of 3.2 with no more accurate value shown in the working and therefore could not score the final accuracy mark.

Answer: **(a)** 2.24 **(b)** 3.22

Question 17

A few tried to factorise but most candidates did use the 'quadratic formula', the most common error being the fraction line being too short and not including the '$-b$' term. The square root sign was often drawn short using the '$\sqrt{}$' symbol and if so candidates should use brackets to show that the entire term is rooted. In substituting, the common error was to use *b* as 2, *a* as –3 or *c* as 7 or +3. Sometimes the formula was not remembered correctly. At the end many gave the answers correct to three decimal places or three significant figures so 0.386 and –3.886 and 0.386 and –3.89 were often given. There was some evidence of prematurely rounding $\sqrt{73}$ to 8.54 causing inaccurate answers such as 0.385 and –3.885. Answers were sometimes incorrectly rounded or truncated also.

Answer: 0.39 and –3.89

Question 18

This was another question that was generally well answered. Most candidates have clearly learned these two constructions and were able to score full marks in both parts. In part **(a)** a few scored one mark only for either drawing the perpendicular bisector using a ruler and protractor or for measuring half way with a ruler and then using only one set of arcs to draw the perpendicular line. Very few candidates scored zero. In part **(b)** a few incorrectly drew arcs centred on points *A* and *C*. Very few answers were seen with no arcs drawn but a small number did allow the radius to vary and produced a line which was out of tolerance.

Question 19

(a) (i) This part was a challenge with only about half of the candidates writing the correct answer. The most common incorrect answers were $\subset$ and $\subseteq$. Candidates should note that *c* is an element not a set, i.e. it was not {*c*}. Other incorrect answers included $\cap$, *c*, = or €. Some candidates also wrote '*b*, *r*, *i*, *d*, *g*' which are the other letters in that part of the Venn diagram.

(ii) This part was nearly always correct, although $\cup$ was seen a number of times.

(iii) This part proved to be the most challenging question on the paper. Candidates regularly wrote 0 or 'nothing' or 'empty' as the answer, demonstrating that they knew where they were supposed to be looking on the Venn diagram, but were unable to express it correctly using set notation. Sometimes all the letters of $Y \cup Z$ were seen. { } was allowed as an acceptable alternative notation to $\varnothing$ and was often seen.

(b) This part was well answered by nearly all candidates. Some candidates did not see the complement symbol and so gave all the elements in *X*, *Y* and *Z*. Others seemed to think that the complement symbol was only for *Z* and gave the appropriate elements.

(c) This part often had the answer as a list of elements in *Z*, showing that the candidate was looking in the correct place but did not understand the significance of the n in the front, i.e. that it meant they should have been looking for a numerical answer. There were other candidates who gave '*x*, *s*' as their answer or 2, which are the elements not in *X* or *Z* (ignoring letters outside of the circles). $\varnothing$ and 0 were also seen regularly, from missing the complement symbol. 10 was another common incorrect answer from the number of elements that are not in *X*.

Answers: **(a)(i)** $\in$ **(ii)** $X \cap Y$ **(iii)** $\varnothing$ **(b)** *u, v, w* **(c)** 5

Question 20

Most candidates correctly identified the single transformation in part **(a)** as a rotation. Many also correctly provided the centre and angle of rotation. Some candidates either missed out one of these features or gave it incorrectly. For example, some candidates gave the centre of rotation as (0, –1) or the angle of rotation as 90° clockwise, rather than anti-clockwise. There were fewer fully correct answers seen to part **(b)**, with an incorrect scale factor of 2, rather than –2, being quite common. Most candidates correctly described the transformation as an enlargement, and the centre of the enlargement was often given correctly. Many candidates incorrectly described mapping shape *A* onto shape *C* by using more than one transformation, usually a rotation and an enlargement. It is worth noting that 'a negative enlargement of scale factor 2' was a very common incorrect description which was given just one mark (for enlargement), rather than two marks for 'an enlargement of scale factor –2'.

Answers: **(a)** Rotation, centre (0, 0), 90° anti-clockwise **(b)** enlargement, centre (0, 3), scale factor –2

Question 21

Candidates demonstrated a good understanding of functions throughout all parts of the question. Part **(a)** was the most successful part with many reaching the correct answer. The most common error was to omit the brackets when writing $7 - 7 - 2$, hence leading to –2 as the answer. Other incorrect calculations seen were $(7 - 2)(7 - 2)$ and $2(7 - 2)$. Part **(b)** was less well answered and produced a wider variety of combinations including $(4x + 2)(7 - x)$, $7 - 4x + 2$, $4x + 2(7 - x)$ and $7 - x(4x + 2)$. From the correct starting point of $4(7 - x) + 2 = 28 - 4x + 2$, there were quite a few candidates with a final answer of $26 - 4x$. A significant number of candidates also followed $4(7 - x) + 2$ by $28 - x + 2$ or $21 - 4x + 2$. Part **(c)** was the most challenging part of the question with far fewer correct answers. By far the two most common incorrect starting points were $2(15 - x^2)$ and $15 - 2x^2$ instead of $15 - (2x)^2$. Less often seen was $15 - 2x(x^2)$ and incorrectly combining terms after the correct answer of $15 - 4x^2$ to $11x^2$.

