MATHEMATICS

Paper 4024/01
Paper 1

General comments

This proved to be a good paper that tested candidates of all abilities. It was pleasing to note that only a small number of candidates obtained very low scores and that many scored very high scores. There was no evidence that the majority of candidates had any problem in completing the paper in the time allowed.

The questions involving standard form (18) and statistics (24) were particularly poorly answered by candidates from many Centres and should receive some extra attention in the future.

As noted in previous years, a small number of candidates at certain centres persist in filling the column reserved "For Examiner's Use" with rough working, usually in a disorganised form. They should be made aware that such work is always likely to be ignored. Rough working should be placed in the space provided in the question. Care should always be taken to ensure that any answers quoted are accurately transferred from the working to the answer space. For example in the first question the value $\frac{1}{14}$ in the working sometimes appeared as $\frac{1}{4}$ in the answer space.

Comments on specific questions

Question 1

Candidates showed an easy facility in dealing with the fractions in this gentle start to the paper, but there were some surprising errors noted when trying to express $\frac{14}{3}$ as a mixed number, with answers such as $2\frac{4}{3}$ appearing.

Answers: **(a)** $\frac{1}{14}$ **(b)** $4\frac{2}{3}$

Question 2

This question was also well done on the whole. A small number gave the first answer as 7.7 or 16.7 and more had difficulty in placing the decimal point accurately in the second part.

Answers: **(a)** 6.7 **(b)** 0.051

Question 3

This was also usually well answered. There were some sign errors in the first part leading to – 12. A small number left the answer to the second part as $\frac{y-2}{5}$, and $\frac{1}{5x+2}$ demonstrated a lack of understanding.

Answers: **(a)** – 8 **(b)** $\frac{x-2}{5}$

Question 4

Many candidates failed to round the numbers first, leading to some terrifying calculations. It was intended that the candidates would use 9, 2^2 and 0.3, but a large proportion of those on the right lines corrected 0.285 to 0.2, 0.5, 1 or even 0, which made the division very difficult. The final answer was expected to be corrected to one significant figure, but two significant figures were accepted.

Answer: 100 or 120

Question 5

Very many failed to use the information given, so long calculations appeared, which often contained errors. For these, long multiplication was likely to be better done than long division. Many had difficulty placing the decimal point in the correct place.

Answers: **(a)** 160.27 **(b)** 6820

Question 6

This question was usually well done, with many correct answers. A few used the wrong ratio, usually the tangent, and a small number overlooked the given length of *BC*, giving 13 cm as their answer.

Answer: 26 cm

Question 7

(a) Although some found the volume of the cuboid, the majority knew how to find the surface area but many were not able to simplify the expression accurately. Errors such as $2(10 \times x) = 20 \times 2x$, or even $20 + 2x$, were common.

(b) Almost all were able to use their expression to form an equation and able to attempt to solve it.

Answers: **(a)** $32x + 120$ cm² **(b)** 8 cm

Question 8

On the whole this question was well answered. The majority knew that the first answer was 1, but some tried to express the last two parts in alternative index forms, such as 3^{-4}. It was not clear whether the answer 1/18 in (b) was intended to be 1/(9 × 2) or a slip. Some gave 27/2 as the answer in (c).

Answers: **(a)** 1 **(b)** $\frac{1}{81}$ **(c)** 27

Question 9

Most candidates were well acquainted with the circle theorems and good solutions were common. A few wrongly assumed that triangle *ABC* is isosceles.

Answers: **(a)** 42° **(b)** 90° **(c)** 48°

Question 10

(a) It was not anticipated that so many candidates would think that the answer to this part should be given as $y = kx^2$. On this occasion the answer was accepted if there was also a clear statement that $k = 4$ in the working. Some candidates failed to start with the correct form however.

(b) Only a minority of candidates found both of the possible values of x. Because of the way the answer space was printed, some realised that two values were expected. Often two positive values, such as 3 and 2, appeared in these cases.

Answers: **(a)** $y = 4x^2$ **(b)** 1.5 and – 1.5

Question 11

There were some good answers here, with many correct answers. Some gave two or more answers to some parts and it was clear that there was considerable uncertainty in the minds of several candidates. A few thought that all six of the given shapes should appear somewhere. Many thought that parallelogram was the answer to (b) and trapezium to (c).

Answers: **(a)** Equilateral triangle **(b)** Rectangle **(c)** Kite

Question 12

The methods required to solve simultaneous equations were quite well known in most cases and often accurately applied. Where errors occurred they were often due to mistakes in signs.

