MATHEMATICS

Paper 4024/01
Paper 1

General comments

This was a good test for candidates of all abilities. It proved to be a challenge for the very able, testing their understanding of the concepts, but many candidates were able to record very high scores. Weaker candidates found many questions on which they could demonstrate their knowledge and ability, scoring quite well. Only a very small number of candidates appeared to be unable to answer a reasonable number of questions. There was no evidence that candidates had any difficulties in completing the paper in the time allowed.

In some cases the presentation of the working leaves much to be desired. Proper credit can only be given when the Examiners can follow what had been intended. Sufficient space for the working was available in all questions, which is where Examiners expect to find all that is to be considered. A small number of scripts are presented with a muddle of numbers in the columns reserved for the use of Examiners. Some Centres clearly issue other sheets of paper on which working may be done. This is not a good idea as it encourages candidates not to show all their working, so credit cannot be given for methods. In a few cases Centres submit these sheets. Credit is not often given for things on such sheets as it is impossible to disentangle the mixture of attempts at all of the questions. Centres should not issue such sheets of paper.

Comments on specific questions

Question 1

This was a relatively simple question testing basic arithmetic ideas. It was fairly well answered though many failed to use the correct order of operations in the first part, obtaining 14. Several ignored the percentage sign in the second part and quoted 17.5 as the answer.

Answer: **(a)** 15.5 **(b)** 0.175

Question 2

This question was well answered, with almost all candidates getting both answers correct. A small number left the second answer as $\frac{10}{1}$.

Answer: **(a)** $\frac{11}{28}$ **(b)** 10

Question 3

The majority had no difficulty in dealing with this question on equivalent fractions, though some careless multiplications led to loss of credit. A small number treated this as a sequence in which the third number in each of the numerators and denominators is the product of the first two, leading to $n = 16$ and $d = 13$.

Answer: **(a)** 12 **(b)** 26

Question 4

(a) This was quite well done on the whole. Some gave a negative value, which was accepted.

(b) This proved to be more demanding. Many correct answers were seen, but some very large or very small answers such as 0.02 or $\frac{1}{18000}$ appeared. Such candidates had little idea of what was a reasonable value.

Answer: **(a)** 0.6 m/s^2 **(b)** 72 km/h

Question 5

(a) The symbol for a recurring decimal was clearly not as familiar as it ought to be. Many took the second term to be 0.6. It was decided to accept either reading of the question and to mark it accordingly. Even then the response was very disappointing with many stating that 0.67 is smaller than 0.666. More work on this topic is needed.

(b) This question also led to a disappointing response. Some felt that they needed to round the number, some quoted 1.507 × 10^3 million or 1507 × 10^6 and very many were unable to quote the correct power of 10.

Answer: **(a)** $\frac{66}{100}$ $\frac{666}{1000}$ 0.6r 0.67 **or** 0.6 $\frac{66}{100}$ $\frac{666}{1000}$ 0.67 **(b)** 1.507 × 10^9

Question 6

The response to this question was quite good. Most were able to quote the prime factors correctly. The most common error in the next part was to find the highest common factor, 7, or to leave the answer as 2 × 7^2 × 11.

Answer: **(a)** 2 × 7 × 11 **(b)** 1078

Question 7

There were many good answers to the first part, though some took the angle sum of a quadrilateral to be 180°. The second part was not well done. Many gave as the reason that the lines never meet, or that it is a trapezium or even that ABCD is a quadrilateral. There was some confused use of words such as "opposite angles". A quick sketch diagram might have helped. Some of those seen had a quadrilateral ACBD in fact. Examiners expected to see a statement that A and D, or B and C are supplementary, hoping that it would be backed by B + C = 72 + 108 or A + D = 36 + 144.

Answer: **(a)** 36

Question 8

Although the first part was well done, the second part was not well answered with the negative sign often missing.