Answers: **(a)** 2 **(b)** $30 - 4x$ **(c)** $15 - 4x^2$

Question 22

In part **(a)** almost every candidate gave the correct answer. A few candidates wrote $\frac{9}{19}$ or $\frac{9}{40}$. Part **(b)(i)** was also well answered but proved a little more challenging for some. Many gave the correct answer but a few added the fractions $\frac{6}{20}$ and $\frac{5}{19}$ instead of multiplying and some gave the incorrect denominator such as $\frac{6}{19}\times\frac{5}{18}$ or even three products $\frac{6}{20}\times\frac{5}{19}\times\frac{4}{18}$. It was also common to see various fractions added to produce $\frac{3}{38}$ and various forms of incorrect written explanations, e.g. that the 3 on the numerator came from 6 green sweets divided by 2 because there are 2 sweets picked, along with similar incorrect explanations for 38. Part **(b)(ii)** was well answered by many candidates having had the help of part **(b)(i)** to remind them that it was without replacement. Some reverted back to probabilities with replacement despite having correctly answered **part (b)(i)**. The most common errors were to forget to double $\frac{5}{20}\times\frac{9}{19}+\frac{6}{20}\times\frac{9}{19}+\frac{6}{20}\times\frac{5}{19}$ or to use products of three terms such as $\frac{5}{20}\times\frac{9}{19}\times\frac{8}{18}$. Other incorrect working included $1-\frac{3}{38}+\frac{5}{20}\times\frac{4}{19}+\frac{9}{20}\times\frac{8}{19}$, i.e. omitting the brackets. Some used the correct method but calculated the fractions incorrectly, e.g. when doubling $\frac{190}{380}$ they doubled the numerator and the denominator.

Answers: **(a)** $\frac{9}{20}$ **(b)(ii)** $\frac{258}{380}$

MATHEMATICS

Paper 0580/32
Paper 32 (Core)

Key messages

To succeed in this paper, candidates need to have completed full syllabus coverage, remember necessary formulae, show all working clearly and use a suitable level of accuracy. Particular attention to mathematical terms and definitions would help a candidate to answer questions from the required perspective.

General comments

This paper gave all candidates an opportunity to demonstrate their knowledge and application of Mathematics. Most candidates completed the paper and made an attempt at most questions. Although a number of questions have a common theme, candidates should realise that a number of different mathematical concepts and topics may be tested within the question. The standard of presentation and amount of working shown was generally good. Centres should continue to encourage candidates to show formulae used, substitutions made and calculations performed. Attention should be made to the degree of accuracy required, and candidates should be encouraged to avoid premature rounding in workings. Candidates should also be encouraged to read questions again to ensure the answers they give are in the required format and answer the question set.

Comments on specific questions

Question 1

(a) (i) This part was reasonably well answered with the full range of possible explanations seen. The most popular explanation was using the idea of enlargement although scale factors, ratio of sides being the same and a numerical comparison of corresponding sides were also successfully used. One common error, often connected to a lack of working, was in simply stating the value of 3. A significant number of candidates described the geometrical properties of the two rectangles, such as their angles are all the same, they are all 90°, opposite sides are equal, the order of rotational symmetry is 2.

(ii) This part was less successful with few candidates appearing to appreciate that the (scale factor)^2 gives the answer directly. The common errors included the answer of 3 with no working or explanation; using $33.75 - 3.75 = 30$ rather than the correct method of $33.75 \div 3.75 = 9$.

(b) (i) This part on identifying the required top face on the given net of a cube was largely successful, although the full variety of incorrect faces was seen.

(ii) This part was reasonably well answered with the full range of possible nets seen.

(c) (i) This part on finding the surface area of a given cuboid was generally well answered with the majority showing clear and sufficient working. Common errors included omission of the $\times 2$ factor, finding the area of just one face (usually the top face), with a number of incorrect or incomplete formulas also seen and applied.

(ii) This part on finding the volume of the given cuboid was generally very well answered with the majority again showing clear and sufficient working. Again a number of incorrect or incomplete formulas were seen and applied, often involving the squares or cubes of the given sides.

(iii) Writing down the dimensions of a different cuboid with the same volume proved successful for the majority of candidates, with the full range of possible answers seen. The common error was to assume that dimensions such as 4 by 3 by 6, 6 by 3 by 4 or 3 by 6 by 4 described a different cuboid to the one given.

