MATHEMATICS

Paper 4024/01
Paper 1

General comments

There were many well presented scripts of a good standard that showed that candidates had been well prepared to deal with questions on all aspects of the syllabus.

There were a number of questions including 1(b), 2(a) and (b), 3(b), 4(a), 5(a), 9(a)(i), 10(a) and (b), 11(a), 14(a), 16(a), 17(a) and 18(b) where candidates of all abilities scored well.

In **Questions 1(a)**, **4(b)**, **6(a)**, **15(c)**, **19(a)** and **21(c)**, however, candidates throughout the range scored less well.

There were opportunities for all candidates to demonstrate what they knew and generally the paper allowed positive achievement across the whole ability range. There were also challenges for the more able.

Candidates were able to complete the paper comfortably in the time available. Inevitably, there were gaps where weaker candidates were not able to give responses to particular questions.

In this non calculator paper, weaknesses in basic arithmetic can be exposed and this can lead to a significant loss of marks for some candidates. For example, in **Question 22(b)(ii)**, the calculations of the areas required to solve this problem were frequently incorrect.

Some candidates appeared to be unsure of the exact meanings of some of the standard terms frequently used in questions. For example, “factors” in **Question 6(a)**, “simplify” and “simplify fully” in **Question 7**, and “formula” in **Question 12(a)**.

Candidates in some Centres should be encouraged to use the working space provided in the paper more effectively. It should not be necessary to use the margins of the printed paper for working, or to attach large numbers of extra sheets of working to the printed paper.

Comments on specific questions

Section A

Question 1

(a) A variety of answers here, such as 1, 37, 48 and –3, showed candidates to be unsure of the order of the four operations of arithmetic, even though BODMAS was frequently seen quoted in the working space.

(b) This was well done, although $\frac{82}{100}$ seen occasionally.

Answer: **(a)** 3 **(b)** 82

Question 2

(a) Well answered.

(b) Mostly correct.

Answer: **(a)** $\frac{2}{3}$ **(b)** $\frac{1}{12}$

Question 3

(a) It was expected that candidates would evaluate these numbers, so that 3^3 and 4^3 were not accepted as the answer unless 27 and 64 were seen in the working. The answer 3 and 4 was not accepted.

(b) Generally well done. Wrong answers included 33 and/or 39 , and occasionally 41.

Answer: **(a)** 27, 64 **(b)** 31, 37

Question 4

(a) The instruction to factorise was clearly understood here. The difference of two squares was well known, although some candidates lost the mark by going on to incorrect expressions such as $x^2 - 2xy + y^2$.

(b) The link with **part (a)** was not always appreciated, with $4^2 = 16$ a common wrong answer, and some candidates preferring to use long multiplication. Candidates needed to go beyond simply writing down (102 – 98)(102 + 98) to score this mark.

Answer: **(a)** $(x - y)(x + y)$ **(b)** 800

Question 5

(a) This needed care, but generally well done. The answer was accepted in standard form. The fraction $\frac{7}{2000}$ was not accepted.

(b) Not always understood. Some candidates appeared to think it was already a decimal. 0.125 was a common wrong answer.

Answer: **(a)** 0.0035 **(b)** 0.8

Question 6

(a) This mark proved to be a difficult one for many candidates. Here, the word "factors" refers to the individual numbers 1,2,3,6,9 and 18. It was essential to include both 1 and 18 to score this mark. Candidates were not penalised for presenting their answer in forms such as 3×6 =18, 2×9=18, etc. provided that all the factors were seen, but wrong factors, such as 4, were not condoned. Many candidates, however, anticipated **part (b)** of this question, and gave the answer 2×3^2, for which no credit was given.

(b) The meaning of this part of the question was well understood, and it was well done. A few candidates seemed to think that 49 was a prime, since it was frequently left without being factorised.

Answer: **(a)** 1, 2, 3, 6, 9, 18 **(b)** $2^3\times7^2$

Question 7

(a) "Simplify" was apparently not always understood. The response $a^2(4a\times1)$ for example suggested some confusion with "factorise". $4a^6$ was a common, incorrect, response.