Answer: **(a)** R marked 2 squares below P **(b)** - 0.75

Question 9

(a) The majority of candidates recognised the correct region, but a few did not put the required symbol in that region. Instead they used shading. Most of these shaded the region expected, but some shaded the remainder of the diagram (as had been done in question 11). Neither of these was accepted without a key, since Examiners could not be sure what was intended.

(b) Some showed that they did not understand the meaning of the symbols by quoting the six elements in the first part. The second part was better done, though a small number also included 3 in the list.

Answer: **(b) (i)** 6 **(ii)** (4, 5)

Question 10

This question was quite well done. A small number gave equations in the second part and a smaller number reversed both inequalities. A few had difficulty in finding equations for the lines AB and AC.

Answer: **(a)** (-1, 3) **(b)** $y < 3$ and $y > \frac{1}{2}x$

Question 11

There was a mixed response to this question. A large number of candidates failed to notice the order of the first two parts and reversed their answers. This was not penalised on this occasion. Many understood histograms and did well, though a few drew a rectangle which had much too large a height. Some failed to draw the vertical line at 95 km/h. Others did not know that frequencies are represented by areas. These usually obtained 40, but were unable to complete the question successfully.

Answer: **(a)(i)** 40 **(ii)** 18 **(b)** Rectangle of width 30, height 0.4

Question 12

This was quite well done in most cases. Some gave 0 or 17 as the first answer, and rather more failed to simplify the last part, leaving it as 1/0.04.

Answer: **(a)** 1 **(b)** 32 **(c)** 25

Question 13

There was a good response to this question. Some had difficulty in the first part, quoting such answers as 27. The second part was well done with many candidates quoting a value in the given range for the last part, usually without showing a possible tangent.

Answer: **(a)** 4 **(b)(i)** 2 **(ii)** 1.1 to 1.3

Question 14

(a) Though a few took the radius of the circle to be 4x, the main error here was a failure to simplify the result.

(b) The working here was often very muddled and difficult to follow. There were a number of correct solutions. The radii of the semicircles were often not taken to be 2x and x and the factor of ½ was often missing from the area of a semicircle, or a factor of 2 introduced when considering a circle. Again answers were often not simplified. There was some confusion between perimeter and area.

Answer: **(a)** $6\pi x$ cm **(b)** $3\pi x^2$ cm^2

Question 15

There was a fairly good response to the area of the trapezium but work on the similar figures was less impressive. It was hoped that Examiners would see something like $\frac{h-4}{h} = \frac{9}{12}$ leading to the expected answer. Several used the height of triangle ADE as their variable but stopped when they had found that height to be 12 cm. Others used the result of the first part, but were again prone to stop when they had found the height of triangle ADE as they usually took that to be the variable h in $\frac{1}{2} \times 12(4 + h) - \frac{1}{2} \times 9h = 42$.

Answer: **(a)** 42 cm² **(b)** 16 cm

Question 16

This question was well done with many correct answers to both parts. A few tried to express the first part as a decimal, when Examiners expected to see at least three significant figures. A few lost some credit in the second part by failing to express the answer as a function of *x*.

Answer: **(a)** $\frac{2}{3}$ **(b)** $\frac{3x+4}{5}$

Question 17

Very many candidates were able to use the angle properties accurately though a few reversed the first two angles.

Answer: **(a)** 140° **(b)** 105° **(c)** 75°

Question 18

(a) This part was usually correct, but $1400 did appear sometimes.

(b) Most candidates chose to work with three cartons, for which the full price of $12.60 was found. Arithmetic errors often failed to lead to a saving of $3.15. Examiners expected this to be expressed as a percentage of the full price but many used $9.45. The division of 315 by either 12.6 or 9.45 was very inaccurately done however. The cancellation anticipated by the Examiners was clearly not obvious to the candidates.

Answer: **(a)** $14 000 **(b)** 25%

Question 19

(a) This geometric question on congruent triangles was not well answered. Many false assumptions were evident. Examiners hoped to see the three facts AY = BC, CY = AB and AC is common stated and the conclusion drawn.