Answers: **(a)(i)** one rectangle is an enlargement of the other **(ii)** 9 **(c)(i)** 108 **(ii)** 72
(iii) three positive numbers (other than 3, 4, 6) with product 72

Question 2

(a) (i) This part was generally well answered with the majority of candidates able to use the pattern from the given diagram to identify the two required numbers.

(ii) This part was less successful with few candidates appearing to appreciate that the pattern could again be used. The common error was 'column 2, row 15' although a full variety of incorrect answers were seen.

(iii) Many candidates found this part challenging and did not seem to appreciate that the Row 1 numbers of 3001, 3021, 3041, formed a sequence with first term 3001 and a common difference of 20.

(b) This part was generally well answered with the majority of candidates able to convert the given time into minutes, increase it by 25% either directly or more commonly in stages, and convert back to a time in hours and minutes. The common errors tended to come from candidates using 1.40 hours or 140 minutes.

(c) (i) This part was generally poorly answered with the majority of candidates not appreciating what the values given in the grouped frequency table actually indicated. A very common error was $64 - 27 = 37$.

(ii) This part again was poorly answered for the same reasons. The very common error was $(63 + 42) \div 2 = 52.5$.

(iii) This part, however, was generally answered better with a significant number of candidates able to score full marks, with others able to score one or two method marks. However, it was also noted that a significant number lost the final accuracy mark with answers of 6.83 or 6.8 and no more accurate figure seen. Common errors included $196 \div 4$, $196 \div 26$ and $26 \div 4$.

(iv) This part was generally well answered with the majority of candidates able to give the required probability.

Answers: **(a)(i)** 3043, 3061 **(ii)** column 7, row 15 **(iii)** $20n + 2981$ **(b)** 2 hours 5 minutes **(c)(i)** 3
(ii) 7 **(iii)** 6.84 **(iv)** $\frac{132}{196}$

Question 3

(a) (i) The majority of candidates were able to successfully complete the frequency table.

(ii) The majority of candidates were able to successfully give the mode as 'surfing' although '8' was a common error.

(iii) The majority of candidates were able to successfully calculate the required percentage.

(b) (i) This part on time conversion using the 12-hour clock was reasonably well answered. As this is a one mark question, 3.37, 03 37 and 03 37 pm are not acceptable responses.

(ii) Working out the time difference proved challenging for a significant number of candidates and the lack of working made it difficult to pinpoint the errors. Working of 22 07 – 09 41 was seen but often led to incorrect answers of 12 h 66 min or 13 h 6 min. The adding on method of 19 min + 12 h + 7 min was rarely seen but did usually lead to the correct answer of 12 h 26 min.

(iii) Working out the start time proved challenging for a significant number of candidates and the lack of working again made it difficult to pinpoint the errors. Common errors included 01 30 – 1.30 = 12.00 from using the incorrect value from the table, 14.22 – 1.30 incorrectly leading to 12.92 or 13.32, and 14.22 – 1.5 = 12.72 or 13.12.

Answers: **(a)(i)** 5, 8, 4, 2, 6 **(ii)** surfing **(iii)** 24 **(b)(i)** 3.37 pm **(ii)** 12 h 26 min **(iii)** 12 52

Question 4

(a) (i) This part was generally well answered with the majority of candidates able to complete the given table and score full marks. Other candidates scored one mark for correctly calculating the missing angle but did not appreciate that the identity '1 fish is represented by 8°' could be obtained from the given information and used to find the two missing values for the number of herring and tuna.

(ii) This part was generally well answered with the majority of candidates able to complete the given pie chart.

(b) This part was generally well answered with the majority of candidates able to work out the required number.

Answers: **(a)(i)** 4, 17, 136° **(b)** 36

Question 5

(a) (i) This part was generally well answered with the majority of candidates able to write the given number in words. The alternative of 'six lakh, four thousand, nine hundred and twenty five' was condoned. Common errors included the use of six or sixty million, use of sixty lakh, use of forty nine hundred, double use of the word 'thousand', and the omission of the words 'hundred' or 'thousand'.

(ii) This part was generally well answered with the majority of candidates able to write down a suitable prime number. Common errors included 51, 57, 55.

(iii) This part was generally well answered with the majority of candidates able to write down the correct value. Common errors included 0, 999 and 9990.

(b) (i) This part was reasonably well answered although the common errors of 98, 700, 7 and 15 were seen. As this is a one mark question, 15 (coming from $7 \times 15 = 105$) is not an acceptable response.

(ii) This part was reasonably well answered although the common errors of 125, 81 and 99 were seen. As this is a one mark question, 4 or 4^3 are not acceptable responses.

(iii) This part was reasonably well answered with many candidates awarded full marks. Other candidates were generally able to find at least four factors and could be awarded one mark. One common error was to write down the first six multiples of 45 although this was rarely seen.