(b) Again, "Simplify fully" was not always understood. Many candidates who achieved $3x^2 + 13x + 6$ in the working space then went on to solve the quadratic equation $3x^2 + 13x + 6 = 0$. These candidates were not penalised. However, candidates who attempted further, incorrect algebra after reaching $3x^2 + 13x + 6$, such as incorrect factorisation, or the final answer $x^2 + \frac{13}{3}x + 2$, were given the method mark only. This was available for reaching $3x^2 + 15x - 2x + 6$. Sadly, many candidates did not achieve this, the usual errors being 15 instead of $15x$, and -6 instead of $+6$.

Answer: **(a)** $4a^5$ **(b)** $3x^2 + 13x + 6$

Question 8

(a) Well answered on the whole. Candidates were expected to carry out the conversion, so the answer 0.8×10^6 was not accepted. A common error was to divide by 10^6.

(b) Care was needed with this calculation. Some credit was given for a correct equivalent of 7×10^3, such as 7000 or 0.7×10^4, that was not in standard form.

Answer: **(a)** 800 000 **(b)** 7×10^3

Question 9

(a) (i) Generally well done.

(ii) Less well done, a common error being to read the graph at the cumulative frequency 20 rather than at the 20th percentile, the cumulative frequency 10.

(b) Quite well done, with many candidates supporting the answer Mathematics with the expected observation about the medians of the two distributions. Credit was also given to those candidates who conveyed the idea that the curve for Mathematics was generally to the left of, or above, the curve for English. No credit was given for comparisons at arbitrarily chosen points, such as the 20th percentiles, or for explanations involving terms such as interquartile range and gradient.

Answer: **(a)(i)** 54 to 56 **(ii)** 28 to 30 **(b)** Mathematics because the median for Mathematics is lower than the median for English.

Question 10

(a) Generally well done. The 12 hr clock answer was accepted if p.m. was stated.

(b) Again, generally well done. Some credit was given for times such as 19 40 or 06 30 seen, that indicated some understanding of the process required. Again, the 12 hr clock answer scored full marks if p.m. was stated.

Answer: **(a)** 14 00 **(b)** 14 40

Question 11

(a) Mostly correct.

(b) The correct answer was achieved by a pleasing number of candidates. Most candidates who attempted this part of the question realised that ideas of proportion were required rather than mensuration formulae. The common error, however, was to use the ratio 2:1. Credit was given for seeing an attempt to use the ratio of corresponding lengths cubed. Those who simplified, for example, $\frac{15}{30}$ before cubing, however, were generally more successful. Some candidates cubed the ratio of corresponding volumes.

Answer: **(a)** 15 **(b)** 6 800

Question 12

(a) The basic algebra required in this question was well understood by many candidates. However, a mark was frequently lost for the final answer $y = k\sqrt{x}$ instead of $y = 2\sqrt{x}$. Weaker candidates attempted to use $y\alpha\ \frac{1}{x^2}$ or $\frac{1}{\sqrt{x}}$.

(b) Usually well done by those working with $y = k\sqrt{x}$, although no credit was given for the answer $\sqrt{625}$.

Answer: **(a)** $2\sqrt{x}$ **(b)** 25

Question 13

(a)(b)(c) Those candidates who tested the given equations by checking values seemed to do reasonably well. It seemed likely that in other cases, where there was no particular pattern to the incorrect answers given, that guessing had been involved.

Answer: **(a)** 3 **(b)** 2 **(c)** 1

Question 14

(a) Usually well done.

(b) A common error here was the answer 36˚.

(c) Credit was given if the link with the angle of 90˚ at *C* was used.

(d) The connection with **part (c)** was usually seen. In a few cases, the link with the angle of 90˚ in **part (b)** was used. In these cases, credit was given.

Answer: **(a)** 36 (**b)** 18 **(c)** 108 **(d)** 72

Question 15

(a) There were a number of unorthodox totals such as 8½ minutes 50 seconds for which no credit was given. Many candidates made hard work of this.

(b) Again, rather poorly done. Division by 2 or 5 was common. Division of this quantity in mixed units seemed to be tackled in a disorganised way.

(c) This question appeared not to be understood by many candidates, and was frequently omitted.

Answer: **(a)** 9 20 **(b)** 2 20 **(c)** 2 45

Question 16

(a) Generally well done.

(b) Generally well done, although working such as $12 - 5 \times 17 = -73$ was seen from time to time.

(c) Construction of the inverse function was generally well understood. Most candidates expressed it in terms of x. Some credit was given if left in terms of y.