Answer: $x = 2$ $y = -3$

Question 13

(a) There was a pleasing number of correct responses, but 15/8 was a common wrong answer.

(b) Candidates were generally aware that the area under the line was required, but care was needed when dividing it up. Many possible divisions of the area are available in this example. Some showed the parts they had chosen clearly on the diagram, but others gave no such indication. They were more likely to omit parts of the area, and it was then not always possible to give credit if an arithmetic error was made. Weaker candidates often used 20 × 30 or ½ ×20 × 30. A few did not use the given scales on the axes, working in printed squares.

Answers: **(a)** 3.75 m/s² **(b)** 270 m

Question 14

(a) Many started by calculating 30% of 370 = 111 g. They then stopped or failed to subtract from 370 correctly, obtaining 269 quite often.

(b) This question was not well answered. Very many expressed 5000 as a percentage of 30 000 rather than the original population of 25 000.

Answers: **(a)** 259 g **(b)** 20 %

Question 15

There was a good start on this question by very many candidates with a good number of correct conclusions to the question. Several examples of inaccurate algebra were noted however, with $-2(2t-1)$ in the numerator leading to many errors, the most common of which was $-4t-2$.

Answer: $\dfrac{8-t}{(2t-1)(t+2)}$

Question 16

(a) A variety of lines was seen here. Many did correctly pass through (0, –2), but not all had a positive gradient. Examiners were looking for a straight line through (0, –2) and (2 , –1).

(b) There was a fairly good response to this even when the line was incorrect. In most cases candidates did shade in the region requested, but many others shaded out the unwanted regions. These are both recognised conventions, and either was accepted, but to gain full credit the label R inside the appropriate triangle was also required to make it clear which system was used.

Question 17

(a) There were many correct answers here, but some reached (3, 6) or (2, 8) or (2, –8).

(b) This was well done.

(c) There seemed to be some confusion concerning what is the equation of a line. It was expected that an equation, containing *x*, *y*, numbers and an equal sign, would be given and that it would be simplified as far as possible. Statements such as $c = 6$ are not sufficient.

Answers: **(a)** (3, –6) **(b)** – 4 **(c)** $y = 6 - 4x$

Question 18

This question was not well done. The use of standard form clearly baffled many and needs further attention.

(a) Too often solutions started with 5.81 – 1.5 which was then multiplied by some power of 10. Several divided one number by the other. Some successful solutions started by writing out the numbers in full, but this is not a good strategy.

(b) Many solutions failed to express the distance from the sun in metres at any stage, often leading to the answer 1.5×10^{-4}. Some multiplied by 10^{12} in place of dividing.

Answers: **(a)** 9.19×10^7 km **(b)** 0.15 terametres

Question 19

(a) The factorisations were usually well done. A few assumed the expressions were to be equated to zero and then wrote down solutions to those equations.

(b) Although the stronger candidates had no problem with this question, there were many amazing errors noted. The multiplications caused problems for many, with 4 × 0.3 becoming 0.12 or 4.3 very frequently for instance. The correct collection of the two constants in the equation was also beyond many, leading to $x = -0.6, -1.8$ or 1.8 from correctly expanded equations.

Answers: **(a)(i)** $5x(3x + 2)$ **(ii)** $(t + 3)(t - 5)$ **(b)** 0.6

Question 20

(a) The majority of candidates seemed to know what was required here but there were many arithmetic errors. Often three of the elements were correct but in place of 3 the value -5 often appeared, or sometimes 5 or –3.

(b) This part was rather better done, with many correct answers seen.

Answers: **(a)** $\begin{pmatrix} 1 & 3 \\ 2 & 1 \end{pmatrix}$ **(b)** $\frac{1}{5}\begin{pmatrix} 4 & -1 \\ -3 & 2 \end{pmatrix}$

Question 21

(a) This question was very badly answered. Although many reached $-4t > 6$ only a minority were able to isolate t in an inequality to complete the answer in the answer space.

(b) Although the response to this part was rather better than that in the previous part, many arithmetic errors appeared. Although most found $x^2 = 4$, the values of $-6xy$ and $2y^2$ found were often not +36 and +18.

Answers: **(a)** $t < -1.5$ **(b)** 58

Question 22

(a) Although most reached 7 – 46, many did not simplify this expression, or gave 39 as the answer.

(b) (i) There were many correct answers. Some unsimplified answers, such as 4 + 3(n – 1), were seen, but more often n + 3 appeared.