(b) It was hoped that candidates would add the area of triangle ACX to each of the congruent triangles to obtain the required result but some obtained it by stating that ACX is congruent to both of the other triangles. Sadly many quoted false statements, wrongly assuming angles to be right angles in most cases or stating that the areas must be equal as the four sides are equal.

(c) Many correctly named the quadrilateral but there was a wide range of wrong answers such as diamond, trapezium or parallelogram.

Answer: **(c)** Kite

Question 20

(a) Some left this as 1:5 m or just quoted (n =) 500, but most obtained the expected ratio.

(b) The drawing was well done in almost all cases. The bearing was occasionally measured but usually obtained direct from the data. In most cases a correct value was found. In the last part almost all took an accurate measurement form their diagram but did not always successfully convert their length to the distance on the ground.

Answer: **(a)** 1 : 500 **(b)(ii)** 340° **(iii)** 28 to 31 m

Question 21

The factorisations were usually well done. A small number of candidates tried to "solve a quadratic equation" but had usually shown the factors in the first part. Some sign errors were noted in the second part but very many correct answers were seen.

Answer: **(a)** $(2x + 3)(x - 5)$ **(b)** $(2y - z)(t - 4s)$

Question 22

(a) The inequality was well done, but a few left it as $-k < -2$ or went on to $k < 2$. Some just quoted 2 as the answer. The equation was well done

(b) The majority of candidates knew how to set about solving the simultaneous equations but the work was often spoilt by poor arithmetic. Sign errors were noted, but the main problem was the inability of many to divide by 2 accurately, in particular $x = 37 \div 2 = 17\frac{1}{2}$ or $19\frac{1}{2}$, or more frequently $y = 21 \div 2 = 1\frac{1}{2}$.

Answer: **(a)(i)** $k > 2$ **(ii)** 30 **(b)** $x = 18\frac{1}{2}$ $y = 10\frac{1}{2}$

Question 23

(a) This was the most searching part of the question. Those who knew that sin 150 = sin 30 usually reached the expected answer, but many quoted $5 \times 0.87 = 4.35$.

(b) The use of Pythagoras was well understood on the whole and many arrived at the expected equation, though some inaccuracies such as $(3x)^2 = 3x^2$ or $(3x + 1)^2 = 9x^2 + 1$ were seen. Most candidates deduced that it followed that $x = 4$ and rejected (or ignored) the other possible value of $x = 0$, which is inappropriate in the given context, though it was not penalised. Very many correct values of the cosine of the obtuse angle appeared, but some gave a positive answer and some ignored the instruction that a numerical value was expected, giving an algebraic value.

Answer: **(a)** 1 **(b)(ii)** 4 **(iii)** $-\frac{5}{13}$

Question 24

Candidates seemed to understand what was expected in the early parts of this matrix question and many correct answers were seen. The last product, in part (b)(ii), caused more problems however. Only a very small minority of candidates were prepared to form a matrix with a single element within brackets. More gave the number 7600 but a much larger number gave the number pair 2800, 4800, with or without brackets. There were many good attempts at explaining what their answer represented. Examiners expected to see a reference to the total cost of making the toys. Reference to the number of toys was not accepted however.

Answer: **(a)** $\begin{pmatrix} 3 \\ 7 \\ 0 \end{pmatrix}$ **(b)(i)(a)** $p = 5$ **(b)** $w = 4$ **(ii)** (7600) **(iii)** Total cost

Question 25

(a) The majority were able to state the modal class but the calculation of the estimate of the mean was rather disappointing. Far too many used the interval widths, thus finding the mean of 40 values all of which were 10. Those who used the mid-interval values usually gained method marks, but arithmetic errors did not always lead to a numerator of 5050. Several of those who did find this number failed to divide it by 40 accurately.

(b) (i) There were good attempts at taking readings from the graph. Most showed at least one of the quartiles to be 121 or 132, but they did not always go on to find the Interquartile range of 11. In particular 132 – 121 = 9 was quite common. Some used 40 × (¾ - ¼) = 30 – 10 = 20 which led to the answer of 127.5. Very many candidates correctly found the last answer.