(iv) This part was generally poorly answered with the majority of candidates not appreciating or aware of the definition of an irrational number. Common errors included 6, 7, 6.5, $\sqrt{6.5}$, 6.33333 together with a full variety of other recurring and non-recurring decimals between 6 and 7.

Answers: **(a)(i)** six hundred and four thousand, nine hundred and twenty five **(ii)** 53 or 59 **(iii)** 1
(b)(i) 105 **(ii)** 64 **(iii)** 1, 3, 5, 9, 15, 45 **(iv)** any irrational number between 6 and 7

Question 6

(a) (i) This part was reasonably well answered with the majority of candidates applying the correct distance, speed, time formula. Common errors included using the time as 0.12, 15.12 and 10.

(ii) This part was generally well answered with the majority of candidates able to perform the calculation of 15 40 – 15 12 or to count the squares from the given graph. A common error was 30 minutes.

(iii) This part was reasonably well answered, particularly with a follow through allowed, with the majority of candidates using either 15 40 – 12 minutes or 15 00 + 28 minutes. A small yet significant number attempted to use a distance, time, speed formula for Samir but were rarely successful.

(b) (i) This part on finding and simplifying a ratio was reasonably well answered. The majority of candidates who correctly started with 6 : 20 were able to simplify to 3 : 10. Common errors included the use of 26 minutes for walking, and using the time of 15 06 with 15 20 or 15 26.

(ii)(a) This part on completing the travel graph for Rahul using the given information was generally poorly answered with many candidates unable to correctly identify the points (15 20, 2) and (15 28, 4). Calculations to show that he walked for 20 minutes and cycled for 8 minutes were rarely seen.

(ii)(b) This part was better answered particularly as a follow through was applied. Common errors included the answer of 2 minutes (the difference at the park rather than at the bench), misreading of the scale, and miscounting of the squares on the graph.

(ii)(c) This part was poorly answered even with a follow through applied. Many candidates did not appreciate that to answer the question they had to find the biggest vertical displacement between their two graphs.

Answers: **(a)(i)** 20 **(ii)** 28 **(iii)** 15 28 **(b)(i)** 3 : 10 **(ii)(b)** 14 **(ii)(c)** 1.25 to 1.5

Question 7

(a) This part was generally well answered although a number of unrealistic answers were seen. Those candidates who found the required area by counting the squares on the given diagram were much more successful than those who attempted to apply a variety of, often incorrect, formulas.

(b) (i) Candidates found describing a single transformation demanding with a significant number omitting part of the description, or a smaller number giving a double transformation as their answer. Less able candidates often give an answer with descriptive rather than mathematical language. In this part the majority of candidates were able to correctly identify the transformation as a rotation. The angle of rotation was generally correctly stated although common errors of 90° anti-clockwise, 90° and 180° were seen. The centre of rotation proved more challenging and was often not given.

(ii) The majority of candidates correctly identified the transformation as translation although many didn't give the correct vector or the correct digits were given but as a co-ordinate.

(iii) The majority of candidates were able to correctly identify this transformation as an enlargement.

The scale factor was generally correctly stated although common errors of $\frac{1}{2}$, –2 and 4 were seen.

The centre of enlargement proved more challenging and was often not given.

(c) This part, which required the drawing of a reflection, proved to be challenging. Common errors included reflections drawn in $x = 0$, $x = -2$, $x = -1.5$ or $y = 0$, $y = 1$ or $y = -1$. A significant number were unable to give a response to this part, possibly because they could not identify the position of the line of reflection, $x = -1$.

Answers: **(a)** 4 **(b)(i)** rotation, 90° clockwise, centre (0,–2) **(ii)** translation, $\begin{pmatrix} -4 \\ 2 \end{pmatrix}$

(iii) enlargement, scale factor 2, centre (–2,–7)

Question 8

(a) (i) The majority of candidates found this part very demanding and few correct answers were seen. The method of 1 cm to 15 km, 1 cm to 15 000 m, 1 cm to 1 500 000 cm giving the scale in the required form as 1:1 500 000 was not generally appreciated. Common errors included 1:15, 1:*n*, 1:15*n* and 6.4, with a significant number of nil responses.

(ii) The majority of candidates were able to measure the required distance and convert to kilometres using the given scale although common errors of 6.4 and 1.5 were seen.

(iii) Many candidates appeared to be confused by bearings with common errors of the distance 6.4 cm and angles of 63, 27, 243, 207, 297 and 333 being often seen.

(iv) The required construction proved very challenging for many candidates and proved to be a good discriminator. Many candidates did not appear to appreciate that the four required constructions were the bearings of 250° and 295° from *Y*, and arcs of radius 3 cm and 4 cm with centre *Y*. Although a number of candidates were able to draw one or more of these constructions, usually the arcs, to score one, two or three marks, full marks were rarely awarded. There were a significant number of incorrect shaded regions drawn with no construction lines or arcs, and also nil responses.