(ii) This was well done, but sometimes clear attempts at 6^2 led to inaccurate values, such as 37.

(iii) A large number correctly followed through from their answer in **part (i)**.

Answers: **(a)** – 39 **(b) (i)** 3n + 1 **(ii)** $\frac{19}{36}$ **(iii)** $\frac{3n+1}{n^2}$

Question 23

Although the scale of the map caused trouble for some, most had no difficulty in writing down the distance between A and B. The construction of the triangle usually showed the arcs used and was accurately done. The majority of candidates drew the perpendicular bisector, though a few drew a line through *C* either to the centre of *AB* or perpendicular to *AB*. Many successfully completed the question by marking *F* and *G* on the perpendicular bisector.

Answers: **(a)(i)** 1 : 300 000 **(ii)** 30 (± 0.5) km

Question 24

This question was surprisingly poorly answered by many candidates, though there were very good attempts by the candidates at some Centres. The whole of the topic clearly needs more attention.

(a) (i) There were many wrong answers, many deriving from confusion between mode, median and mean.

(ii) Many errors were noted here, though most knew what was required. The correct terms were added in the numerator, but addition errors were common so that 126 was not obtained. A common total was 136, usually coming from assuming that 10 × 0 = 10. Although the question stated that there were 50 students, that number did not always appear in the denominator. Surprisingly common was 40, doubtless excluding the 10 who had no books, or 28 (the sum of the number of books, 0 up to 7) or just 7.

(iii) There was a mixed response here. At some Centres almost all candidates obtained the correct answer. In these Centres the most common errors were to use $2 \times 7/50 \times 7/49$ or $7/50 \times 7/50$. Weaker candidates produced a variety of answers often with denominators of 7 and/or 6.

(b) Only a minority of candidates seemed to be familiar with frequency polygons. Many drew block diagrams, often in addition to their attempts at the polygon. Examiners expected to see a uniform scale on the time axis with plots at (5 , 21), (7 , 11), (9 , 13) and (11 , 5) which were joined by straight lines. Some did not chose sensible scales on the axis. Some felt that they should form a closed polygon and produced what appeared to be something like a parallelogram.

Answers: **(a)(i)** 2 **(ii)** 2.52 **(iii)** $\frac{3}{175}$

MATHEMATICS

Paper 4024/02

Paper 2

GENERAL COMMENTS

The paper seemed, on the whole, to be of an appropriate length and standard. Most question gave the weaker candidate an opportunity to gain some marks, but also had one or two parts which tested even the strongest candidates. The full range of marks was seen.

There were, perhaps, more candidates than in previous years who were not able to attempt the required number of ***Section B*** questions and there were more cases where a question stopped prematurely. Often these candidates had lost time either by writing down excessive and unnecessary working or by selecting long methods, particularly in the trigonometry questions.

Candidates generally scored well on **Questions 2**, **4**, **8**, and **9**, although this varied very much with the centre. Some were very adept with transformations, matrices and/or vectors whereas others had clearly hardly covered the topics.

Most candidates presented their work clearly and neatly, although a small number gave their solutions in double columns, especially in the earlier questions.

Quite a number of candidates lost marks by not reading questions carefully enough. For example, in **Question 1 (a)** not recognising that one measurement was given in metres and the other in centimetres, in **Question 5 (b)** not giving their answers in lowest terms and in **Question 10** not giving their answers correct to 2 decimal places.

In many cases, candidates do not recognise the need to use brackets in algebraic expressions and this often leads to mistakes. For example in **Question 10** the area of the triangle *CRQ* was written as $\frac{1}{2} \times x \times 8 - x$ and this became $4x - x^2$ in the next line.

In trigonometry questions (**1** and **9**), candidates would be much more successful if they used the simple trigonometric ratios in right angled triangles and the Sine and Cosine Rules in triangles that do not have a right angle. Some candidates also seemed reluctant to use cosine or tangent ratios in right angled triangles, preferring to use Pythagoras and sine. Apart from wasting time, many of these candidates, even if they did follow the method through correctly, regularly lost accuracy marks by approximating a value to be used later in the question to only 2 or 3 significant figures. Candidates should be aware that when a method involving several stages is chosen, it is imperative that they keep intermediate answers to at least 4-figure accuracy and make full use of the memory facility on the calculator.

COMMENTS ON INDIVIDUAL QUESTIONS

Question 1

Most candidates were able to pick up some marks in this question, but relatively few gained full marks.