Answer: **(a)(i)** $125 < h \leq 135$ **(ii)** 126.25 **(b)(i)** 11 **(ii)** 16

MATHEMATICS

Paper 4024/02
Paper 2

General comments

The paper proved to be more difficult than last year's which had been more accessible than normal.

The first question was quite difficult for weaker candidates. The graph question, **Question 8**, usually a good source of marks for these candidates, was also a little harder than usual, particularly part **(d)**, and the difficulties in these two questions perhaps accounted for the lower marks this year. Very few candidates used grads or radians this year and it appears that Centres are stressing the need to use calculators correctly in this respect. However very many candidates lost marks through premature approximation – usually in the trigonometry questions (**Question 2** and **9**) but also in **Question 7**. It is hoped that Centres will stress to candidates the importance of the instruction on the front cover to give their answers to three significant figures and that this should mean working to 4 significant figures and correcting to 3 as they give their final answer. It was also noticed that candidates used a number of values for π, such as 3.1 and $\frac{22}{7}$ rather than their calculator value or 3.142 as instructed.

It was again noticeable that some candidates spent a lot of time and effort on questions that have only 1 or 2 marks allocated to them. They should realise that they are not using the best method in these cases and that they are either on the wrong track altogether or, at best, wasting a lot of time. They might, for example, have noticed that **Question 9(a)** has 4 marks allocated to it for the use of the cosine rule. Thus if they are using this rule as part of a solution to a 2 mark question, they should realise that there must be a much simpler and quicker method.

Overall, nevertheless, candidates seemed to complete their attempt at 4 'B' Section questions within the time allowed and the presentation of their work was generally good. A small number of candidates, however, do continue to work in two columns on each page which does make it more difficult for marking and checking.

Centres could perhaps also remind candidates that it would help Examiners it they attached any supplementary sheets and booklets at the back of their initial booklet — loosely, and in the order in which the questions were attempted — so that it is easy for Examiners to open and turn the pages and to follow through each of the questions.

Comments on Individual Questions

Question 1

(a) Many candidates found this question difficult, often misreading or misunderstanding the fare structure. Some thought that the \$1.20 was for the whole of the first 10 km, leading to answers of \$0.96 (or \$1.20) in (i)(a); \$12.40 in (i)(b) and 28.50 km in (ii). Others apparently misplaced the 'additional' in the fare table and took it to mean an additional 80c for each km, leading to answers of \$40 in (i)(b) and 12 km in (ii). All these candidates were allowed credit for the work they did.

A number of candidates tried to use a proportional argument and answers of \$2.88 from $\frac{1.20 \times 24}{10}$, 133.3 km from $\frac{10 \times 16}{1.20}$ or 13.3 km from $\frac{24}{28.8} \times 16$ were often seen.

Occasionally candidates confused dollars and kilometres and gave, for example, 17 from 5 km + \$12 in part **(ii)**.

(b) Many candidates had difficulty interpreting the 24 hr clock. In part **(i)** many took the time on May 6^{th} to be in the evening and hence gave an answer of 1 hr 16 min. In (ii) the most common error was to find 6.28 correctly, but than fail to complete the method by adding on the 10.

(c) The majority of candidates realised that they had to multiply 0.15 mm by 20 million, but very many failed to manipulate the decimal point correctly as they tried to convert to metres. Relatively few achieved the final answer of 4800 m.

Answer: **(a)(i)(a)** \$9.60, **(b)** \$23.20, **(ii)** 15 km; **(b)(i)** 13 hr 16 m, **(ii)** 16 28; **(c)** 4800 m.

Question 2

On the whole this was a very well answered question, with most candidates gaining 5 or more of the 7 marks. However very many marks were lost through premature approximation or truncated answers. Even though each part could be solved by a single stage method, it was common to see multistage methods involving Pythagoras, Sine Rule and Cosine Rule. In (c) it was sometimes assumed that either ΔBDC was isosceles or that $E\hat{B}C$ was a right angle.