Answer: **(a)** -8 **(b)** -1 **(c)** $\frac{12 - x}{5}$

Question 17

(a) Generally well done. A method mark was available for reaching $9x - 6 = 5x$. A common error, however, was that $4x = 6$ was sometimes followed by $x = \frac{2}{3}$.

(b) Again generally well done. Sometimes the possible values of y were given as 1½ and 5. Credit was given for establishing both the inequalities $y > 1½$ and $y < 5$. A common error was to find that $y > -1.5$ by failing to take due account of the -6 at that stage.

Answer: **(a)** 1.5 **(b)** 2, 3, 4

Question 18

(a) (i) Generally well done. Some candidates lost this mark by showing two 3's in this set. Others had confused union and intersection.

(ii) A little more difficult, but nevertheless, understood by many candidates.

(b) A lot of success in this question. Most candidates used a Venn diagram, and many used algebra with x representing the number of children who played both Football and Hockey. For those not gaining full marks, for example giving the answer as 7, credit was given either for the equation $(35 - x) + x + (29 - x) + 3 = 60$, or for $(35 - x)$, x, $(29 - x)$ and 3 correctly placed in the diagram. For those candidates working numerically, but not able to extract the final answer, credit was given for the numbers 28, 7, 22 and 3 seen in a Venn diagram.

Answer: **(a) (i)** 1, 2, 3, 4 **(ii)** 1, 2 **(b)** 22

Question 19

(a) Although there were a number of good solutions, these were invariably from better candidates, with most candidates continuing to find geometry difficult.

The final mark was perhaps the most difficult to earn. Two method marks were available, one for stating that LM and LN were equal, and the other for stating either that angle L was common to each triangle, or that $L\hat{M}Q = L\hat{N}P$. These marks were earned in a good number of solutions. However, for the final mark, candidates must have identified both pairs of equal angles, together with the pair of equal sides, so that the triangles could be said to be congruent.

The most common mark for this question was 1, usually for a correct pair of equal angles. These candidates were generally aiming to show that the triangles were equiangular, from which, of course, congruency does not follow.

The main difficulty candidates seemed to have was in separating out what could be assumed from the information that was given in the question from what would follow should the triangles be congruent.

(b) It was expected that candidates would use the congruent triangles established in the previous part, the angles here being each adjacent to two equal angles of the congruent triangles. Whilst this approach was seen, there were in fact a good number of solutions given using the equiangular triangles *PRM* and *QRN*, or the equiangular triangles *MPN* and *MQN*.

This part was quite well done, but a common misunderstanding amongst weaker candidates was that the given angles were equal because they were angles on the same base, or that they were angles in the same segment of a circle.

(c) A number of candidates stated trapezium or diamond, but a pleasing number were correct.

Answer: **(a)** In triangles *LMQ* and LNP, *LM=LN,* $M\hat{L}N$ is common or $L\hat{M}Q = L\hat{N}P$, conclusion that triangles *LMQ*, *LNP* are congruent having given all the evidence required.
(b) $L\hat{Q}M = L\hat{P}N$, $M\hat{P}N = 180 - L\hat{P}N$ and $M\hat{Q}N = 180 - L\hat{Q}M$ and conclusion.
(c) Kite

Question 20

(a) Generally well done.

(b) Generally at least one mark scored. Some credit was given either for a 90˚ clockwise rotation, or for a triangle with two vertices correct.

(c) Quite well done. Candidates were given credit for mentioning either reflection, or the line $x = 1$.

Answer: **(a)** Triangle *C* with vertices (–1,3), (1,3) and (1,4) **(b)** Triangle *D* with vertices (3,0), (3,–2) and (4,–2) **(c)** Reflection in the line $x = 1$

Question 21

(a) Each term was required in its simplest form, so that $\frac{4}{1}$ for example was not accepted. 0.4.. was accepted provided that $\frac{4}{9}$ had been seen. In a number of solutions, $\frac{4}{9}$ was wrongly simplified to $\frac{2}{3}$.

(b) When attempted, this part was often done well. Some credit was given for attempts to solve the equation $\frac{4}{k^2} = \frac{1}{100}$. A number of candidates, however, lost the 4 at this stage.

(c) Fewer candidates managed full marks here. Credit was given for the answer 25. A method mark was available for an attempt to solve the inequality $\frac{4}{m^2} < 0.0064$. However, although essentially similar to the method in the previous part, fewer candidates seemed to manage this. Some candidates used 0.0063 at this point.

