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FOREWORD

This booklet contains reports written by Examiners on the work of candidates in certain papers. **Its contents are primarily for the information of the subject teachers concerned**.

MATHEMATICS

GCE Ordinary Level

Paper 4024/01
Paper 1

General comments

Overall, this year's paper proved to be a little more straightforward than last year's, although there were a number of searching questions which only the better candidates were able to complete satisfactorily.

There were some very good scripts although many candidates had difficulty with most of the questions.

Problems which tested even the best candidates included **Questions 5 (b)**, **12**, **13 (b)**, **15 (a)**, **18** and **25**, while weaker candidates usually gained marks in **Questions 3**, **6**, **7**, **20**, **22**, **23** and **24**.

Presentation was not always good and a number of candidates lost marks because of non-existent or extremely untidy working which meant that Examiners were unable to credit possible method marks.

Occasionally the last question was not attempted, but this was probably because candidates had overlooked it or were unable to attempt it, rather than because of lack of time.

Comments on specific questions

Question 1

The decimal point was often misplaced in one or both parts.

Answers: **(a)** 0.024; **(b)** 0.2.

Question 2

Despite the wording of the first sentence, a number of candidates gave only one letter as their answer in each part. Shape *F* (the parallelogram) was often given as the answer to part **(a)** rather than part **(b)**.

Answers: **(a)** *A* and *E*; **(b)** *B*, *D* and *F*.

Question 3

This was quite well answered. Occasionally, 3 was given as the answer to part **(a)** and a fractional answer was given in **(b)**.

Answers: **(a)** $\frac{1}{3}$; **(b)** 2.82.

Question 4

(a) This was well answered.

(b) $n + 3$ was a very common wrong answer. Although '…expressions for the n^{th} term' is specifically mentioned in the syllabus, many candidates did not appear to know how to tackle this part of the question.

Answers: **(a)** $2\frac{1}{2}$, -1; **(b)** $3n - 2$

Question 5

(a) This was well answered, with most candidates successfully converting 181 centimetres to metres.

(b) There were relatively few correct answers to this part, with 40 by far the most common answer. Many candidates did not understand the relationship between line and area magnification.

Answers: **(a)** 16.66 m; **(b)** 0.04 km^2

Question 6

(a) 4.25 was seen occasionally, but this part was fairly well answered on the whole.

(b) Answers of $\frac{1}{9}$ and $-\frac{1}{9}$ were seen fairly frequently.

Answers: **(a)** 42.5%; **(b)** 9.

Question 7

This was generally well answered, particularly the volume. Slips were sometimes made in calculating the surface area, and occasionally the volume and surface area were interchanged.

Answers: **(a)** 120 cm^3; **(b)** 184 cm^2.

Question 8

There were many correct answers to part **(a)**, but many forgot the negative sign in **(b)**. Weaker candidates often left this question blank.

Answers: **(a)** $\frac{5}{12}$; **(b)** $-\frac{5}{13}$.

Question 9

Although the answers were reversed on a number of occasions, the question, as a whole, was fairly well answered.

Answers: **(a)** 300°; **(b)** 120°.

Question 10

(a) This was often correct, although many gave 6.5°C, the difference between the first and last value, rather than the highest and the lowest.

(b) Those candidates who knew what an integer was and who could handle inequalities had no difficulty finding the two numbers. A common error was to include –2 as a possibility. Weaker candidates left their answer in the form of inequalities.

Answers: **(a)** 11°C; **(b)** –3 and –4.

Question 11

There were a number of all correct answers, although there were many candidates who understood what was required but made careless errors resulting in answers of 12 for k and/or –3 and 4 for l and m.

Answers: **(a)** –12; **(b)(i)** –4, **(ii)** 3.

Question 12

Candidates had real difficulty with this question. The power of 10 in part **(a)** was often given as –30 and in **(b)**, although many candidates recognised that multiplication was required, relatively few could cope with both standard form and the units.

Answers: **(a)** 6.8×10^{-24} g; **(b)** 0.612 g.

Question 13

(a) This was quite often correct, although many candidates subtracted the two vectors.

(b) Many candidates did not understand what was required here. Those who showed some understanding and tried to draw the trapezia often drew the wrong parallel or an inaccurate one.

