MATHEMATICS (SYLLABUS D)

Paper 4024/11
Paper 11

Key messages

In this paper it is important that candidates are familiar with the whole syllabus and remember necessary formulae.

All working should be shown and answers clearly written in the appropriate answer space.

Accuracy in basic number work is essential.

Care should be taken that letters and digits are formed clearly and unambiguously e.g. distinguishing between 4 and 9.

Candidates should remember to obey specific instructions in the questions e.g. express as a fraction in its simplest form or give your answer to 2 significant figures.

General comments

There were many well presented scripts of a good standard and candidates appeared to have sufficient time to complete the paper.

Candidates of all abilities scored well in **Questions 1, 3(b), 12(c), 14(a)** and **(b), 16, 17(b), 18(a)(ii), 20(b), 22(a)** and **(b)(i),** and **26(a)** and **(b)(i)**.

The questions with which candidates had the most difficulty were **Questions 2(b), 13(b), 15, 18(b), 21(b), 23(b)** and **(c), 24** and **25(b).**

Comments on specific questions

Question 1

(a) This basic fraction work was well done. There were some numerical errors e.g. $1\frac{1}{3} = \frac{5}{3}$, $9 + 32 = 31$ and $\frac{3}{8} + \frac{4}{3}$ cancelled or equated to $\frac{7}{11}$.

(b) There was more room for error here so slightly less well done. 2×0.6 was a popular incorrect answer. Candidates who begin by removing the brackets need to ensure that they deal correctly with the minus sign.

Answers: **(a)** $1\frac{17}{24}$ **(b)** 3.2

Question 2

(a) Some candidates shaded the correct square. Many omitted this question or shaded a square which resulted in just part of the diagram having a line of symmetry.

(b) Some candidates identified the correct centre of rotation but omitted or gave the wrong order of rotation. Again many omitted this part.

Question 3

(a) A good proportion of correct answers were seen. The most common misunderstanding was to give the answer as $\frac{15}{4}$, $\frac{375}{100}$ or even 375. Candidates need to remember to do as the question instructs so $\frac{15}{400}$ needed to be cancelled to give the fraction in its simplest form.

(b) This question was well answered with candidate showing a good understanding of the need to change all to decimals, percentages or 40 ths.

Answers: **(a)** $\frac{3}{80}$, **(b)** $\frac{3}{4}$, $\frac{31}{40}$, $\frac{4}{5}$

Question 4

(a) Candidiates understood the demand in terms of finding the difference. The full subtraction was not always accurate and the answer not always corrected to 2 significant figures as required so answers such as .004389, .0040, 4300, 4400, .004 and 0.44 were seen.

(b) There were some good responses to this question with candidates understanding the need to estimate 2.986^2 as 3^2 and 4.002^2 as 4^2. Some cancelled the squares and square root and gave the answer as 3 + 4 and a few did some long multiplication.

Answers: **(a)** 0.0044 **(b)** 5

Question 5

(a) Many candidates need to work on the use of standard form as the answer 16×10^{10} was seen a lot with candidates forgetting to convert to standard form.

(b) There were some good responses here. Candidates need to remember the importance of place value as some simply added 7 and 4 and gave the answer as 11×10^x where x ranged from 11 to 30.

Answers: **(a)** 1.6×10^{11} **(b)** 7.4×10^6

Question 6

This was generally well answered and the correct mathematical processes were often seen. Candidates were able to cope with the arithmetic needed. Most marks were lost by errors in the units e.g. converting g to kg

Answer: 2.2

Question 7

Most candidates labelled the vertical axis so that the correct frequencies could be recorded. Candidates need to understand the difference between a frequency polygon and a bar chart (as the latter were very common) and to remember that with a frequency polygon the plots are at the mid-interval values.

Question 8

Many candidates were able to obtain solutions to the inequalities in the form n $\frac{23}{4}$ and n $\frac{33}{4}$ but some had difficulty in translating their solutions into the integer form in order to completely answer the question.

Answer: 6, 7, 8

Question 9

There were many good responses to this question. Some candidates read the question as '*y* is inversely proportional to *x*' and some others started with the correct relationship, found that $k = 12$ and then used $k = 12$ in the formula $y = k.\frac{1}{x}$. It is important to read such questions very carefully.

Answer: $\frac{12}{25}$

Question 10

Candidates need to revise the multiplication of a 1 × 3 matrix by a 3 × 2 matrix. Less than half of the candidates answered this question correctly. Overall many shapes were seen indicating some confusion with this topic.

Answer: $\begin{pmatrix} 1 & 8 \end{pmatrix}$

Question 11

The basic rules of combining fractions were well known so that many candidates gained the method marks available and there were many correct solutions. The simplification of the numerator proved a problem for some candidates and prevented them from presenting a completely correct solution.

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

Question 12

Answers in all parts sometimes contained *x*.

(a) Usually either correct or omitted. Some answers of –9 were seen.

(b) Some candidates read this as 9 × ½ and a number of answers of $\frac{9}{2}$ were seen.

(c) Candidates found this part the easiest of the three and many gave the correct answer.

Answers: **(a)** $\frac{1}{9}$ **(b)** 3 **(c)** 10

Question 13

(a) A good proportion of correct answers were seen. Some candidates did not appreciate the significance of the triangles being similar and attempted to use Pythagoras' theorem or thought that because *YZ* was 4 more than *BC* then *XY* was 3 more than *AB* and was equal to 7.

(b) Many found this question demanding. The main error was to use the linear scale factor. Candidates need to remember that in the formula '$A = ½\, b \times h$' the '*h*' refers to the perpendicular height of the triangle and cannot be used easily in this problem.

Answers: **(a)** 4.5 **(b)** 22.5

Question 14

(a) Most candidates completed the pie chart correctly.

(b) The response to this question was generally good but candidates must remember to express the ratio using the smallest possible whole numbers. Many left the ratio with large numbers or fractions in it e.g. 80 : 120 : 160 or $\frac{2}{9} : \frac{1}{3} : \frac{4}{9}$.

(c) There were many complicated calculations seen in response to this question as candidates had difficulty using the information given. Some used algebra e.g. $\frac{x+6}{x} = \frac{3}{2}$ => $x = 6$ but were then unsure how to use the value 6 obtained.

Answers: **(b)** 2 : 3 : 4 **(c)** 54

Question 15

(a) Many candidates had difficulty in getting to grips with this question and a greater understanding of how a translation works is needed. Candidates need to be able to apply a translation in different contexts. Some found the mid-point of *AB* and others gave the answer as (1 – 7, 6 – 7) = (– 6, –1).

(b) Most candidates who negotiated **(a)** successfully went on to do well in this part.

(c) Most candidates who negotiated **(a)** successfully went on to also do well in this part.

Answers: **(a)** (6, 2) **(b)** Square **(c)** 25

Question 16

(a) There were many good responses to this matrix subtraction. Some candidates need to be more competent in dealing with negative numbers.

(b) A good proportion of correct answers were seen with the two components of an inverse matrix, determinant and adjoint, usually attempted. Candidates need to remember that there are two items to be found and then combined and that the adjoint on its own is not sufficient.

Answers: **(a)** $\begin{pmatrix} -2 & -1 \\ -1 & 5 \end{pmatrix}$ **(b)** $\frac{1}{8}\begin{pmatrix} 3 & 1 \\ -5 & 1 \end{pmatrix}$

Question 17

(a) Most candidates achieved the partial factorisation e.g. $3(1 - 4a^2)$. Many did not go any further.

(b) Many candidates understand this type of factorisation and it was well done. Some began to factorise successfully with $x(x - 3)$ but did not complete the factorisation.

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

Question 18

(a) (i) The notation was understood by many candidates who gave the correct answer. Some candidates listed the elements of *P*.