Answer: **(a)** 4, 1, $\frac{4}{9}$ **(b)** 20 **(c)** 26

Question 22

(a) Many candidates showed this convincingly.

(b) (i) Careful arithmetic was needed here to achieve full marks. Unfortunately, this let many candidates down: correct lists of numbers were often added incorrectly. Candidates were given some credit if they were clearly evaluating the perimeter required, but had simply made a minor error. A consolation mark was also given for the answer of 120, the perimeter of the shape without the triangle removed.

Candidates who used the formula 2(L +B) for the perimeter of each rectangle that the complete shape had been divided into, however, generally failed to take account of the extra lengths being generated, and so gained no credit, since this was not an appropriate strategy for solving this problem.

(ii) Again, careful attention to the necessary arithmetic was imperative. Correct ideas were often spoilt, such as calculating the area of a rectangle 30 by 18 and arriving at 2400, or even 54.

Credit was given if the separate areas being calculated could be combined to give the area required, and if the correct formulae were being applied to each individual area.

Common errors resulting in no marks being awarded were (a) calculating the areas of rectangles only, or (b) using inappropriate values in the formulae for the area of either a triangle or a trapezium.

(c) This was known by many of the better candidates.

Answer: **(a)** $\sqrt{13^2 - 5^2}$ evaluated or $13^2 = 12^2 + 5^2$ confirmed **(b)(i)** 116 **(ii)** 690 **(c)** $-\frac{5}{13}$

Question 23

(a) A good number of correct answers. A common wrong answer was 1:1200

(b) If attempted, this part of the question was generally done quite well. When incorrect, credit was given if *C* was due West of *B*, or if $C\hat{A}N$ was 150˚. In some cases, the label *C* was rather vaguely attached to a correct line *AC* drawn, and this possibly resulted in the loss of a mark.

(c) This part of the question was answered well on the whole. However, a few candidates had D on the wrong side of AB, and in some cases, the triangle ABD was not equilateral.

(d) Again, when attempted, often done quite well. Credit was given if *E* was on *AB* or *AB* produced, or if *AE* was 10 cm.

Answer: **(a)** 200 **(b)** *C* due West of *B* with $C\hat{A}N$ = 150˚ **(c)** *D* to the North of *AB* with *AD* = *BD* = 6 cm **(d)** *E* on *AB* produced with *AE* = 10 cm

MATHEMATICS

Paper 4024/02
Paper 2

GENERAL COMMENTS

The paper seemed to be of appropriate length. Most candidates seemed to have sufficient time to attempt 4 questions in ***Section B***, and of those who did not, many had lost time on excessive and unnecessary working or had chosen long or incorrect methods, especially in **Question 2(a)(i)**, **Question 7(b)** and the Trigonometry questions.

Most candidates presented their work neatly and clearly and the graph in **Question 8**, in particular, was often extremely well drawn, even by relatively weak candidates.

There are, however, still a small number of candidates who give their solutions in double columns. As well as sometimes confusing the candidates themselves, this makes it difficult for Examiners.

Centres could perhaps remind candidates to attach any supplementary sheets/booklets loosely at the back, in the order in which the questions were attempted. Answer booklets from some Centres were not hole-punched, forcing candidates to make holes with a pen or pencil.

Quite a number of candidates lost marks by not reading the questions carefully. For example, not realising that **Question 1(d)** asked for each answer to be given correct to 2 decimal places; **Question 10(e)** asked for answers as fractions in their lowest terms. Candidates should also be alerted to the instruction on the cover of the question paper, that "If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place." They should also be aware that, in order to give this accuracy in the final answer, all working should be to at least 4 figure accuracy. This applies particularly in Trigonometry questions. Some candidates lost a number of marks through this premature approximation.

COMMENTS ON INDIVIDUAL QUESTIONS

Question 1

Most candidates attempted all parts of this question, and although a good number gained full marks, most gained 4, 5 or 6 and a few made errors in all parts.

(a) Most attempts started well but very many continued with incorrect subsequent working. Many thought the numerator $4a^2 + 9$ could be simplified as $(2a + 3)^2$ or $(2a + 3)(2a - 3)$ or that an 'a' could be 'cancelled' with the 'a' in the denominator. A few equated to zero and tried to 'solve'.