Answers: **(a)** $\begin{pmatrix} 14 \\ 0 \end{pmatrix}$; **(b)** $5\frac{1}{2}$ and 2.

Question 14

The majority of candidates did not understand this question. Very few candidates knew that a chair could cost $(70 ± 5), and even fewer that a desk could cost $(900 ± 25). Many candidates who did know about bounds still had trouble writing the upper bound as 75; instead they wrote 74, 74.5, 74.9 or 74.99… In getting the lower bound of the total cost, a common error was to calculate 900 + 4 × 70 = 1180 and deduce that the required bound was $1175.

Answers: **(a)** $\begin{matrix} 65 & 75 \\ 875 & 925 \end{matrix}$; **(b)** $1135.

Question 15

(a) Many candidates could not calculate a determinant and so made no progress with this part. Many of those who could, made slips getting to $2k + 5 = 14$ or in solving it.

(b) Many knew the rule for dealing with the elements of the matrix and a few could divide by the correct value of the determinant, but completely correct solutions were rare.

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

Question 16

Some candidates knew how to approach this question, but the majority did not. Some gained the mark for $y \geqslant -3$ but common responses were $y < -3$, $y < 3$ and $x \leqslant -3$.

Those who could obtain the equation of the slanting edge gained a mark, very few produced the correct inequality.

Answer: $y \geqslant -3$ and $x + y \leqslant 5$.

Question 17

(a) This was well answered; the majority understood the notation and correctly substituted 3.

(b)(i) Many candidates who had no trouble with f(3) were totally confused dealing with g(0). They were required only to solve $(-3)k = -15$.

(ii) In this part candidates had to solve a quadratic equation which was already factorised; just a few managed this. Some rejected the negative solution for no good reason. Many wasted time by expanding the brackets before more laborious algebra, occasionally getting the right solutions.

Answers: **(a)** 14; **(b)(i)** 5, **(ii)** $1\frac{1}{2}$, –5.

Question 18

There were a few candidates who had clearly spent some considerable time studying set theory and they produced commendable responses, but many made little or no progress.

(a) Some produced a correct expression but the majority had little idea or gave incorrect expressions like $A \cup B' \cap C'$.

(b) It was common for the added set to go in the usual position on a Venn diagram, intersecting both *T* and *R*. Just a few realised that quadrilaterals would not have an intersection with triangles.

(c) Very few managed to list the elements of the universal set and reject the members of *F* and *O*. There was a widespread weakness in set notation but also weak organisational skills.

(d) Disappointingly, few could see that 20 elements appearing 23 times implied an overlap of 3.

Answers: **(a)** $A \cap (B \cup C)'$ or $A \cap B' \cap C'$; **(c)** 8 and 10; **(d)** 3.

Question 19

(a) This was sometimes correct, although very many displayed a lack of understanding by using a wrong height for the third column.

(b) This part was not well answered. Some had no idea what was required and calculated $\frac{40}{16}$. Of those who had the right idea, many failed to use the correct mid-interval values.

Answer: **(b)** 5.8.

Question 20

(a) There were many correct answers, although a significant number quoted the interior angle formula incorrectly, often using $(n - 2)\ 180 = 160$. A surprising number reached $\frac{360}{20}$ correctly but then gave an answer of 12 or 13.

(b) x was usually correct, but many candidates made false assumptions about which sides of triangle *BCM* were equal and gave their values of y as 90 or 120.

Answers: **(a)** 18; **(b)(i)** $x = 70$, **(ii)** $y = 105$.

Question 21

In the first two parts most candidates had the right idea, but many misread the scales, with answers of 1.8 and 1.09 appearing frequently in **(a)**.

In parts **(c)** and **(d)**, it was very common to see candidates trying to evaluate the distance from home divided by the actual time.

Answers: **(a)** 1.9 minutes; **(b)** 420 m; **(c)** 0 m/minute; **(d)** 500 m/minute.

Question 22

(a) $(a - 2b)(-3\ c)$ or $-3\ c\ (a - 2b)^2$ were fairly common wrong answers.

(b) A large number of candidates had –6 instead of +6.