Answer: **(a)** 37.9°; **(b)** 0.606 m; **(c)** 41.6°

Question 3

(a) Most candidates had the correct method and formed a correct denominator, very often 6a × 9a. The most common error, having reached 63a – 30a in to numerator was to progress to $\frac{33a}{54a}$ and then to $\frac{11}{18}$ or $\frac{11a}{18}$. Many left their answer as $\frac{33a}{54a^2}$.

(b) Although many correct answers were seen, there were several stages in the simplification process where mistakes were made. Clearance of the first bracket regularly produced $3b^2 - 3$ and even more candidates struggled with the binomial product. Many incorrect expressions were seen, with –2b + 4 (b + 2) being one of the most common.

(c) Answers of 127 were quite common, but many seemed not to understand the second part requiring a comparison of the two sequences S and T.

(d) Many candidates had difficulty understanding this part. Even when x – 38 was obtained, it was common to see 3(x + 60) = x – 38

Some candidates left their first answer as y = x + 22 – 60 and then wrote (x + 60) = 3(x + 22) – 60.

Some, successfully obtaining x = 87, failed to find the correct total number of shells, either leaving their answer as the individual's shells, 87 and 109, or adding Monday's and Tuesday's figures and getting 392.

Answer: **(a)** $\frac{11}{18a}$; **(b)** $b^2 - 3b + 8$; **(c)(ii)** 127, **(iii)(a)** 132, **(b)** $n^3 + n + 2$; **(d)(i)** x – 38,
(ii)(a) x + 60 = 3(x – 38) giving x = 87, **(b)** 196.

Question 4

(a) The first past was almost always correct and most candidates knew what was required in parts **(ii)** and **(iii)**. However those who used percentage often got into difficulties, using 26% or 27% in (ii) and often finishing with 20:9. In (iii) these candidates again used approximation and regularly failed to get 165.

(b) The majority of candidates seemed to be aware of the relevant theorems, and there were a good number of all correct solutions.

Answer: **(a)(i)** 60, **(ii)** 9: 4 **(iii)** 165; **(b)** 33°, 24°, 57° and 123°.

Question 5

(a) This was very well answered by many candidates. In (i) a few did not make it clear whether their answer was 3 or 6, in (ii) 5 was seen quite often, for obvious reasons, and in the last part Σfx was usually found correctly, but division by 7 or 35 was sometimes seen.

It was pleasing to see that there was very little confusion between the three types of average.

(b) Many candidates had difficulty with these relatively straightforward questions. The probability of 5 or 6 letters was regularly given as $^{11}/_{25}$ and of fewer than 9 letters given as zero.

(c) A large number of candidates assumed the replacement of the first word, ignoring the phrase 'from the remaining words'. A number of the better candidates gave $\frac{1}{60}$ or their answer to (ii), overlooking the fact that these were two combinations.

Answer: **(a)(i)** 3, **(ii)** 4, **(iii)** 4.6; **(b)(i)** $\frac{9}{25}$, **(ii)** 1; **(c)** $\frac{1}{50}$, $\frac{1}{30}$.

Question 6

(a) Many answers involved descriptions of lines, sides, triangles, quadrilaterals and many more seemed to equate symmetry with 'line' symmetry only, and seemed unaware of rotational symmetry. Those who did mention rotational symmetry sometimes spoilt their answer by stating line symmetry as well. The order of rotational symmetry was sometimes given but the centre of the rotational symmetry was rarely given.

(b) The term "column vector" appeared to be unfamiliar to quite a large number of candidates and there were many answers of the form $\overrightarrow{CD} = \overrightarrow{CA} + \overrightarrow{AD}$ etc. Sign slips accounted for most errors in serious attempts. In (iii) many gave $\begin{pmatrix} 6 \\ 4 \end{pmatrix}$ i.e., $\overrightarrow{OD}$ instead of $\overrightarrow{DO}$.