(b) This was usually answered correctly although a few attempted to 'solve' for b.

(c) Most candidates knew what was required here. Very many were successful with **part (i)** but a few struggled with the directed numbers in **part (ii)**.

(d) The majority of candidates used the quadratic formula and there were many completely correct solutions although $\sqrt{37}$ instead of $\sqrt{205}$ was quite common and quite a number failed to correct to 2 decimal places accurately. Solutions such as 0.553 or – 4.21 were not unusual.
A small number tried to 'complete the square' but were rarely successful.

Answers: **(a)** $\dfrac{4a^2+9}{6a}$; **(b)** $5b(b-2)$; **(c) (i)** (6, 2), **(ii)** 10.8; **(d)** 0.55 and –4.22.

Question 2

(a) (i) Most candidates had the right idea and tried to divide 378 million by the number of seconds, but many omitted one or more of the required factors. Many made it a very long process by working each stage out, rather than writing 378 million divided by 20 × 7 × 24 × 60 × 60 and doing the calculation in one step. A small number divided their number of seconds by 378 million.

(ii) Quite a varied response. Many showed correct working, although a few of these went on to subtract 100% and gave 50% as their answer. Some used $^{945}/_{378}$ and did not subtract 100%. Some used 78.125 and 31.25 instead of the easier 945 and 378. Many, though, started with $^{378}/_{945}$ or $^{567}/_{945}$ or $^{378}/_{567}$.

(iii) A few candidates made errors in their cancelling and a few gave 1 : 2.5 as their answer, but there were very many correct answers.

(b) There were a large number of correct solutions, with just a few candidates starting with 480 × 0.6.

Answers: **(a)(i)** \$31.25, **(ii)** 150%, **(iii)** 2 : 5; **(b)** \$16.

Question 3

(a) (i) Answered correctly by many candidates, although quite a number gave the complement. A good number of candidates seemed averse to using the direct tangent ratio, preferring to use Pythagoras to find PB and then the Sine Rule or the sine ratio. These candidates often lost accuracy marks by approximating PB to only 2 or 3 significant figures.

(ii)(a) Again, this was well answered although a few assumed that angle PXD was a right angle and worked with 11 cos 28°. A smaller group assumed that the horizontal from X bisected PD and evaluated PX from 5.5/cos 28.

(ii)(b) Those who drew the horizontal line from X and labelled it with a 4 were usually successful. A few used the Cosine Rule in ΔDPX to find DX and then used Pythagoras in ΔDXB. Others used the Cosine Rule in ΔPXB. As in the earlier part of the question, these longer methods often led to the loss of accuracy marks when candidates approximated intermediate values.

(b) Very many correct answers, although some gave their answer correct to 2 significant figures, instead of the required 3.

Answers: **(a)(i)** 70.0°, **(ii)(a)** 8.52 m, **(ii)(b)** 3.48 m; **(b)** 2.84 cm.

Question 4

(a) (i) There was a clear lack of understanding of both line and rotational symmetry. There were no obvious common wrong answers with 1, 2, 6 and 9 appearing in both parts. In the rotational symmetry part, clockwise appeared as an answer and sometimes a number of degrees.

(ii)(a) Generally well answered from $(n - 2) \times 180$ or $(2n - 4) \times 90$.

(ii)(b) Many gave the correct equation $6x + 3y = 1260$ but a good proportion of these could not go on to give an expression for y in terms of x. Some gave x in terms of y.

(ii)(c) There were many correct answers here, even from those candidates who failed to give the expression for y in the previous part.

(b) This was a very well answered question with candidates showing a good knowledge of the properties of angles and parallel lines.

Answers: **(a)(i)(a)** 3, **(i)(b)** 3, **(ii)(b)** $y = 420 - 2x$, **(ii)(c)** 136; **(b)(i)** 114°, **(ii)** 42°, **(iii)** 63°.

Question 5

This was one of the least successfully answered questions.

(a) (i)(a) There was a reasonable amount of success here although a number used $8/200$ = 0.04 and almost as many, with little understanding of retardation, worked out $\frac{200}{4}$ to give 50.

(i)(b) Most candidates realised that they needed to find the area under the graph but very frequently only found part of the area, usually the triangle.

(i)(c) There was a poor response to this part, with many simply dividing their previous answer by 150.

(ii) This was the least well answered part. Many argued that since Ben ran the same distance he must have the same speed and simply repeated their previous answer.