(ii) Well done by most candidates.

(b) Some completely correct answers were seen. Many candidates attempted to use a Venn diagram and others tried to use algebra. Candidates appear to need more practice in this type of question.

Answersr: **(a)(i)** 3 **(a)(ii)** 42, 48 **(b)** 11, 19

Question 19

Throughout this question weaker candidates were heavily influenced by the diagram into assuming parallel lines, e.g. *BC* and *AD*, and hence using alternate angles, corresponding angles etc. Candidates need to remember that in a diagram only the information given can be used and nothing can be assumed. Many candidates applied the appropriate circle theorems where needed.

(a) About half the candidates were successful here. Incorrect answers included 68 from assuming that *BO* is parallel to *CD* and using corresponding angles.

(b) Very few candidates were successful here. Most assumed that *BC* and *AD* were parallel and gave the answer 43 from alternate angles.

(c) About half the the candidates were successful here but some omitted this part.

(d) Many gained a mark here often from a follow through from previous answers.

Answers: **(a)** 47 **(b)** 34 **(c)** 22 **(d)** 77

Question 20

(a) Some candidates did not use the figures on the diagram but chose to measure the angles. Candidates need to remember that such diagrams, where all the figures are given, are not drawn to scale.

A lot of candidates had difficulty with this question and did not seem to understand which angles were required for the bearings. Candidates need to improve on this topic.

(b) This part was well understood and well answered.

Answers: **(a)(i)** 220° **(ii)** 130° **(iii)** 040° **(b)** 7 mins

Question 21

(a) Many gave a good response to this part. Some thought that the shading should involve line L and shaded below the line, ignoring the given inequalities. Most knew where the lines $x = 1$, $x = 5$, $y = 2$ and $y = 4$ lay but then some were confused about which area to shade.

(b) Only the most able candidates were able to successfully answer this part. Some candidates drew a straight line through the origin. More work appears to be needed on straight lines so that candidates realise that what is needed is a straight line parallel to the given line and so that they can use their knowledge of straight lines in different contexts

Answer: **(b)(ii)** 3.5 to 4 (inclusive)

Question 22

(a) Most candidates did very well on this construction.

(b) (i) This part was also well done by the majority of candidates.

(ii) Again many good accurate constructions were seen. A few candidates drew the perpendicular bisector of *AB* or *AC*.

(c) Most candidates who completed all the constructions correctly gained this mark.

Answer: **(c)** 5.4 to 5.9 inclusive

Question 23

(a) Generally well done. A common misread of the distance was 1500.

(b) The correct answer was very rare, the common incorrect answer being 1.2. Candidates realised that Kim finished 1.2 mins after Lee but did not appreciate that Kim also started 1 min before Lee.

(c) (i) Only the most able candidates were able to draw the distance –time graph for Melvin. The most common error was to forget that Melvin was running in the opposite direction and the line was drawn from (3,0) to (13,2000). Other incorrect lines seen were from (3,0) to (10,2000), from (0,0) to (10,2000), from (3,2000) to (10,0) and from (0,2000) to (10,0)

(ii) Some good responses to this part. Some candidates chose to work initially in metres/min and then either forgot to convert or had difficulty in converting this to km/hr.

Answers: **(a)** 1450 **(b)** 2.2 **(c)(ii)** 12

Question 24

(a) Candidates did not seem to fully understand what to do to answer this question and more work on this topic is needed. Some incorrect scale factors offered were 2, –1/2 and 1:2 and the centre was sometimes given as a single digit e.g. 2. Successful candidates usually had carefully drawn construction lines to find the centre. Often one or both of these parts were omitted.

(b) More work needs to be done on shears so that candidates are more confident with this topic. Very few correct answers were seen and many candidates omitted this part.

Answers: **(a)** –2 and (0,2) **(b)** triangle with vertices at (3,1), (4,1) and (7,3)

Question 25

(a) There were a good number of correctly extended tree diagrams. Some candidates did not realise that there was no need to continue a branch finishing with a blue ball and some stopped after the third ball.

(b) (i) Many candidates found this part challenging. They forgot (or did not realise) that in order for the second ball to be blue the first one had to be red and gave the answer ½.

(ii) Some correct answers were seen. Many candidates again ignored the red ball and gave the answer as $\frac{2}{4}+\frac{2}{3}=\frac{7}{6}$ or $\frac{2}{4}\times\frac{2}{3}=\frac{1}{3}$.

Answers: **(a)** $\frac{1}{3}$, $\frac{2}{3}$, 0, 1 **(b)(i)** $\frac{3}{10}$ **(ii)** $\frac{1}{2}$

Question 26

This question relied on pattern spotting and the majority of candidates did very well.

(a) Most candidates answered this correctly.

(b) (i) Many correct answers were seen.

(ii)(a) Again many correct answers seen.

(b) Usually correct if **(ii)(a)** correct.

(c) A more challenging part and lots of correct answers seen.

Answers: **(a)** $\frac{1}{10}-\frac{1}{11}$ **(b)(i)** $\frac{1}{1}-\frac{1}{5}=\frac{4}{5}$ **(ii)(a)** $\frac{19}{20}$ **(b)** 109 **(c)** $\frac{n}{n+1}$

MATHEMATICS (SYLLABUS D)

Paper 4024/12
Paper 12

Key messages

Questions should be read carefully.

All necessary working should be shown in the working space provided in the paper. It should not be necessary to attach additional sheets of rough working, or additional sheets of unused paper.

When there is more than one attempt at a question, candidates should delete the solution that is not used. Letters and numerals should be clearly and unambiguously formed.

The practice of working initially in pencil and then inking over should be discouraged as this leads to a shadowy image often difficult to read.

General comments

There were many well presented scripts of a good standard. Scripts were seen covering the whole range of marks, with perhaps fewer candidates this year achieving really high marks.

The paper provided opportunities for candidates at all levels to demonstrate what they knew. There were questions that all candidates were able to cope with as well as more challenging questions that stretched the most able candidates.

Very few candidates appeared to have insufficient time to finish the paper.

Candidates showed a good grasp of basic ideas across all areas of the syllabus. This year, many candidates tackled the vector question confidently, earning good marks.

In this non-calculator paper, candidates continue to miss out on marks as a result of inaccurate number work.

It was noticed this year that some candidates begin each line of working with a dash. This can lead to errors and confusion when negative signs are involved.

Comments on specific questions.

Question 1

(a) Well answered. The answer was sometimes left as $\frac{4.2}{0.2}$. Not all evaluations from this point were successful. A common wrong answer was 2.1.

(b) The success rate in this part was not as high. Most candidates expressed the correct answer as $\frac{9}{20}$. A few chose 0.45. $\frac{9}{4} \times \frac{1}{5} = \frac{45 \times 4}{20}$ was sometimes seen in the working. Other errors seen included such as $2\frac{1}{4} = \frac{9}{5}$.

Answer: **(a)** 21 **(b)** $\frac{9}{20}$

Question 2

A completely reversed answer was very rare, so clearly candidates understood what was required here. The popular strategy was to convert the three vulgar fractions to decimals. These were sometimes truncated, such as $\frac{7}{12} = 0.5$, leading to errors in the order. There were a number of correct answers given without any preliminary work shown.

Answer: $\frac{7}{12}$ $\frac{5}{8}$ 0.64 $\frac{13}{20}$ 0.7

Question 3

Candidates arrived at 6 × 5*b* = 120 in different ways, including the direct use of the formula for the area of a trapezium. This equation was not always solved correctly, with such as 5*b* = 120 – 6 seen. Not all attempts at remembering the formula for the area of a trapezium were accurate. Perhaps these candidates should have chosen an alternative strategy, such as dividing the shape into a rectangle and a triangle. This needed care also since the base of the triangle was 3*b*, and not *4b* as often seen.