(c) 'Equilateral' or 'right angled' were almost as common as the correct answer.

(d) The majority of candidates recognised that the transformation was a shear, although many gave 'stretch'.

Answer: **(a)** Rotational symmetry of order 2, centre (3, 0); **(b)(i)** $\begin{pmatrix} 0 \\ 8 \end{pmatrix}$ **(ii)** $\begin{pmatrix} 6 \\ -4 \end{pmatrix}$ **(iii)** $\begin{pmatrix} -6 \\ -4 \end{pmatrix}$;

(c) Isosceles; **(d)(i)** (3, –2), **(ii)** Shear.

Question 7

This was a popular question, but oversights, dealing with spheres instead of hemispheres, dealing with one hemisphere instead of three, and using a linear instead of a 'cube' relationship in (b) lost many marks.

(a) Some candidates just gave the volume of the cuboid as their answer, others forgot to halve the volume of their spheres. Most were successful in part **(ii)**. Candidates answered (iii)(a) well although some again forgot to halve. They were less successful in (iii)(b) where many simply subtracted their answer to part **(a)** from 140 instead of using the circular areas.

(b) A surprisingly large number, including some very good candidates, took the volume to be proportional to the depth, and answers of 288 and 27.1 were very common. Those who interpreted the question correctly were usually successful, although a small number approximated $\frac{1}{3}$ as 0.3, obtaining answers outside an acceptable range. A small number took the square root of 3900 instead of the cube root.

Answer: **(a)(i)** 462 cm^3, **(ii)** 216 cm^2, **(iii)(a)** 118 cm^2, **(b)** 81.1 cm^2; **(b)(i)** 72 cm^3, **(ii)** 15.7 cm.

Question 8

This was a fairly popular question but relatively few seemed able to link the physical situation to the graphs. Many candidates could do little more then draw the graph and the tangent.

(a) Very few candidates used incorrect scales and most plotted the points correctly and drew acceptable curves. A few joined the top two points with a straight line.

(b) The value of t was sometimes not given, even though the graph had been correctly extended.

(c) The tangent was usually well drawn and in most cases candidates knew how to calculate the gradient, although the negative sign was omitted on a significant number of scripts. In (ii) a number gave 'speed' as their answer but most spoke of retardation or distance down the slope or about the curve sloping down.

(d) Only the strongest candidates were able to make any progress with this part of the question. Many did not attempt it, and those who did, usually drew a line from (0, 15) to (4, 19).

Answer: **(b)** 5.7 to 5.9; **(c)(i)** –4 to –6, **(ii)** speed; **(d)(i)(a)** 15, **(b)** 9, **(ii)** line from (0, 15) to (6, 6), **(iii)** 7 to 7.4.

Question 9

Generally candidates scored well on this question, although marks were often lost through premature approximation. Candidates who followed the structure of the question usually gave concise, accurate answers, but many used very long and complicated methods which produced many opportunities for errors.

(a) Competent use of the cosine rule provided many fully correct solutions. There were relatively few cases where 4621-3660cos41 became 961cos 41.

(b) Again this was very often correct from candidates using the appropriate area formula. Candidates who made a slip should have realised something was wrong when their answer was seen not to equal 600 m^2 when corrected to the nearest square metre. Candidates should also realise that the 600 is given so that they should use that figure in the rest of the question and not their incorrect value.

(c) Few could give an adequate explanation. Most candidates merely stated that the ratio of the areas was equal to the ratio of the sides, failing to mention that the triangles had the same height. A significant number found the area of ΔABC, then ΔBCD by subtraction and finally obtained the fraction which was required – a very long method for the one mark allocated.

(d) Many candidates did as was intended and used parts **(b)** and **(c)** to find the area directly, but a significant number again used long and complicated methods.