(b) (i) There were many correct answers seen, although 190 and 199.5 appeared quite frequently.

(ii) In many cases the bounds were initially ignored and $200/25$ produced 8, which was then occasionally followed by 8 – 0.5 = 7.5. Although the majority of candidates did use the bounds, relatively few realised that they required the upper bound in the denominator.

Answers: **(a)(i)(a)** 0.02 m/s^2, **(i)(b)** 1200 m, **(i)(c)** 5 m/s, **(ii)** 6.5 m/s; **(b)(i)** 195 m, **(b)(ii)** 7.65 m/s.

Question 6

(a) Very well answered, with most candidates clearly recognising the patterns.

(b) The expression for x was often correct, but there was less success with y and particularly z.

(c) There were many correct answers although 101 was common and 101.5, 50 and 202 were seen occasionally.

Answers: **(a)** $p = 11$, $q = 30$, $r = 60$, $s = 6$; **(b)** $x = 2n + 1$, $y = n(n + 1)$, $z = 2n\,(n + 1)$; **(c)** 102.

Question 7

This was the least popular ***Section B*** question. Some started, stopped partway through, deleted their working and started on another question. Many candidates seemed unaware of dimensions and in **part (b)** found volumes and arc lengths, often adding quantities with different dimensions.

(a)(i) A significant number gave the actual height of 10 cm, rather than the fraction of the height. Occasionally it was given as a fraction of 15, producing $2/3$.

(ii)(a) The common wrong responses were 21 from 15 + $2/5$ of 15 and 24 from 15 + $3/5$ of 15.

(ii)(b) Relatively few candidates were successful here. Many included the top surface, giving 9 300 and almost as many omitted the base, giving 3 300. Many candidates calculated the volume of the block.

(b) There was much confusion between curved and flat surfaces, and whether or not water was in contact with them proved difficult for candidates to appreciate.

(i) Many started with πr^2 or $2\pi\ (r + h)$ or $2\pi rh$, or found $AB \times 35$, or found the area of triangle *OAB*. Many used $1 - {}^{140}\!/_{360}$ instead of the direct ${}^{220}\!/_{360}$.

(ii) Candidates had a better idea of what was required in this part. Many found the 155.5 for the large sector area, but frequently it was left as the final answer. When candidates tried to find the area of the triangle it was very often by long methods rather than by using $\frac{1}{2} \times 9 \times 9 \times \sin 140$, usually leading to inaccuracies.

(iii) Many saw *AB* in the question and gave the length of *AB* as their answer. Others interpreted it as finding the arc length above the water level and found ${}^{140}\!/_{360} \times 2\pi \times 9$. Relatively few used the direct approach and found $9 \cos 70°$. Most then realised that they had to subtract from 9 but premature approximation quite often led to an answer of 5.9 or even 6 and the loss of a mark.

Answers: **(a)(i)** ${}^{2}\!/_{5}$, **(ii)(a)** 25 cm, **(ii)(b)** 6 300 cm^2; **(b)(i)** 1 210 cm^2, **(ii)** 182 cm^2, **(iii)** 5.92 cm.

Question 8

This was a popular question and most candidates were able to pick up at least 4 or 5 marks.

(a) Most were able to find the expression for *PQ,* but *BC* and *QR* proved to be a bit more difficult.

(b) Relatively few candidates could get to the required expression convincingly. Most started with $(x + 2)\left(\frac{168}{x} + 11\right)$ but made no mention of the area of the pond. The algebra in multiplying out the brackets was generally accurate but the $\frac{168}{x} \times x$ term was often conveniently forgotten.

(c) Very well answered.

(d) Most candidates used the correct scales and the graphs were generally well drawn from accurate plotting. Nevertheless quite a number lost a mark when they joined the plots at $x = 5$ and $x = 6$ with a straight line.

(e) A tangent was usually drawn reasonably well, but sometimes not exactly at the point (4, 150). The gradient was not always found correctly with some candidates reading the scales incorrectly and very many not realising that it was negative.

(f) Most candidates realised that they were to investigate the turning point of the curve but not all were able to interpret it. Some just wrote down the coordinates of the point and many forgot to add 2 onto the value read from the *x* axis to give *PQ*. Very many gave 144 or their smallest area.