(b) The required reverse bearing proved very challenging for many candidates and proved to be a good discriminator. Many candidates did not appear to appreciate the calculation required was either 180 + 73 or 360 – 107. Those candidates who drew a sketch diagram tended to be more successful. Common errors included 360 – 73 = 287, 180 – 73 = 107 and 90 + 73 = 163, with a significant number of nil responses.

Answers: **(a)(i)** 1:1 500 000 **(ii)** 96 **(iii)** 117° **(b)** 253°

Question 9

(a) This part was generally answered well although common errors of 9*pn* were seen.

(b) This part was generally answered well although common errors of 13*pn* were again seen.

(c) Some very good solutions to the simultaneous equations were seen. The majority of candidates used the elimination method to solve their equations. The setting out was generally very clear with very few errors or slips being made and only the rare candidate choosing the wrong operation for the elimination. On the rare occasion when candidates did choose to use the substitution method, most were able to rearrange one of the equations and correctly substitute into the other. However, this method did cause more candidates to lose accuracy marks with numerical and algebraic errors leading to incorrect final values for *p* and *n*.

Answers: **(a)** 450 **(b)** $10p + 3n = 525$ **(c)** $p = 30$ and $n = 75$

Question 10

(a) This part was generally answered well although a common error was the inclusion of Ful.

(b) (i) This was generally well answered although common errors included $\sqrt{19.6} \times 10 = 44.3$, and $\sqrt{19.60} = 4.43$.

(ii) Changing the subject of a formula proved demanding for a number of candidates. The first working line of $s^2 = 19.6 \times h$ was not always appreciated. Common errors included $\frac{s}{\sqrt{19.6}}$, $\sqrt{19.6s}$ and $\frac{\sqrt{19.6}}{s}$.

Answers: **(a)** Cala, Elu **(b)(i)** 14 **(ii)** $\frac{s^2}{19.6}$

Question 11

(a) (i)(a) This part was generally answered well although common errors of *A* or *D* were seen.

(i)(b) This part was reasonably well answered although the full range of incorrect answers were seen suggesting that the use of $y = mx + c$ was not always appreciated.

(i)(c) This part was reasonably well answered although the full range of incorrect answers were seen suggesting that the use of $y = mx + c$ was again not always appreciated.

(ii) This part was generally answered well although the common error of $-3 \times -26 + 4 = 82$ was often seen.

(b) (i) The table was generally completed very well with the majority of candidates giving three correct values although a common error was calculating $y = 21$ when $x = -3$.

(ii) This part was well answered by many candidates who scored all four possible marks for accurate, smoothly drawn curves. Most others scored three marks, the fourth mark being most commonly lost for one point being plotted out of tolerance, or for just plotting the points without drawing the curve through them, or for joining the points with ruled lines.

(iii) Candidates found this part challenging with (6, –24) being a very common error.

Answers: **(a)(i)(a)** *C* **(i)(b)** *A* **(i)(c)** *D* **(ii)** 10 **(b)(i)** 39, 0, –9 **(iii)** (5, –25)

MATHEMATICS

Paper 0580/42
Paper 42 (Extended)

Key messages

To achieve well in this paper, candidates need to be familiar with all aspects of the extended syllabus. The recall and application of formulae and mathematical facts to apply in varying situations is required as well as the ability to interpret situations mathematically and problem solve with unstructured questions.

Work should be clearly and concisely expressed with answers written to an appropriate accuracy.

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

General comments

Some questions allowed candidates to recall and demonstrate their skills and knowledge; others provided challenge where problem solving and reasoning skills were tested. Solutions were usually well-structured with clear methods shown in the space provided on the question paper.

Candidates had sufficient time to complete the paper and omissions were due to lack of familiarity with the topic or difficulty with the question rather than lack of time.

Most candidates followed the rubric instructions with respect to the values for π and three significant figure accuracy for answers. A few approximated values in the middle of a calculation in some parts and lost accuracy for the final answer as a result.

The topics that were done very well included percentages and money calculations, algebraic manipulation and solving inequalities, volume and surface area of prisms, forming and graphing inequalities, statistics, inverse of a 2 by 2 matrix and sequences.

The weaker topics included problem solving with bounds, 2D problem solving with circles, using graphs to solve related equations and inequalities, problem solving with 3D shapes, accuracy with magnitude of a vector, time conversions and calculating the distance between two points.

Comments on specific questions

Question 1

(a) (i) This part was almost always answered correctly. On occasion, candidates inappropriately rounded this exact answer of \$23.27 to \$23.3.