Answer: 4

Question 4

Using the fractions $\frac{2}{5}$ and $\frac{5}{12}$ to find the numbers 24 and 25 was the most effective way to begin this problem. There was a lot of accurate work with fractions that did not lead to definite numbers of counters, including leaving $\frac{11}{60}$ as the answer. Common misunderstandings were answers of 60 – (5 + 2) and 60 – (5 + 12). Common arithmetical errors included $\frac{5}{12} \times 60 = 30$.

Answer: 11

Question 5

There was a lot of information to process here, so the need to organise work clearly was imperative.

Many candidates succeeded in doing this. Successful candidates made a clear choice to work either using London local times or Astana local times, most choosing to work using London local times. Many candidates reached 20 55, the London local time that Fariza left Moscow. This was occasionally miscalculated by using 4.5 instead of 4 hours 30 minutes. A common wrong answer was 8 hours 30 minutes, the period from 20 55 London local time to 5 25 Astana local time. Some candidates used a mixture of the 24 hour clock and the 12 hour clock. This invariably led to errors being made.

Many candidates could be encouraged to set out their work more clearly.

Answer: 3 hours 30 minutes

Question 6

Unsuccessful candidates fell into two categories. Those who realised that some form of approximation was required but were unable to carry out the instruction given in the question, and those who did not understand that approximation was required. Typical errors in the first group were replacing 29.3 with 3, 0.874 with 1, and forgetting that they were dealing with 29.3^2. Common wrong answers were 450 5 and 50. Without a calculator, the second group were faced with an impossible task, sometimes appearing to spend a lot of time getting nowhere.

Answer: 500

Question 7

There were a good number of successful solutions achieved by expressing the variation in algebraic terms. A common error in evaluating *y* was to give the answer $\frac{96}{8}$. It is important in variation questions that the question is accurately read and the correct type of variation selected.

Answer: $\frac{96}{64}$

Question 8

Some candidates could be encouraged to form letters such as *u*, *v* and *r* more clearly.

(a) This part was generally well answered. A common error was to omit *s*, *t* and *u*.

(b) Again, this part was generally well answered. This time there were many different wrong answers seen.

Answer: **(a)** *p, q, r, s, t, u* **(b)** *s, v*

Question 9

(a) Most candidates understood the implications of standard form. Sometimes the answer was truncated to 5.2×10^{-6}. 5.21×10^{6} was sometimes seen.

(b) There was a wider range of answers in this part. A common wrong answer was 30×10^{4}, with 0.3×10^{6} also seen. Answers were also seen with indices such as 10^{21}.

Answer: **(a)** 5.21×10^{-6} **(b)** 3×10^{5}

Question 10

This question was generally well answered. Congruency was understood in this context and the correct correspondence between the triangles was achieved by many candidates. Some candidates would have benefitted by re-drawing say the second triangle so that it could be directly compared with the first. Attempting this without doing so led to answers of 5.6 and 41°. The arithmetic using the angle sum of a triangle was not always accurate, and in some cases this result was not known. Some candidates changed their 3.8's to 3.85.

There were some attempts to use the sine rule.

Answer: $p = 3.8$ $q = 77$

Question 11

There was quite a lot of information to interpret in order to answer this question. This was achieved in many cases. Many of the answers seen consisted of extra points. A number of candidates who appreciated the situation chose to express their answers as options for *a* and *b*. The question specifically asked for all the possible coordinates of *P*.

Most candidates realised the significance of the lines $x = 2$ and $y = 7$ and drew them on their diagrams. Some answers contained points from the region below the line $y = 2x + 1$.

Answer: (1, 6) (1, 5) (1, 4)

Question 12

Many candidates found all parts of this question difficult.

(a) This part was generally correct. The common incorrect answer was 4.

(b) (i) Clear working was often seen showing that the problem had been fully understood. Candidates got to –6 but did not always know what to do with it. Common errors included division by 5 in the calculation of the mean and arithmetic errors in the addition of the 5 numbers. The answer –2 was seen on a number of occasions...Was it thought that " mean" meant the "total" of the 6 numbers?

(ii) Completely correct answers were hard to find. Some candidates showed that the difference between 4 and –8 was 12, but then gave 4 and –8 as their answer. The same applied to –4 and 8. Quite a number of wrong answers offered showed no working. Candidates seemed to find it difficult to fully understand the implications of this question.

Answer: **(a)** –2 **(b)(i)** –3 **(ii)** –8 8

Question 13

(a) This part was mostly understood with candidates showing their working. Occasionally the answer given was the set of 3 prime numbers rather than the appropriate product. Some candidates omitted this part.

(b) There were fewer correct answers here. It was expected that 3 × 5 would be evaluated. The significance of finding the integer *m* did not always appear to be appreciated. Common answers were 6 and 60, the latter coming from thinking that 360 was a square number. Quite a number of guesses were made, and in a number of cases, the answer given was based on work unrelated to the work shown in part **(a)**.

(c) Only a small minority of candidates understood this question.

Answer: **(a)** $2^2 \times 3 \times 5$ **(b)** 15 **(c)** 9

Question 14

(a) Most candidates used the space below the line *BC* effectively. There were some rare attempts squeezed in above the line. The triangles drawn usually had visible arcs. There were very few unacceptable triangles.

(b) This part usually followed on successfully. There were a number reading off the wrong end of the protractor. It appeared that some wrong answers could have been the result of not having a protractor available. Occasionally, the answer given was a length.

Answer: **(a)** Correct triangle with arcs **(b)** 128° to 133°

Question 15

(a) There were very few incorrect answers. The product $(-3)(-4)$ was well managed.

(b) Generally the response to this question was very good. Isolating $-3b$ sometimes led to errors in the subsequent transposition. Some first steps were not sensible and recoveries were impossible. Some candidates continued with numerical substitution in this part.

Answer: **(a)** 6 **(b)** $b = \dfrac{8a - c^2}{3}$

Question 16

(a) (i) This part was often correct.

(ii) Again, this part was often correct. In simplifying expressions of this sort, candidates must show that they know that 3^{-1} is $\frac{1}{3}$. A number of 81's were seen.

(b) Candidates clearly found this part a lot harder but a good response was made nevertheless. Again, candidates must show that the number involved here is $\frac{1}{16}$.

Answer: **(a)(i)** 9 **(ii)** $\frac{1}{3}$ **(b)** $\frac{1}{16x^4}$

Question 17

(a) Candidates familiar with transformation geometry answered this well, often supplying all the necessary details of the transformation whose matrix was given. Candidates not gaining full marks tended to give an incorrect invariant line. A common error appeared to be the use of "shear" when in fact "stretch" may have been intended. Weaker candidates had a wide variety of views about this transformation.

(b) Many candidates made the direct link here from the scale factor.

There were some more elaborate attempts, not usually successful.

Answer: **(a)** Stretch, *y*- axis invariant, factor 4 **(b)** $\frac{x}{4}$

Question 18

(a) The expression was usually factorised completely. There were some partial factorisations. *pq(p)* was seen. Some candidates thought that the difference of two squares was involved.

(b) (i) There was generally a good response here. Care is needed with signs when factorising a quadratic expression. Some managed to get only as far as $x(5x + 1) – 4$.

(ii) Most candidates understood the wording of this question, and produced answers either from the correct factors or from their factors seen in the previous part. A number of candidates attempted the use of the quadratic formula at this point.

Answer: **(a)** $pq(p-1)$ **(b)(i)** $(5x-4)(x+1)$ **(ii)** $\frac{4}{5}$ -1

Question 19

(a) There were many accurate solutions, clearly constructed and well presented.