(e) It was, of course, expected that candidates would equate the area found in (d) to $\frac{1}{2}$BD × CN, but many again used long methods, involving $B\hat{D}A$, hence $B\hat{D}C$ and then CN = 45 sin $C\hat{D}N$.

(f) This part was quite well done, candidates understanding the move to the three dimensional diagram without too much difficulties. Most appreciated that $C\hat{N}E$ was required and used appropriate trignometer to find it.

Answer: **(a)** 43.1 m; **(c)** same height; **(d)** 900 m^2; **(e)** 41.8 m; **(f)** 21.1°.

Question 10

This was a very popular question and one in which candidates generally gained good marks. Most candidates displayed a good grasp of the algebraic techniques required and careless slips and misreads were the main reasons for loss of marks.

(a) Most candidates were successful here with just a few giving –9 as the square of –3 and obtaining the incorrect answer of –7.8.

(b) Many candidates arrived correctly at $x^2 = 4$ and gave x = 2 but omitted the negative solution.

(c) Able candidates recognised which values of x would produce the largest and smallest values of y and realised that the working for (i) had already been done in (a). Many others failed to see this and worked out all the y values corresponding to each integer value of x in the given range.

(d) The rearrangement of the expression was successfully carried out by a great many candidates. The most common errors were to give –12, instead of +12 or to indicate the square of only the numerator of the expression rather than the whole expression.

(e) (i) This was usually completed successfully by those who started with $\frac{t-3}{2} = \frac{3t^2 - 12}{5}$, but not by many who used a different starting point. Some ended ups with an equation in y. Others did not attempt this part.

(ii) Most candidates correctly attempted to use the formula for the solution of a quadratic equation, although relatively few gained all four marks. Some used –5 for –b or 25 – 216 for $b^2 - 4ac$, but the most common error was to give the final answers as 1.71 and –0.88 which are correct to 2 decimal places but not to 2 significant figures as required.

Answer: **(a)** 3; **(b)** ±2; **(c)(i)** 3, **(ii)** –2.4; **(d)** $x = \sqrt{\frac{5y+12}{3}}$; **(e)(ii)** 1.7 or –0.88.

Question 11

This was only answered really well by a small number of candidates. Many had a good idea of most of the transformation involved, but could not give the detail required to score well.

(a) (i) Most saw that P was a translation but many could not define it with the correct column vector.

(ii) Many realised that Q was an anticlockwise rotation, but the angle, and particularly the centre of rotation, were rarely correct.

(iii) A number of candidates were able to write down the correct matrix immediately by considering the images of $\begin{pmatrix}1\\0\end{pmatrix}$ and $\begin{pmatrix}0\\1\end{pmatrix}$ but many used very lengthy methods involving simultaneous equations which often produced errors.

(b) Very many gave 2 as the scale factor, rather than –2 and relatively few were able to find the image of (0, 4). One wrong approach was to take the matrix of the enlargement to be $\begin{pmatrix}-2 & 0\\0 & -2\end{pmatrix}$ resulting in an answer of (0, –8).

(c) The first two parts were usually correct although the determinant was sometimes quoted as $\frac{1}{2}$ or –10.

The more able candidates went on to use the inverse to answer part **(iii)** but many tried to use $\begin{pmatrix}-1 & 3\\-2 & 4\end{pmatrix}\begin{pmatrix}x\\y\end{pmatrix} = \begin{pmatrix}4\\-2\end{pmatrix}$ and made slips in the process.

Answer: **(a)(i)** Translation $\begin{pmatrix}-3\\0\end{pmatrix}$, **(ii)** Rotation, 90°AC, centre (0, 1), **(iii)** $\begin{pmatrix}-1 & 0\\0 & 1\end{pmatrix}$;

(b)(i) –2, **(ii)** (3, 1); **(c)(i)** 2, **(ii)** $\begin{pmatrix}2 & -1\frac{1}{2}\\1 & -\frac{1}{2}\end{pmatrix}$; **(d)** $\begin{pmatrix}11\\5\end{pmatrix}$.