(ii) This reverse percentage question was answered correctly by the majority of candidates. Errors seen included finding 108% of \$2.97, 92% of \$2.97 or dividing \$2.97 by 0.92 instead of by 1.08.

(b) Most candidates successfully converted \$35 into rupees and went on to give the correct answer. Some candidates stopped after correctly carrying out the conversion and did not calculate the difference in the prices. A few candidates gave the answer in dollars or misinterpreted the question and began by equating \$35 to 2300 rupees.

(c) There were few candidates who scored full marks. Some candidates did not recognise the need to use bounds and simply calculated 600 ÷ 9. Many candidates identified 8.5 and 9.5 for the dress length and of these some incorrectly selected 9.5. The most common difficulty was identifying the bounds for the fabric length. 605 m was often used instead of 602.5 m. Some candidates who correctly calculated 602.5 ÷ 8.5 rounded their answer up to 71 or did not round at all.

Answers: **(a)(i)** 23.27 **(ii)** 2.75 **(b)** 12.4 **(c)** 70

Question 2

(a) Candidates found this part challenging. A common error was to assume that the side length of the square was 8 cm or, on occasion, 16 cm. A significant number of candidates who correctly used Pythagoras' theorem to find the side length lost accuracy by square rooting 128, approximating to 11.31 for example, and then squaring again to give an inexact value for the area.

(b) (i) The majority of candidates completed a correct method to find the segment area. Occasionally candidates who subtracted the area of the square from the area of the circle omitted the final step of dividing by 4. Some candidates assumed the segment was a semi-circle with radius of half of the square's side length and others used 60° or 120° instead of 90° for the intersection of the diagonals of a square.

(ii) Many candidates were able to find the arc length for the segment and completed a correct method by adding on their square side length. A common incorrect approach seen was to subtract the perimeter of the square from the circumference of the circle and then divide by 4. Some candidates continued to treat the segment as a semi-circle as did some others who now used the area from part **(b)(i)** to calculate its radius first.

Answers: **(a)** 128 **(b)(i)** 18.3 **(ii)** 23.9

Question 3

(a) Nearly all candidates found the correct values 0 and 2.4. Many candidates did not score the third mark by incorrect rounding to –0.16.

(b) There were many fully correct graphs and most other candidates scored at least two marks. When plots were incorrect the errors usually occurred reading the horizontal scale with the first three points in the table and occasionally (1.5, 0.67). Very few candidates were penalised because of line segments or poor curves.

(c) Few candidates scored full marks. Many candidates were able to identify two values on the curve where $y = 2$. However, many treated this as an equation and gave two single values rather than inequalities, only scoring one mark.

(d) (i) Only the more able candidates could relate the given equation to the equation of the graph and give a correct equation for the line. Many found this question challenging and simply attempted to rearrange the equation given in the question, usually ending up with a quadratic or an equation containing $\frac{1}{x}$. Marks were lost due to slips in the rearrangement or for giving an answer as an expression instead of an equation, usually $4 - x$.

(ii) Candidates who had given the correct equation in part **(d)(i)** almost always drew the line correctly and were able to give two correct values for x. Several rearranged the given equation to obtain a quadratic and then used the formula. It was quite common for candidates to draw a straight line even though their equation was not linear. A small but significant number did not attempt this part.

Answers: **(a)** 0, −0.17, 2.4 **(c)** $x \leqslant 0.17$ to 0.25 and $x \geqslant 2.25$ to 2.3 **(d)(i)** $y = 4 - x$ **(ii)** 0.125 to 0.2 and 2.15 to 2.2

Question 4

(a) This part was nearly always answered correctly, with only a few candidates reaching $-t^2 = s - k$ and either ignoring the negative sign or being unable to proceed.

(b) (i) Most candidates were able to factorise the difference of two squares.

(ii) While many candidates were able to simplify the given expression, a significant number made sign errors in factorising the denominator. There were a few candidates who attempted to cancel terms in the original expressions.

(c) This part was well done by a large number of candidates who scored full marks. Many of those who omitted to use brackets in their initial working, writing $x - 8(x + 1) + 3x \times x$ for the numerator, recovered to obtain the correct terms, although there were others who did not.

(d) There were many good answers to this part but also many errors. A number of candidates correctly dealt with the inequalities separately to obtain $n > 2.25$ and $n \leqslant 6$, and this was quite often left as the final answer, although many did continue to state the integers required. There were, however, many candidates who made a variety of different errors when rearranging the inequalities and there were also a number who simply tested various numbers.