Most candidates managed the first part of the calculation, 140 × 8, but had difficulty in constructing the expression required for the payment of the overtime. Typical errors here included 50% of 1120 and 1120 + 80 +4.

(b) Many candidates seemed to find it easier to gain marks in this part. Generally, the idea of simple interest was well handled. The interest calculated was sometimes subtracted from 240. Some misunderstandings seen included (240 + 7.2) × 5, and attempts using compound interest. 240 = $\frac{P\times3\times5}{100}$ was seen on a number of occasions.

Answer: **(a)** \$1240 **(b)** \$276

Question 20

(a) (i) The relationship between median and cumulative frequency was generally understood. The scale of the graph was such that 27 was the only acceptable answer. Some candidates gave the answer 30, which was the middle value on the Time axis, and some gave 22, half of 44, the highest value on this axis.

(ii) Again, when not omitted, this part was generally understood, with many correct answers. Some answers were left in the form 30 – 25, or even 25 – 30. 75% of 44 – 25% of 44 was seen, as was 75% of 200 –25% of 200. The latter resulted in the graph being read at 100, producing the answer 27. Candidates could be encouraged to draw the relevant lines on the cumulative frequency diagram when calculating the interquartile range.

(b) The common error here was to add 1 to each. In some cases, either or both were reduced by 1.

Some answers were completely unrelated to the values given in the other parts of the question.

Answer: **(a)(i)** 27 minutes **(ii)** 5 minutes **(b)** Median 28 minutes, Interquartile range 5 minutes.

Question 21

(a) This question was usually well answered. Sometimes –7 was seen in place of –5.

(b) (i) This was generally correct with candidates handling the negative numbers with confidence. A typical error was to take the wrong diagonal order leading to the answer -2.5. The answer 2 was also common.

(ii) Candidates usually remembered how to construct the inverse matrix.

Answer: **(a)** $\begin{pmatrix} -1 & 9 \\ -5 & 13 \end{pmatrix}$ **(b)(i)** 2.5 **(ii)** $\frac{1}{2}\begin{pmatrix} -1 & 2 \\ -2.5 & 3 \end{pmatrix}$

Question 22

(a) The majority of candidates found this difficult. Many appeared not to understand the idea of scale as set out at the beginning of the question. Answers such as 25 and 25000 were common as well as various powers of 10.

(b) Candidates seemed to have a better idea of the process required here. Wrong answers in part **(a)** were not always consistently worked through.

(c) Attempts here were often inconsistent with answers given elsewhere. Some incorrect answers in part **(a)** led to difficult calculations here. Many candidates were unable to maintain consistency of units in this part.

Answer: **(a)** 0.25 **(b)** 32 **(c)** 1.9

Question 23

(a) Many candidates were able to isolate the two relevant inequalities. Solutions were often well written and presented. Most candidates managed to solve one of the inequalities correctly. A common error was to write such as $2x-5<7+4$.

(b) The most successful strategy was to equalise coefficients. Problems crept in at the subtraction stage. The method of substitution was also seen. Here, the problems occurred in simplifying the resulting equation in one variable. There were many completely successful solutions, and most candidates gained marks in this question.

Answer: **(a)** $\frac{1}{2} \le x < 6$ **(b)** $x = 5$ $y = -3$,

Question 24

Most candidates attempting this question failed to grasp the implications of the situation described in the stem. Only the most able candidates were able to make significant progress through the complete question. Many candidates did not know how to begin, and so the question was often omitted.

(a) The conditions in the stem were accurately translated into correct equations by a minority of candidates. The equations were not always correctly solved. A lot of attempts to form equations were inaccurate. It was common to see some rearrangement in terms of h of one of the volume formulas given in the question. Typical mis-readings of the question involved the use of the volume of a sphere instead of a hemisphere, setting the volume of the hemisphere equal to $\frac{1}{3}$ of the cone, or equating $\frac{1}{3}$ of the volume of the hemisphere to the total volume of the solid. Some solutions used a numerical value for π.

(b) This part was successfully followed through by some candidates, and in these cases, the significance of the notation was usually appreciated. $\sqrt{h^2+r^2}$ was often seen in the working but not always developed even when the answer to the previous part gave h as a multiple of r. A recurring error here was to write h^2 as $4r^2$ instead of $(4r)^2$. Some candidates equated $r\sqrt{k}$ to one of the volume or surface area formulas given in the question.

(c) Again, this was quite well followed through when it was possible to do so. A common error in this part was to omit the $\sqrt{\ }$ sign. The correct surface area, $2\pi r^2+\pi rl$, was seen in the working, without attempts to substitute a value for k. It was common to use the surface area of a sphere rather than a hemisphere.

Answer: **(a)** $h = 4r$ **(b)** 17 **(c)** $\pi r^2(2+\sqrt{17}$

Question 25

The first parts of this question proved accessible to a wide range of candidates

(a) (i) This mark was often awarded. A common wrong answer was a –b.

(ii) Again, candidates scored well here.

(b) (i) Many candidates worked out and wrote down correct vector paths. Candidates generally were able to use the information given in the stem of this part to work out appropriate vectors based on their answer to part **(a)(ii)**. A common error at this stage was the use of $\frac{1}{2}$ instead of $\frac{1}{3}$ or. $\frac{2}{3}$. Working through to a successful conclusion required great care in handling fractions and negative signs. The answer $-\frac{4a}{3}$ was sometimes seen.

(ii) Kite was a common wrong answer here. There were many correct guesses which unfortunately were not consistent with the answer given in the previous part.

Answer: **(a)(i)** b – a **(ii)** 3b – 2a **(b)(i)** $\frac{4}{3}$ a **(ii)** Trapezium

Question 26

(a) (i) Many candidates had some knowledge of arithmetic progressions so chose to tackle this part by quoting and then simplifying the expression for the *n*-th term of an arithmetic progression. This was often unsuccessful. On this syllabus, a straight forward pattern spotting strategy is expected. Work out the pattern and then express it algebraically. Common wrong answers were $83 + 6n$ and $n - 6$.

(ii) .This depended heavily on success in the previous part. There were some near misses with the answer 15. Wrong answers were often given without showing any working.

(b) (i) Many candidates had no idea what was required here. Even good candidates sometimes got only as far as $(n+1)^2 - 4(n+1)$, following this with $-n^2 - 4n$ leading to $-6n - 3$.

(ii) Again this depended heavily on the previous part. A correct **(b)(i)** invariably led to the correct answer here.

Answer: **(a)(i)** $95 - 6n$ **(ii)** 16 **(b)(i)** $2n - 3$ **(ii)** 39

MATHEMATICS (SYLLABUS D)

Paper 4024/21
Paper 21

Key messages

- To succeed in this paper, candidates need to have completed full syllabus coverage and remember necessary formulae.
- All working must be clearly shown. This is especially important since the use of a calculator on this paper can lead to answers being written with no working.
- Candidates are advised to check that their calculators are set in degrees mode before evaluating trigonometric expressions.
- Candidates need to ensure that unless otherwise stated, that they work with enough figures that they can produce an answer which is correct to at least 3 significant figures, otherwise they may not gain accuracy marks.
- It is also important to ensure that work is, as far as possible, written clearly in pen; it is not advisable for candidates to write in pencil and then over-write it with ink.

General comments

The paper proved to be a good test of a candidate's knowledge of the subject and of their ability to apply that knowledge. This was evidenced by the broad range of marks obtained by candidates. It must be pointed out, however, that candidates of all abilities need to read the questions and study diagrams carefully, in order that false assumptions are not made, such as using Pythagoras' theorem in a non-right angled triangle. It was very pleasing indeed to see so many candidates this year who had mastered the technique of solving simultaneous equations. Also, candidates generally showed good ability in plotting points accurately, in the questions involving graph work.