(a) Most, but by no means all, candidates used the correct formula for the volume of a cylinder – but the most common error was to ignore the difference in units and simply use r = 7 and l = 15. Some of those who did realise that they had to change the centimetres to metres tried to do this at the end of the calculation and usually failed – those who wrote r = 0.07 m were much more likely to be successful.

(b) (i) Many candidates seemed not to know the basic trigonometric rules for a right angled triangle and as mentioned above lost marks through premature approximation.

(ii) It was common to see candidates assuming $T\hat{P}A$ from **part (i)** was valid here: hence 180 – 49.3 = 130.7 was often seen. Others assumed that Pythagoras could be used in triangle *TPB.*

(iii) Many of those who did know which was the angle of elevation preferred to use Pythagoras to find *AT* and then use sine of the angle.

Answers: **(a)** 0.231, **(b) (i)** 49.3,° **(iii)** 114,° **(iv)** 33.1.°

Question 2

Generally well answered, with weaker candidates often gaining most of the marks.

(a) (i) A few candidates confused 'used' and 'unused' and gave 68.75 as their answer.

(ii) Rather more difficulty met by candidates here, with many leaving their answer as 88 and others calculating $\frac{50}{88}$.

(b) (i) Well answered by most candidates.

(ii) There were many correct answers, but a number were confused with the idea of the discount. Some thought it meant 10% and others used $2, presumably thinking it meant $1 for each $10 or part of $10.

(iii) This part caused the most difficulty. Most candidates used ‘trial and error’ methods and some did finish with the correct answer. More, however, simply tried one value, say 18, and because this gave a cheaper outcome for shop B, opted for this as their answer. Candidates were expected to work with $\frac{1000}{63}$ (= 15.87….) and to conclude that 16 was the smallest number – a few who did use this approach gave 15 as their answer.

A significant number gave their answer as 33, which was the largest number.

Answers: **(a) (i)** 31.25%, **(ii)** 1.76; **(b)(i)** $5.60, **(ii)** $0.28, **(iii)** 16.

Question 3

(a) It was common to see one of the factors (often 75) missing and occasionally to see the 60 repeated. Many who used all the correct factors were unable to give their answer in standard form, with 378×10^5 seen quite frequently.

(b) This part was poorly answered, with relatively few candidates producing either a correct equation or expression to find Ali’s heart rate. A large number simply worked out $\frac{15}{17}$ of 18, some misread “18 times per minute more than Ali’s" as "18 times more than Ali’s" and made no headway. Some who were able to produce a correct equation such as $\frac{15}{17} = \frac{x}{x+18}$ could not then do the algebra to solve it. Only a minority used the fact that the differences between 17 and 15, 2 units, is equivalent to 18 beats per second, so 15 units is equivalent to $15 \times 9 = 135$ beats per second.

(c) **Parts (i)** and **(ii)** were usually correct, but many had a problem transforming the formula, and many left their answers in a most inelegant form, often with – 4/5 in the denominator.

Answers: **(a)** 3.78×10^7; **(b)** 135 ; **(c) (i)** 156, **(ii)** 40, **(iii)** $220 - \frac{5H}{4}$.

Question 4

(a) There were many correct solutions with the most common method using $\frac{(8-2)180}{8}$. A number used the given 135° to prove that the figure was an octagon. A significant minority attempted to 'fiddle' the answer.

(b) (i) Although this appeared to be a fairly straightforward test of isosceles and right angled triangles there were many candidates who were unable to make very much headway.

(ii) A variety of responses included parallelogram, kite and cyclic quadrilateral.

(iii) This part was very well answered, with roughly equal numbers using Pythagoras and trigonometry.

(iv) Able candidates knew what was required, but there were very many references to equal lengths. Those working with angles quite often gave $F\hat{B}G = G\hat{C}E$ (angles in the same segment).

Finding the ratio of the areas proved to be very difficult, and even those who attempted to work with the idea of squares on corresponding sides were often unable to produce the simple value required.

Answers: **(b) (i) (a)** $22\frac{1}{2}$, **(b)** 45, **(c)** 45, **(d)** $67\frac{1}{2}$; **(ii)** trapezium; **(iii)** 14.1;
(iv) (b) 2.

Question 5

(a) Many gave correct answers – sometimes using a Venn diagram and sometimes by direct reasoning. A small number gave probabilities.

(b) Those who drew a good possibility diagram were usually successful. Predictably the answer $\frac{1}{12}$ was common in **part (iii)**.