Answers: **(a)** $\sqrt{k-s}$ **(b)(i)** $(x+5)(x-5)$ **(ii)** $\frac{x-5}{x-7}$ **(c)** $\frac{4x^2-7x-8}{x(x+1)}$ **(d)** 3, 4, 5, 6

Question 5

(a) (i) Nearly all candidates recognised that they must multiply the area of the hexagon by 15.2 and there were many correct answers. A number of candidates appeared to have learnt formulae for finding the area of a regular polygon. This could only succeed when the formula was quoted and used correctly, which was not always the case. Among those who worked from first principles, there was a variety of methods of dividing the hexagon into different parts to find its total area. The most obvious and least susceptible to errors, six equilateral triangles of side 7 cm, was not a common choice.

(ii) The majority of candidates found the total surface area correctly. The area of the six rectangles was usually correct, but some candidates forgot to include the area of a second hexagon.

(b) This part was often done correctly. A few candidates lost accuracy at the final stage in giving their answer to only two significant figures and sometimes also lost a method mark by not showing that they must find the cube root of their value for r^3. Some candidates misread the question and assumed that the prism was formed into a single sphere, whose radius they found. A final error among some of these candidates was to divide this radius by 6.

Answers: **(a)(i)** 1930 or 1940 **(ii)** 893 **(b)** 2.71

Question 6

(a) There were many fully correct answers in this part. Apart from $y > x$, which was usually correct, errors were evenly spread across the other three inequalities. Errors usually involved the inclusion or exclusion of the equality and in other cases the inequalities were reversed.

(b) Many candidates demonstrated a good understanding of regions. Drawing the four straight lines proved to be the most common cause for loss of marks. The line $x = 15$ produced the least number of errors followed by $y = 50$, which was sometimes drawn as $x = 50$. The two sloping lines produced the most errors, sometimes drawing the line $y = x + 1$ to represent the inequality $y > x$. Shading out was generally accurate, the common error usually involved including the small triangle where $y > 50$.

(c) Most candidates understood the need to test points in their region but some candidates tested points for which $x + y < 70$. Only a minority were able to determine the maximum spend of \$189, with most candidates offering answers such as \$190 and \$187.

Answers: **(a)** $y > x$, $x \geqslant 15$, $y < 50$, $x + y \leqslant 70$ **(c)** 189

Question 7

(a) (i) The great majority of candidates answered this part correctly.

(ii) Most candidates were very efficient at finding the mean of grouped data and many correct answers were seen, either in full, as the answer was an exact one, or corrected to three significant figures. The common errors that a few candidates made were to use the group width instead of the mid-interval values, or to find the mean of the six mid-interval values.

(b) Nearly all candidates correctly answered this part.

(c) The cumulative frequency diagram was plotted and drawn accurately by nearly all candidates. The few who drew blocks gained no credit and could only make guesses at the answers to part **(d)**.

(d) (i) The median was nearly always correct.

(ii) Many candidates found the interquartile range correctly. Where errors were made in reading values off, these were usually in the upper quartile rather than the lower quartile. Some less able candidates subtracted the frequencies at the upper and lower quartiles to obtain a frequency of 80 and read off the median value again.

(iii) This part was usually correct. A mark was available for those who misread their curve but who indicated that they were looking at a frequency of 144.

(iv) There were many correct responses but a number of answers were out of range because candidates misread the scale of the cumulative frequency axis.

Answers: **(a)(i)** $\frac{9}{160}$ **(ii)** 58.125 **(b)** 85, 140, 151, 160 **(d)(i)** 57 to 59 **(ii)** 36 to 42 **(iii)** 92 to 94 **(iv)** 130 to 137

Question 8

(a) Many candidates answered this question well and were able to score full marks. There were a number of candidates who struggled to correctly find angle *LPM*. The most common error was to use the 201° bearing anti-clockwise from *P* giving angle *LPM* = 32° from 360° – (201° + 127°). Provided it was clear that a candidate was using *their* angle *LPM*, these candidates were often awarded method marks for the correct use of the sine rule.

(b) (i) This proved challenging for many candidates. The simplest way to answer this question was to use 356 × sin 64. Whilst some candidates used this method successfully, others were successful in using longer methods. There were many candidates who were not aware that they needed to find the perpendicular distance from *M* to *LP* and common errors included methods involving either bisecting 248 km or bisecting the 42° angle or using angle *LPM* = 90°.

(ii) This part was answered reasonably well. Common errors were to either give the time in the incorrect form, for example, 2.57 or 14.57, or to be unable to convert the time in hours to a time in hours and minutes, for example, 6.2 incorrectly given as 6 hours 20 minutes or 6 hours 2 minutes. In addition, a considerable number of candidates did not read the question carefully and found the time to travel their distance from part **(b)(i)**.

Answers: **(a)** 356 **(b)(i)** 320 **(ii)** 02 57

Question 9

(a) The majority of candidates understood that Pythagoras' theorem should be used to find the magnitude of a vector and many correct answers were seen. However, the omission of brackets for $(-1)^2$ frequently led to an incorrect answer. Inaccurate answers of 7 or 7.1, without a correct method shown, scored zero. A number of candidates did not recall the meaning of magnitude and omitted this question part; others gave an answer as another vector, as co-ordinates, or as a negative number.