Comments on specific questions

Section A

Question 1

(a) (i) A good number of fully correct answers were seen here. If not, then it was usual for candidates to at least earn the mark for obtaining \$7964 successfully. Some then either gave this as their final answer, or were unable to successfully subtract this amount from \$36200. Only a small percentage of candidates chose to do the single calculation 0.78 × \$36200.

(ii) There was much apparent confusion here. Candidates knew that they had to find 8% of something, but seemed unsure of what. Some opted for 8% of \$36200 or 8% of \$25000 or 8% of \$11200, giving a variety of answers. Only the better answers used the connection that 8% = \$11200 and went on to successfully obtain the correct answer. The vast majority earned 1 mark here for reaching \$11200 in their working.

(iii) Having correctly obtained that the price paid was 70%, the commonly seen error here was for candidates to give this as the final answer, rather than realise that they then needed to subtract this from 100% to get the 30% as their final answer for the discount.

(b) Few were able to make the correct connection here, namely that $1.135x = 681$, where \$$x$ represented the initial amount invested. The vast majority wanted to use \$681 as the principal in the Simple Interest formula, thus not getting anywhere. Others used \$681 and equated this to (P × 4.5 × 3) / 100, again leading to an incorrect answer.

Answers: **(a)(i)** 28236 **(ii)** 140000 **(iii)** 30 **(b)** 600

Question 2

(a) Few realised that they needed to use Pythagoras' theorem here in order to calculate *QR*, and a number did so successfully. The majority of candidates either did not attempt an answer, or used the pairs of coordinates randomly.

(b) There were many who did not attempt this part of the question also. Only a handful of completely correct answers were seen. Some lost their accuracy by rounding the previous answer of 8.94 to 8.9 which then led to the final answer of – 0.449 instead of – 0.447. A small number of candidates obtained 0.447 from correctly using $4 / \sqrt{80}$ and gave this as their final answer, forgetting that $\cos(180 - \Theta) = -\cos\Theta$. A number used the cosine rule on triangle *SQR* and again one or two were completely successful.

(c) (i) Instead of deriving the equation of the line $x + 2y = 13$ by using the given fact that the distance *PQ* = the distance *PR* and using Pythagoras, many candidates obtained the mid-point of *QR* correctly as (1, 6), but then just substituted this value into the equation to show that it satisfied it.

(ii) A good number of correct answers were seen.

Answers: **(a)** 8.94 **(b)** – 0.447 **(c)(ii)** (–1, 7)

Question 3

(a) (i) Although many candidates realised that triangle *ACB* and triangle *ADB* shared the same base, they often did not give the other important required fact, namely, that they had the same perpendicular height. Commonly seen was reference to the fact that *AB* and *DC* were parallel lines, which was not quite sufficient, or, because *AD* = *BC*.

(ii) (a) Many candidates failed to recognise that triangle *HGF* was the required answer here, or gave no attempt at all. Common among the incorrect choices were *HEF* and *GFK*. Failure here by candidates to recognise that triangles sharing the same base and between the same parallel lines, were equal in area, meant that candidates were unlikely to score in the next part question as well.

(b) There was much confusion here; many candidates made no attempt at all.

(b) (i) 'Vertically opposite angles' and 'angles in the same segment' were quite well known and this was pleasing to see.

(ii) Many candidates did not score here. The most common mistake was to think that angle *PLM* was a right angle, which made angle $y = 90°$. Among the better answers there were some that recognised that angle *PRM* + *PLM* added up to 180° and went on to correctly deduce that *PRM* was $180 - (180 - y) = y$. A few just stated that $y = PRM$ since it was the external angle of a cyclic quadrilateral.

(iii) Another part question which caused problems for many candidates, or was not attempted. Some did score for saying that the triangles were similar, but then became confused in identifying which angles were equal to which in triangles *PRM* and *QSM* respectively. Others thought that to be similar meant that the triangles had to have a combination of equal sides and angles, and not just angles.

Answer: **(a)(ii)(a)** *HGF*

Question 4

(a) Usually well answered, with many fully correct answers seen. A small percentage of candidates did not score here for using incorrect formulae e.g. $2\pi r^2$, $\pi r^2 h$.

(b) Another well answered question. When not earning full marks, it was usually because the response had used a sphere and not a hemisphere in calculating the total volume.

(c) Again, this part question was quite well answered. As in the previous part, candidates who did not score full marks often did equate the two formulae, but the error was made in using a whole sphere instead of a hemisphere.

Answers: **(a)** 63.6 to 63.62 **(b)** 352 to 353 **(c)** 10

Question 5

(a) The majority of candidates correctly chose to use tan x = 4/11 here and were successful in using the inverse tan and showing the figures 19.98 before rounding to 20.0°. However, some only gave the figures 19.9 so did not earn the accuracy mark here. Others decided to make extra work for themselves by first of all using Pythagoras' theorem to calculate side *DF* and then using either sin x or cos x, to evaluate x.

(b) Only a handful of candidates recognised that angles *BCA* and *CDF* were corresponding angles and formed the required explanation using $y + BCA = x + CDF$. Most just stated that y and x were equal because they were alternate angles or that they were equal since triangles *ABC* and *DEF* were similar.

(c) Another well answered part question for many candidates, with many fully correct answers seen. Most chose the direct approach using $AC = 4 / \cos y$. Fewer used Pythagoras' theorem and found side *DF* first of al,l and then similar triangles and the calculation $AC = 4/11 \times DF$. Some candidates did not earn the accuracy mark here due to early truncation or rounding, leading to the incorrect answer of 4.25.

(d) This was also well answered by a good number of candidates and again full marks were often awarded. It was good to see that candidates recognised the trapezium and also knew the formula to calculate its area, with very few making arithmetical errors.

Answers: **(c)** 4.256 to 4.26 **(d)** 55.8 to 55.9

Question 6

(a) A good question for many candidates, with many correct answers seen.

(b) There was a fair proportion of fully correct answers seen here also. Most candidates used the common denominator of $(x + 2)(x – 2)$, but slips, such as $3(x – 2)$ or $4(x – 2)$ in the numerator, or $3x^2 – 6 – 4x + 8$ in the expansion of the brackets, meant that further correct progress was impossible.

(c) The most successful question on the paper for the vast majority of candidates. It was pleasing to see so many candidates earning full marks here and applying the technique of solving simultaneous equations successfully.

Answers: **(a)** $x^3 – 1$ **(b)** 0.4 **(c)** $x = – 0.5$, $y = – 2$

Question 7

(a) (i) Nearly always correct.

(ii) Not as well answered as the previous part. The common error was for candidates to take the square root of 4.73^2 and subtract the product of 1.65 sin 43 from this, giving the answer of 3.60.

(b) (i) Many candidates made the assumption that angle *ABC* was a right angle, even though it was not marked as such. Consequently, they used Pythagoras' theorem and earned no marks for the question. Those candidates who did recognise that they had to use the cosine rule usually went on to obtain the required equation.

(ii) **T**he quadratic formula was shown to be well practised by a large number of candidates, with many gaining full marks. Some candidates did not give their answers correct to 2 decimal places as requested, with answers of 7.6969 and –10.6969, or 7.7 and – 10.7 being seen.

(iii) Many correct answers were seen here also, with candidates knowing to use the positive value from the previous two solutions and correctly evaluating their $2x + 3$.

(iv) Those candidates who thought that *ABC* was a right angled triangle with 16 cm being the height, did not score here either. However, those candidates who did know that they had to use the area formula ½ *ab* sin *C*, nearly always scored full marks.

Answers: **(a)(i)** 20.9 to 21.(0) **(ii)** 4.6(0) to 4.61 **(iii)** 7.70 and –10.70 **(iv)** 61.3 to 62.(0)

Question 8

(a) (i) Many correct answers werer seen for this part. However, some candidates made errors in recalling the formula and used πr^2 or even $2\pi r^2$.