(c) Answers to **part (i)** were very often 1×3 or 3×1 matrices, with candidates correctly multiplying the appropriate pairs, but failing to add the three products.

In **part (iii)** many candidates added 40, 30 and 50 and then divided by 3 and a few, having correctly calculated the distance 215 divided it by 3 instead of 5.

Answers: **(a) (i)** 24, **(ii)** 8, **(iii)** 31; **(b)(i)** $\frac{5}{36}$, **(ii)** $\frac{1}{9}$, **(iii)** $\frac{1}{6}$; **(c) (i)** (215),
(ii) total distance travelled, **(iii)** 43 km/h.

Question 6

(a) (i) This was almost always correct; only very occasionally did candidates read incorrectly from the graph.

(ii) There were a few more wrong answers here with some weaker candidates quoting 20 and 60 to give an interquartile range of 40, which was then often linked with 64.2, the candidates clearly not recognising that this "method" would always give a value of the IQR the same as the median.

(b) Very few candidates seemed to realise that the more consistent runner was the one whose times varied less, i.e. had the smaller IQR. Many apparently thought "more consistent" meant "better runner". Some thought that larger IQR implied "more consistent". Thus most gave the answer "Sam" with reasons such as "faster runner", "shorter time" or mentioned "median".

Answers: **(a)(i)** 64.2, **(ii)** 0.9, **(iii)** 50, **(b)** Paul, smaller IQR.

Question 7

Although many candidates selected this as one of their ***Section B*** questions, it was usually very badly answered and relatively few gained more than 3 or 4 marks.

(a) (i) Few candidates recognised the "compound" idea of the question and most simply calculated 7500×0.76 (or equivalent) = 5700.

(ii) In recent years it has been suggested that the idea of 'reverse percentages' has been well understood – but that was not the case with this particular question. The answer of 7268.8 was regularly seen and few candidates identified 6490 with 88% and then found 100%.

(iii) This proved to be the most difficult part of the paper. Most subtracted various multiples of 12%, reflecting the same error as in **part (i)**. It was very unusual for candidates to use their calculator to multiply a value (say 100), repeatedly by 0.88, keeping a record of the number of times, until the value is less than half the original value. Of the few who did use this method, some who arrived at 52.77… on Saturday and 46.44… on Sunday, then gave Saturday as their answer.

(b) (i) This was the best answered part of the question although many used a sphere instead of a hemisphere.

(ii) Those who did use a hemisphere often forgot that a solid hemisphere has a circular face as well as the curved surface, so that the total surface area is $\frac{1}{2} \times 4\pi r^2 + \pi r^2 = 3\pi r^2$.

(c) Only the stronger candidates realised that the ratio of the volumes equalled the ratio of the cubes of the heights.

Many merely calculated $\dfrac{12 \times 1080}{5000} = 2.59$.

Answers: **(a) (i)** 5810, **(ii)** 7375, **(iii)** Sunday, **(b) (i)** 12200, **(ii)** 3050, **(iii)** 7.2.

Question 8

Generally, this question was well answered. Even less able candidates were able to score for the graphs and for drawing the tangent.

(a) Usually correct, but 3.2 or – 3.2 were sometimes seen.

(b) The graph was usually well drawn. A few candidates used a wrong horizontal scale and few misplotted one or two points. A small number joined the points with straight lines.

(c) Many candidates did not give a value here and simply stated that y increased or decreased or approached the x axis.

(d) A tangent was usually drawn reasonably well, but sometimes not exactly at the point (3, 6.4). Most who drew the tangent knew how to calculate the gradient although some did not give their answers as a single number.

(e) The line was often drawn correctly, although a number joined (0,8) and (2,0). Candidates usually quoted the point of intersection correctly. There were very few correct answers to the last part. Only a small number realised that they should equate $4/5 \times 2^x$ and $8 - 2x$, rearrange the equation into the form given in the question and read off the values of A and B.

Answers: **(a)** 0.2; **(c)** 0; **(d)** any value between 4 and 5; **(e)(ii)** (2.2,3.6)
(iii) $A = -2\frac{1}{2}$ $B = 10$.

Question 9

This was a popular question and most candidates gained good marks.

(a) Some confusion, but most candidates showed a good grasp of bearing measurement. Common wrong answers were 138° in **(i)** and 73° or 253° in **(ii)**.

(b) There were many fully correct applications of the Cosine Rule although errors were sometimes made in collecting the terms. A small number tried to use Pythagoras or the Sine Rule.

The formula for area was well known and competently applied by most candidates.