(b) Many correct answers were seen in this question part. Errors included equating $\frac{1}{6m-10m}$ to 24, equating $10m-6m$ to 24 or equating $10m+6m$ to 24.

(c) (i) Candidates found this multiplication of a 1×2 matrix with a 2×1 matrix a challenge. The most common incorrect answers were $\begin{pmatrix}-4\\14\end{pmatrix}$ and $(-4 \quad 14)$. Other candidates gave a 2×2 matrix or stated that the multiplication was not possible. Some candidates who correctly multiplied the two matrices spoilt their answer by omitting the brackets of the resulting 1×1 matrix.

(ii) This multiplication of a 2×2 matrix with a 2×1 matrix was well answered irrespective of success or otherwise in part **(c)(i)**. Errors seen were usually numerical slips and on occasion the matrix $\begin{pmatrix}-8 & 10\\-12 & 18\end{pmatrix}$.

(iii) Most candidates were successful and scored full marks. A few arithmetical slips were seen. The most common error was $\begin{pmatrix}4 & 25\\9 & 81\end{pmatrix}$ found from squaring the individual elements.

(iv) Finding the inverse matrix was answered very well.

Answers: **(a)** 7.07 **(b)** –6 **(c)(i)** (10) **(ii)** $\begin{pmatrix}2\\6\end{pmatrix}$ **(iii)** $\begin{pmatrix}19 & 55\\33 & 96\end{pmatrix}$ **(iv)** $\frac{1}{3}\begin{pmatrix}9 & -5\\-3 & 2\end{pmatrix}$

Question 10

(a) This question gave mixed answers with a number scoring full marks. Errors arose from candidates adding the corresponding co-ordinates instead of subtracting and from writing part of their calculation incorrectly, for example $4-(-2)^2$ instead of $(4-(-2))^2$. A few subtracted the squared terms instead of adding them. Some calculated the gradient of the line.

(b) (i) There were many correct answers. A small number made a slip with one of the co-ordinates and earned partial credit. Those earning no credit often subtracted the corresponding co-ordinates before dividing by 2. A small number found the mean of $x + y$ for each pair.

(ii) This part was also answered well by most candidates who showed a good understanding of gradient. Most errors were made from slips when subtracting the co-ordinates and a few who continued further and attempted to give the equation of the line.

(iii) Many candidates understood the relationship between the gradients of perpendicular lines and those who wrote the perpendicular gradient as $-\frac{1}{2}$ usually went on to earn full marks. Other candidates often gave the gradient of the perpendicular line as 2, –2 or as $\frac{1}{2}$. Some of these were able to earn a method mark for attempting to calculate the constant term. Some gave an expression, $-\frac{1}{2}x + 4$, as their answer and not an equation.

Answers: **(a)** 10.8 **(b)(i)** (6, 4) **(ii)** 2 **(iii)** $y = -\frac{1}{2}x + 4$

Question 11

(a) Most candidates had no difficulty in completing the table. Errors were rare and were usually arithmetic slips. A small number of candidates left sequence *C* blank, not spotting that it could be found from *A* – *B* or by working with the differences.

(b)(i) Many candidates gave a correct formula for sequence *A*. Some appreciated that a quadratic expression was needed but could get little further than n^2. A small number attempted to write the general formula for the *n*th term of a quadratic sequence but almost all were unable to recall it correctly.

(ii) Many correct expressions were seen with common errors including $n + 1$ and $4n \pm k$.

(c) A large majority of candidates correctly equated 576 with $(n-1)^2$ and many solved the equation correctly. Some obtained the equation and attempted to expand the bracket and solve the resulting quadratic equation, but slips caused many to lose the accuracy mark. Others earned a method mark for equating 576 to their incorrect expression. A small number misinterpreted the question and calculated the 576th term.

(d) (i) Candidates were slightly less successful in this part of the question and with a greater number making no attempt. Some appreciated that a quadratic expression was needed and attempted to write simultaneous equations derived from $an^2 + bn + c$. Several were successful but slips in the arithmetic or algebra led to a loss of some or all of the marks. Those that realised that *C* could be derived by subtracting the terms of the two sequences were often successful in obtaining the correct expression, although writing the subtraction as $(n-1)^2 - n + 3$ was a common error.

(ii) A majority of candidates substituted $n = 30$ into their answer for part **(d)(i)** and obtained the correct value. A higher number of candidates made no attempt at a response.

Answers: **(a)** 25, 9, 16 **(b)(i)** $(n-1)^2$ **(ii)** $n + 3$ **(c)** 25 **(d)(i)** $n^2 - 3n - 2$ **(ii)** 808