(ii) Again there were many correct answers seen here also. A small number of candidates did however calculate the area of the minor sector instead by using 100/360.

(b) (i) Not as well answered as the previous two parts. The common error was to do $(9.3 - 0.8)^2$ and then multiply this answer by 260π / 360.

(ii)(a) Candidates often did not use the correct formula for the circumference to start with and then just tried to manipulate their figures, knowing that they had to arrive at 0.578. Candidates need to remember that they must show their working to at least 4 significant figures when they are asked to give their answer correct to 3 significant figures.

(b) Once again, there was confusion with formulae; commonly seen were $\pi r^2 h$, $2\pi r^2 h$ or πrh.

(c) The volume of a cylinder formula was more well known and this part was usually answered correctly even if the previous part was incorrect.

Answers: **(a)(i)** 42.18 to 42.22 **(ii)** 196 to 196.32 **(b)(i)** 194 to 195 **(b)(ii)(b)** 18.1 to 18.2 **(b)(ii)(c)** 5.24 to 5.25

Question 9

(a) Nearly always correct, very few errors seen.

(b) The vast majority of candidates used the required scales on both axes and the standard of plotting of points was very good. Candidates should remember that joining the points with a smooth curve means not using a ruler to join the points with line segments, which did occur on a small number of occasions.

(c) (i) Quite well done. There were a few who had misread the question or omitted the negative sign, by giving their answer in the range 2.4 to 2.6.

(ii) Some candidates read off the graph correctly, while other answers of around 1.2 suggested that readings were being taken at 1.7 on the f(x) axis and read off at 1.2 on the x-axis. That is, the reverse procedure of what was required.

(iii) Many candidates did not attempt this part. If an attempt was seen then more often than not the answer given was $\sqrt[3]{u}$.

(iv) The vast majority of candidates knew what was required in drawing a tangent to the curve and there were a good number of very good attempts, with very few leaving a gap between the curve and tangent. Some did not then attempt to calculate the gradient, while other given answers fell outside the allowed range, either from using incorrect readings for 'difference in y' / 'difference in x' or from simply using the inverse of this ratio in their calculation.

(d) (i) Again, there were a sizeable number of candidates who made no attempt at drawing the required line. However, there were more who did know what was required and produced good, accurate, ruled straight lines.

(ii) Of those who had drawn both the curve and the line, a fair proportion were able to produce three acceptable solutions from reading their graphs.

Answers: **(a)** –27 –8 –1 0 1 8 27 **(c)(i)** –2.4 to –2.6 **(ii)** 4 to 6 **(iii)** $t = u^3$ **(iv)** 10 to 13 **d(ii)** –1.95 to –1.7, –0.8 to –0.5, 2.4 to 2.6

Question 10

(a) (i) Many correct answers were seen here.

(ii) There was a small number of fully correct answers for this part. The most common error was to give the single product 60/300 × 24/299 = 24/1495, omitting the other possible combination of 24/300 × 60/299. One or two candidates did know that there were two possible combinations, but unfortunately did (60/300 + 24/299) × (24/300 + 60/299). Also, one or two used two combinations but with replacement.

(b) This was a good question with many earning full marks. Some lost marks for just giving an incorrect answer without showing any working. It is important in a calculator question such as this for candidates to write down their working, which may then earn them some method marks. A handful of candidates made the error of using the class width and not the class midpoint.

(c) (i) Nearly always correct.

(ii) The plotting of the points was done with good accuracy. Candidates need to remember that drawing a smooth curve entails using freehand and not joining the points with a ruler.

(d) (i) There were a number of candidates who were reading on the cumulative frequency axis at between 145 to 147.5, instead of at 150. Those who did read correctly from 150 usually then read off the correct value on the Mass axis.

(ii) Unfortunately there was a substantial number of candidates who had this part wrong. They knew to use the upper and lower quartiles at 225 and 75 respectively, but then they made the error of just subtracting 225 – 75 =150 and then reading off the cumulative frequency axis at 150 and finding the corresponding reading on the Mass axis. Those who did know the correct method however, usually did obtain an acceptable answer. Candidates should remember to write down their readings at the upper and lower quartiles, as this may earn them a method mark, even if their final answer is not in the acceptable range.

Answers: **(a)(i)** 1/3 **(ii)** 48/1495 **(b)** 50.8 **(c)(i)** 100 148 220 276 **(d)(i)** 50 to 50.5 **(ii)** 7.25 to 8.00

Question 11

(a) (i) Usually correct. If not, then the erroneous answer seen was 2a – b, from not reversing the signs for the vector *FA*.

(ii) Candidates who did get the previous part correct, usually were able to successfully arrive at the correct answer here also. Although a few candidates made slips again with the signs when reversing the direction of a vector.

(iii)(a) Sign errors were often made where candidates chose the long route of getting from *D* to *C*, rather than the direct route of *DC* = *DG* + *GC*. Good answers reversed the vector *GD* and then addws vector *GC*, which made the process much simpler, especially when it came to substituting in order to express the answer in terms of a and b.

(b) A few were able to score here if they had successfully arrived at the correct answer for the previous part.

(i)(a) Only a handful of fully correct answers were seen here. Most of the incorrect answers thought that the transformation involved a rotation or a rotation and reflection. A few suggested that it was a translation and reflection.

(b) Many did not attempt this part at all.

(ii) Done successfully by many more candidates.

(iii) Again this was a better part question for many, with most able to work out that it was a 90° rotation.

Answers: **(a)(i)** b **(ii)** 2b **(iii)(a)** $\frac{8}{5}$ a – $\frac{8}{5}$ b **(b)** 1: $\frac{8}{5}$ **(b)(i)(a)** reflection in $y = x$ **(b)** matrix $\begin{matrix} 0 & 1 \\ 1 & 0 \end{matrix}$
(ii) (–3, 6) (– 3, 0) (0, –2) **(iii)** 90°

MATHEMATICS (SYLLABUS D)

Paper 4024/22
Paper 22

Key Messages

Premature approximation has been mentioned before in these reports – but it appeared to be a particular problem this year. Many candidates seemed to be happy to approximate to 2 significant figures early in a question and then think that they could give their answer to 3 or 4 significant figures. Clearly this practice can lose accuracy marks.

Candidates generally gave their answers in a clear and well-presented fashion. Quite a significant number, however, are working first in pencil, then overwriting it in ink. This produces 'ghosting' and double images in the work seen by the Examiners and this makes it very difficult to read what has been written (even if an attempt had been made to rub out the pencil work).

General Comments

Overall, this paper had a mixture of routine questions, giving all candidates the opportunity to gain confidence and show that they had prepared well, and some trickier parts which challenged the more able and acted as good discriminators.

Almost all candidates were able to make a reasonable attempt at the paper and very few appeared to have been entered at a level too high for them.

Most candidates seemed to have adequate time to complete the paper, with rather fewer attempting all 5 questions in ***Section B***. Those who attempted less than 4 generally seemed to have done as much as they were able.

Most candidates appeared to take great care in the work in the pie chart, graph, construction and histogram questions and this regularly produced good marks.

There were a few candidates who were comfortable with the trigonometry of obtuse angles, but a majority had difficulty with parts **(b)** and **(c)** of **Question 5** and even very able candidates lost marks here.

Comments on Specific Questions

Section A

Question 1

(a) Candidates had to put over a common denominator, remove brackets and collect like terms; many did this well and scored two marks. Some thought the denominator was 5; some multiplied throughout by 6, so there never was a denominator. Nevertheless the majority of marks that were lost came from slips made removing brackets or by arithmetic slips such as –2 + 15= –17 or –13.