(c) (i) This part caused more difficulty. Some thinking was required to sort out the distance required and then choose the appropriate method to calculate it. Triangle *ABL* featured regularly; sometimes it was assumed to be isosceles, sometimes the required distance was assumed to be *BL*. Some correctly calculated angle *AHL* (others thought it was 48°), but then used tangent to find the perpendicular from *A* to *HL*. Some, who did realise that the perpendicular distance from *L* to *HB* was required lost accuracy in the course of unnecessarily long methods.

The stronger candidate went straight to the correct answer using either 2.8 sin 65° or their answer to the previous part.

(ii) Most candidates realised that they had to divide distance by speed, but many made an error in managing units. Thus $\frac{4.5}{3}$ = 1.5 hours, leading to an answer of 05 45 was common. Even candidates who reached 25 minutes did not always find the correct time.

Answers: **(a)(i)** 222°, **(ii)** 107°; **(b)(i)** 6.22 km, 5.71 km^2; **(c) (i)** 2.54 km, **(ii)** 06 50.

Question 10

This question did not often produce high marks – but many candidates were able to pick up the first two marks and 2 or 3 marks from **part (d)**.

It needs to be emphasised to many candidates that when a question states "show that…." and gives the final expression (as in both **(b)** and **(c)**) then candidates must be absolutely clear in each stage of their solution.

(a) Both parts were usually well answered, although *QC* was sometimes given as x – 8.

(b) Generally this was poorly answered, with many candidates not realising that their answers in **part (a)** were relevant.

It was also common to see the lengths *PQ* and *RQ* worked out using Pythagoras and then the two multiplied. Other candidates, seeing the answer, thought it came from (8 – x) (12 – x). Better candidates did use the correct method, but sometimes their algebraic steps were flawed.

(c) Candidates had more success with this proof.

(d) The majority of the candidates attempted to use the formula and most of these gained at least 2 marks. Common errors included using –10 (instead of –(–10) = +10), or only dividing part of the numerator by 2.

A number of those who did use the formula correctly lost the last mark when they failed to give the answers correct to 2 decimal places.

(e) (i) Most attempted this part by multiplying out the right hand side, but slips were common. Those who attempted to rearrange the LHS similarly often made algebraic errors. Those who substituted a value for x were generally more successful.

(ii) Very few candidates could see the connection between the expression $2\ (x-5)^2 + K$ and the area of *PQRS.*

Answers: **(a)(i)** $8-x$, **(ii)** $\frac{1}{2}x(8-x)$; **(d)** 7.65 and 2.35; **(e) (i)** 46, **(ii)** 46, $x = 5$.

Question 11

There was some good work seen in both parts of the question, but generally only a minority of candidates gained high marks.

(a) The ideas of transformations were understood by many candidates, but relatively few were able to give full descriptions.

(i) The vector was often correct, but $\begin{pmatrix} 6 \\ -3 \end{pmatrix}$, $\begin{pmatrix} 6 \\ 3 \end{pmatrix}$ and (–6, 3) were all seen.

(ii) Most realised that an enlargement was involved, but few could also give both the scale factor (2, –2 or $\frac{1}{2}$ were common incorrect values) and the centre. Some candidates quoted an enlargement and a rotation, ignoring the emphasised 'single'.

(iii) The centre of rotation was often incorrect or omitted.

(iv) A number of candidates quoted $\begin{pmatrix} k & 0 \\ 0 & k \end{pmatrix}$ but often with $k = 2$ or $\frac{1}{2}$.

(b) (i) The first two parts were often correct but in **part (c)**, although quite a good number gained partial credit for a correct vector expression for $\overrightarrow{QS}$ which involved $\overrightarrow{RT}$, only a very small number succeeded in getting a correct, simplified expression for the required vector.

(ii) The majority of those who achieved the correct expression for $\overrightarrow{QS}$ were able to obtain the correct value here.

Answers: **(a)(i)** Translation, $\begin{pmatrix} -6 \\ 3 \end{pmatrix}$; **(ii)** Enlargement, SF $-\frac{1}{2}$, centre (–2, 1);

(iii) Rotation, 90° anticlockwise, centre (–1, 0); **(iv)** $\begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix}$.

(b) (i) (a) $\mathbf{p} + 2\mathbf{q}$, **(b)** $2\mathbf{p} - 2\mathbf{q}$, **(c)** $\frac{1}{3}\mathbf{p} + \frac{2}{3}\mathbf{q}$; **(ii)** $\frac{1}{3}$.