Answers: **(a)** $PQ = x + 2$, $BC = \frac{168}{x}$, $QR = \frac{168}{x} + 11$; **(c)** 158; **(e)** –6 to –12;
(f) (i) $143 \le \text{area} < 144$, **(ii)** $7.4 \le PQ \le 7.6$.

Question 9

(a) (i) This was very well answered with almost all candidates realising that this was a standard Sine Rule question. Errors in the calculation were usually due to a lack of accuracy when writing down values of sin 38° or sin 114° correct to only 2 decimal places.

(ii) Almost as many realised that the Cosine Rule was required here, but there were very many more errors in the calculations, particularly when candidates started by writing the Rule in the form "$17^2 = \ldots$ " rather than " cos $B\hat{C}D = \ldots$"

A few calculated angle *B* or angle *D*. Some gave *C* = 114° from a kite idea and others 66° from "the cyclic quadrilateral".

(b) (i) Candidates were considerably less successful in this part, although quite a number gained 2 marks for **parts (a)** and **(c)**. In **part (b)**, **q** – **p** was a common wrong response, with this often leading to 4**q** in **part (d)**.

(ii) Those who got the correct answer, 4*p*, for $\overrightarrow{OT}$ usually gained the "collinear" mark, but relatively few gave the distance connection between the 3 points.

Answers: **(a) (i)** 11.5 cm, **(ii)** 127°; **(b)(i)(a)** **p** + **q**, **(i)(b)** **p** – **q**; **(i)(c)** 2**p** + 2**q**; **(i)(d)** 4**p**, **(ii)** collinear and $OT = 4OP$ or equivalent.

Question 10

(a) The histogram was generally constructed correctly using frequency density, but a number of candidates incorrectly drew the first rectangle between 0 and 3, rather than 1 and 3. A few weaker candidates drew a bar chart.

(b) Many candidates stated the upper quartile to be 37.5 but far fewer went on to identify the correct interval class.

(c) This was quite well answered with most candidates correctly forming the products of the frequencies and the mid-points. A small number used the end points of the intervals and a few divided by 6.

(d) Quite a number of candidates gained both marks here, although a few considered only the $5 < t \le 7$ interval and gave $^{14}/_{50}$ as their probability in **part (ii)**.

(e) There was less success in these two parts. In **part (i)** evaluation of $^{28}/_{50}$ x $^{27}/_{50}$ was quite common, even though the question gave a big hint by talking about 'the remaining 49 people'. In **part (ii)** many forgot to multiply the appropriate product by 2. Some candidates misunderstood the question and assumed that a further 2 people were chosen from the remaining 49 people, using denominators of 49 and 48.

Answers: **(a)** Heights 2, 10, 8, 7, 4, 2; **(b)** $7 < t \le 9$; **(c)** 5.8; **(d)(i)** 0, **(ii)** $\frac{14}{25}$;

(e)(i) $\frac{54}{175}$, **(ii)** $\frac{88}{175}$.

Question 11

(a) (i) When calculating the matrix representing 2**A** – 3**B** errors were quite common where negative numbers were involved.

(ii) Almost all candidates tried to evaluate the inverse of *B* and although many successfully found the determinant to be $\frac{1}{3}$, a large proportion then multiplied the adjoint of *B* by $\frac{1}{3}$ instead of 3.

(b) (i) Although most candidates calculated the magnitude of the enlargement as 2, relatively few realised that it should be negative. Almost all gave the coordinates of the centre of enlargement correctly.

(ii) Many recognised that the transformation was a shear, although a number gave 'stretch'. Candidates often gave only one element of the further description rather than the two necessary for the second mark.

(iii) In **part (a)** many candidates successfully completed the matrix multiplication *TL* to determine the value of *k*. Other candidates produced working leading to $\frac{8-k}{2} = 2$. An answer of $k = 4$ without explanation gained no marks. Very few candidates were successful with the last part, most not realising that, having been given the coordinates of $T(L) = (8, 2)$ then they only needed to apply the enlargement from earlier in the question to obtain the required coordinates.

Answers: **(a)(i)** $\begin{pmatrix} -3 & 9 \\ -3 & 2x \end{pmatrix}$, **(ii)** 3; **(b)(i)(a)** –2, **(i)(b)** (1, 2), **(ii)** Shear, SF2, *x* axis invariant; **(iii)(a)** 4 **(iii)(b)** (–13, 2).