(b) (i) Most candidates knew how to calculate the gradient, the common mistake being to switch the numerator and denominator yielding an answer of 2. Some took the line K as the *x*-axis and gave the gradient as 3/5. It is expected that fractions such as 3/6, 5/10, etc. be reduced to ½.

(ii) The majority presented the correct equation of the line but a few offered $x = 1$ or just 1. A few gave the answer as an inequality, $y \geq 1$ being quite common. A fair number of candidates started off with $(y - y') = \text{slope } (x - x')$ – some were then successful, but many were not.

(iii) Some thought was required here; a triangle, area 6 with base 6 would need a height of what? It was encouraging that so many solved the puzzle and found the line that cut *J* at (4, 3).

(iv) When candidates did draw line *L* correctly, they usually went on to calculate the correct gradient and were able to state the *y* intercept from their line. Where errors occurred a part mark was often awarded for a correct gradient or intercept.

(v) Candidates tackled this in two ways, some drew the perpendicular line on the diagram and simply stated the correct coordinates of (0, 6) while others went back to calculating the perpendicular gradient and substituting in the point of (2, 2). A small number found the correct point but gave the answer 6 or (6, 0).

Question 2

(a) Almost all the candidates interpreted the graph correctly and the vast majority of these candidates scored this mark by reading the graph correctly. Only a small number misread the scale.

(b) The most commonly occurring wrong option was "Stopped at the station" but the majority realised that it was the speed that was not changing.

(c) The fact that acceleration is found by dividing speed by time was appreciated by most candidates and the answer 0.08 was achieved by very many.

(d) In this part also, candidates interpreted the graph correctly and in most cases identified the required speed.

(e) Most knew that the area under a speed/time curve gave the distance travelled. The area of the trapezium gave the neatest solution, sides 50 and 200 and height 12. Rather a large number used distance = speed x time = 12 × 200, not realising this method only applies to constant speed.

(f) Most candidates used their distance from the previous part and divided by 200, but many struggled with the conversion of units. A few simply tried to convert 12 m/s to km/h.

Question 3

(a) (i) Candidates were clearly very familiar with this type of question requiring them to find the mean from grouped frequency data. Most understood that they should use the mid points of the intervals but it was not too uncommon for end points to be chosen. A small number opted to form the products of the frequencies with 14.5, 44.5, 74.5, etc. It was relatively common to see candidates using the lengths of the intervals (30), obviously resulting in an answer of 30 for the mean.

(ii) Unfortunately many candidates did not understand the content of this part of the question or the word 'interval' and did not associate it with the previous part. Responses reflected this, with answers such as "Thursday", "24 hour clock" or "minutes" occurring regularly. A small number who calculated the two lengths of time, 47 and 45 minutes, gave the answer $30 \leq t < 60$.

(b) (i) This was generally well answered and the correct answers 100, 76 and 48 regularly seen.

(ii) There were many well-constructed pie charts. Unfortunately, a few candidates failed to label the sectors while others got the labelling the wrong way round.

Question 4

(a) (i) This was a straightforward question and most candidates obtained the correct value. The most common error was an answer of 25, presumably from the assumption that *AE* and *BC* were parallel.

(ii) This was generally well answered with a large majority of candidates earning the mark. There was no pattern to the incorrect answers with a wide range of values given, some of which were based on wrong assumptions such as triangle *BCX* being isosceles or *AC* and *BE* being perpendicular.

(iii) A majority of candidates demonstrated an understanding of cyclic quadrilaterals (or angles in opposite segments) and earned this mark. 97 was a common wrong answer, candidates assuming that *CDEX* was a parallelogram.

(iv) Only a small number of candidates seemed aware of the parallel lines. Those that did usually earned the mark for using alternate angles (either with a correct answer or a follow through answer from their *CXB*).

(b) (i) The majority were happy finding the area of a sector, most stating the area of the circle to be $\pi 6^2$ and seeing the fraction required to be 40/360. There were quite a few who presented the evaluated answer of 12.56 in the answer space while others, realising the $k\pi$ requirement, promptly divided by π to end with an answer of 3.998 or 4.001.

(ii) Rather fewer candidates were successful with this part. Many knew how to find the arc length using the appropriate fraction of $2\pi r$ and many saw the need to add on the two radii in order to reach an expression for the perimeter. Sadly, it was in the subsequent attempts to give their answer in the form $a + b\pi$ that algebraic mistakes were made.

Question 5

(a) A majority of candidates scored full marks using the cosine rule with clear correct working. It was fairly common however for candidates to set out the correct cosine rule but fail to evaluate the terms to reach BC^2 successfully. The usual error subtracting the coefficient of cos 56° from $8^2 + 11^2$ was seen regularly. A few lost the accuracy for the final answer because they rounded cos 56 prematurely. A small minority omitted BC^2 and hence did not find the square root of their answer. A very small number used sin 56 rather than cos 56 in the formula.

A few candidates did not realise that the question required the cosine rule and attempted to use the sine rule or just trigonometry for a right-angled triangle or Pythagoras' theorem.

(b) This was not often correct but it was the obtuse angle that caused the problem. Most applied the sine rule competently and reached an angle in the range 57.7° to 58.8° but gave this as their final answer even though the question specified 'obtuse'. If they carried on, the most common thing was to take their 57.8° from 360° rather than 180°, giving them 302.2°. There were of course some more long winded methods adopted. A small proportion of these were successful but a few made assumptions about the diagram that were wrong. The two main ones were to take triangle *ADC* to be isosceles and/or to take angle *ABC* to be half of angle *ADC*.

(c) Only a small number of candidates scored full marks in this question and errors were varied. Many gained marks for finding the correct area of the large triangle ABC and using this as a denominator in their fraction to find the percentage shaded. Errors were usually made in finding the area of the shaded triangle *ADC*. Many used ½ × 11 × 6.5 × sin 30 having assumed the triangle was isosceles or ½ × 11 × 6.15 × sin 92.2 from having left the final answer for angle *ADC* as 57.8 in the previous part of the question. A number of candidates lost marks when they rounded 27.7° to 28°.

It was quite common for candidates to use the sum of the two areas as the denominator of their fraction to find the percentage shaded or the difference of the areas as the numerator. Other errors stemmed from candidates who thought angle *ABC* = ½ × angle *ADC*, others used the angles 26° and 30° in their formulae for the areas of the two triangles, a few found the perimeters as a percentage of each other and a few found 26° and 30° as a percentage of each other.

Question 6

(a) Most candidates handled this foreign exchange question with a high degree of success with many reaching £325. Occasional calculator errors sometimes caused this answer to be out by a factor of 10 and thus £32.5 was seen.

(b) The majority of candidates correctly computed 468 with only a very small group performing the division of 400 by 1.17. After this, some got to 465 but others went down to 460 for their multiple of 5. Sometimes those who got the 465 then gave the change as 3. Many however did evaluate 3 / 1.117 but sometimes gave 2.6 as their answer instead of 2.56.

(c) There was again mixed success in this part. Only a small proportion took the more direct route and found the total cost before the sale, arriving at \$420 and then subtracting the \$250 to get \$170. Most started with the normal price of the freezer and reduced it by 15%. In most cases this was done competently and the sale price of the freezer correctly found to be \$212.5. Most of these candidates then correctly subtracted from \$357 to get \$144.5 for the cost of the fridge in the sale. Some method errors were made in this process but it was more than usual that, after this, candidates could not find the cost of the fridge before the sale. A large number did not see the need to divide by 0.85. Rather, it was much more common to see the addition of 15% giving an answer of \$166.2.

Question 7

(a) (i) This part was generally well done, candidates rearranging the equation $y = (2x + 7)/3$ effectively to make x the subject. Some errors with signs occurred in this process but the more common failing was to leave the answer in terms of y. Occasionally candidates found the reciprocal expression rather than the inverse.

(ii) Only about half the candidates who attempted the question were successful. A very common error was to substitute $m/2$ into the expression rather than m, leading to a common wrong answer of 14. Some candidates worked with $m/2 = (2x + 7)/3$ so that x was involved in the solution. They appeared not to have a real understanding that f(m) only involves the variable m.

(b) (i) Most candidates computed the correct values for the table but a significant number arrived at the value 6 when $x = –1$. Plotting of points was usually done well although a few candidates plotted the first point at (-3, 6) even though they had no problem with any of the other points. Curves were generally of good quality. The most common error was to join the two points at $y = 6$ with a straight line rather than continuing the curve through a maximum.

(ii) Those candidates who had drawn a good curve found no difficulty with this part. Occasionally however, coordinates or the value of x were written instead of the y value.

(ii) There were a pleasing number of correct lines drawn although inaccuracy crept in on occasions, usually when candidates plotted just two adjacent points. Most candidates effectively used the line to find solutions to the equation, clearly appreciating the fact that these solutions come from the intersections of the curve and the line. However a number solved the equation algebraically without drawing the required line.

(iv) Stronger candidates were able to show their ability in this relatively difficult part. A large number drew the vertical line through $x = 3.5$ and regarded this as L. Only a small minority went on to draw the required horizontal line and were able to read off the second solution.

Question 8

(a) Many candidates clearly had difficulty with bearings involving reflex angles. The wrong responses 39°, 141° and 219° were seen more often than the correct answer.

(b) There was a lot of misunderstanding with this part, many candidates finding the distance of the boat from B when it was east of B. Consequently, the answer 12.1 was very common. Those who did realise where the boat was when it was closest to B almost always applied the trigonometry successfully to find the appropriate distance.

(c) Many candidates who found the distance east in part **(b)** used this and applied Pythagoras' theorem to find the distance of the boat from A in this part, a high proportion getting the correct result. The more able candidates approached this part independently and took the direct route of computing 15 / cos 39.

(d) (i) A significant number of candidates did not realise that this part of the question followed on from the earlier part, with the boat travelling on a bearing of 141°, wrongly assuming the boat to be sailing along AC. There were other wrong positions but the large majority of these scored some credit for being the correct distance from A. Those who did appreciate the bearing requirement almost always constructed a sufficiently accurate angle.

(ii) Most candidates realised the need to draw a circular arc, radius 6 cm and centre *A*. It was less common to see the bisector of angle ABC drawn. In cases where both loci were correct, identification of the area to be shaded *was* generally done well. However, some were confused by other lines which were on the diagram and this influenced their decision as to which area to shade. Despite the line *AX* having nothing to do with the location of the second boat, a good number used this line as a boundary for their shading. Others shaded the region bounded by the arc, the angle bisector and the line joining *A* to *C*.

(iii) Very few candidates gained full marks in this part mainly as a consequence of not having a correct shaded area in part **(ii)**. Most candidates who did have a correct shaded region did locate the position of *Y* correctly. In many of these cases, however, the diagrams had not been constructed sufficiently accurately to gain full marks.

Question 9

(a) (i) Most candidates did this part correctly. Common wrong answers were: $x\,(4x^2 - 10y)$, $2x^2\,(2x - 5y)$ or $2x\,(x^2 - 5y)$.

(ii) A very high success rate in this part with virtually all candidates identifying the expression as the difference of two squares. The incorrect response $9\,(a - b)(a + b)$ was seen a few times.

(b) In this part also the large majority of scripts revealed a correct solution of the equation. Almost all candidates saw clearing the fraction as the correct first step. It was in multiplying the minus sign that most errors occurred.

(c) (i) Most candidates correctly saw the base of the triangle to be $h + 7$, although a number used $7h$. The vast majority realised that Pythagoras needed to be applied next, the resulting equation being correctly stated on a regular basis. Progression from here to the required given form of the equation was, for some, a straightforward process which earned them full marks. In other cases problems were encountered and there were some obvious attempts at working back from the answer. Unfortunately a good number thought that $(h + 7)^2$ was $h^2 + 7^2$.

(ii) Most candidates gave a correct unambiguous expression for the area of the triangle, credit being given for it being written in the form $\frac{1}{2} \times h \times (h + 7)$ or equivalent. A few candidates omitted the brackets.

(iii) Only the strongest candidates saw what was required here. Even those who expressed their area as $(h^2 + 7^2)/2$ rarely appreciated the need to halve the 240 to get the exact area. Many simply quoted the area formula again as their response. Some returned to the question after finding h in part **(iv)**.

(iv) This was well answered and most candidates intelligently used the quadratic equation formula to good effect. It was surprising however how many did not give their answers to one decimal place, 12.38 and –19.38 being very common.

(v) Most candidates appreciated what was required in calculating the perimeter and successfully substituted their value of h to find the lengths of the two perpendicular sides. Only arithmetical slips prevented the sum of these and 23 producing an answer which earned the mark.

Question 10

(a) (i) Of those attempting this question, almost all earned one mark for stating the transformation was a rotation. Many quoted the correct angle for rotation. Stating the direction was clockwise was fairly common but most errors involved an incorrect or omitted centre of rotation, with (0, 4) a common wrong answer. Consequently few candidates earned the second mark.

(ii) Triangle *C* was positioned accurately by very many candidates. Most clearly showed good knowledge of translations although a significant number applied the translation which produced the triangle with vertices (-7, 0) (-6, 1) and (-4, 0).

(iii) It was clear that most candidates had an appreciation of reflections and those who could correctly draw the line $y = x$ were usually able to reflect the triangle successfully. Other candidates drew a variety of lines, most commonly the x axis and lines such as $y = 1$.

(iv) The lack of understanding of the concept of similarity was very evident and a significant number made no attempt at this part. Those with any understanding usually earned both marks but answers such as 1.5×4^2 were few and far between.

(b) Many candidates were able to identify the octagon as having two lines of symmetry, although 8 was a common answer, treating the shape as a regular octagon.

(c) This proved a challenge to most of the candidates and the answer of 3 was extremely common. Only a few gave the correct answer of 4. Some of those attempting Question 10 made no attempt at this part.

(d) A small minority were able to recognise both shapes and give their correct name. A majority earned one mark for identifying one of the shapes, almost always the rectangle. The use of 'oblong' and 'diamond' was rare.

Question 11

(a) (i) Most managed 7/30 with just a few decimal answers.

(ii) Some candidates gave the probability of a person going to Asia and others did not reduce their fraction 22/30 to its lowest terms.

(iii) (a) The tree diagram was frequently correct. Those diagrams which were wrong generally demonstrated a complete lack of understanding rather than minor slips. There were a few candidates who replaced the first person and gave 30 as the denominator for all the factors.

(b) Those who were successful in a) were often successful in this part as well. They selected the appropriate branches of the tree diagram, extracted the values from them and performed the correct operations to evaluate the required probability. It was pleasing that the latter process was regularly carried out correctly by those who made mistakes in completing the tree diagram.

(b) (i) There were many completely correct histograms and it appears that this was a topic that had been very well emphasised. Those who did not score in full usually got the first three bars correct and then plotted the last two bars at 0.08 and 0.04 instead of 0.008 and 0.004. In some cases the error was in the calculation and in others the misplotting of the correct values.

(ii) Many candidates had little idea of what was required. The more able ones made an attempt at linear interpolation to find the number of people in the middle interval who spent less than \$700. Unfortunately a few took this to be 7.5 and ended up with an answer of 62.5 or 63.

(iii) Many realised that they were required to evaluate $2/7 \times 35$ but this part did not produce as much success as one would have expected, with some calculating $2/7 \times 84$ or $2/7 \times 250$.