(c) The majority of candidates showed that they understood the methods of solving simultaneous equations but many made arithmetic errors.

Answers: **(a)** $(a - 2b)(1 - 3c)$, $5t^2 + 6$; **(c)** $x = 4\frac{1}{2}$, $y = -2$.

Question 23

(a) This was often correct, although 9 hours 20 minutes was a fairly common wrong answer.

(b) Most candidates recognised that $\frac{660}{\text{time}}$ was required, but very many failed to evaluate $\frac{660}{5\text{h } 30\text{ minutes}}$ correctly.

(c) Again, most candidates wrote down $\frac{660}{150}$, but very many failed to get to the correct answer. Even many of those who got as far as 4.4 hours were unsuccessful. Common incorrect answers were 4 hours 40 minutes, 4 hours 4 minutes and 4 hours 15 minutes.

Answers: **(a)** 8 hours 20 minutes; **(b)(i)** 120 km/h, **(ii)** 4 hours 24 minutes.

Question 24

(a) *C* was usually accurate, with almost all candidates using compasses.

(b) Weaker candidates sometimes gave the acute angle supplementary to $A\hat{C}B$.

(c) The 5 cm arc was usually drawn accurately. A few candidates bisected $\hat{A}$ instead of $\hat{B}$ or constructed the mediator of *AB* and some did not give the full loci within the triangle.

Generally, the construction work was excellent.

(d) Most answers were written within the generous acceptable range, but *P* was occasionally shown outside the triangle and the length *PB* was sometimes given.

Answers: **(b)** 103°; **(d)** 11.9 cm.

Question 25

(a) This was often correct but a few did not understand T(*P*) and concentrated on ΔA to ΔB. Answers such as (5, 5), (5, –5) and (–5, 5) were therefore quite common.

(b) Some thought this was a rotation. Those who recognised it as a reflection usually gave $y = -x$ correctly, just a few giving $y = x$.

(c) There were a number of good attempts at this part. Most of the candidates who understood the multiplication of matrices were able to identify the triangle successfully.

(d) This part was sometimes omitted, but was usually correct when it was attempted. A few rotated anticlockwise.

Answers: **(a)** (0, –1); **(b)** Reflection in the line $y = -x$; **(c)** Δ (2, 1), (2, –1), (3, –3); **(d)** Δ (5, 3), (5, 4), (7, 4).

Paper 4024/02
Paper 2

General comments

There was a very wide range of responses to this paper. Some candidates produced excellent scripts which were well presented. Others found the paper difficult, struggling to understand what was required.

A small minority of candidates made it difficult for the Examiners, and themselves, by poor presentation, often dividing the page into two (or more) columns and answering parts of a question in a seemingly random order.

Calculator work was good, but a few had their calculators set in grads or radians. Some of the weaker candidates lost accuracy marks by not showing or using at least three significant figures in their working or answers at any stage.

The majority of candidates chose to answer both of the graphical questions. The work was often good and candidates scored well on both questions, though some had difficulty in reading off required values accurately.

The weakest responses were received in the geometrical questions, especially **Question 4**, where too many made unjustified assumptions.

Candidates did not appear to have any undue difficulty in completing the paper in the time allowed.

Comments on specific questions

Question 1

This straightforward trigonometry question gave confidence to candidates, but it was surprising how many able candidates used inefficient methods to find the required lengths. This was particularly noted in **(b)**, where many found the lengths of *CD* and *DE* separately rather than quoting $CE = \frac{8}{\cos 35^\circ}$ directly. It was anticipated that the sine formula would be used in part **(c)**, but it also appeared in part **(a)**.

Answers: **(a)** 4.59 m; **(b)** 9.77 m; **(c)** 8.96 m.

Question 2

This was another well answered question, with many high scores. The gradient of *AB* was well answered, though a few left it in an unsimplified form. The concepts required for the equation of a parallel line through a given point were also well understood, as was the calculation of the lengths of the line segments.

The demonstration that the two lines were perpendicular was most frequently attempted by showing the product of the two gradients is –1 rather than using Pythagoras' Theorem as had been expected. Some very odd methods were seen, such as stating they were perpendicular because *BC* = 2 *AB*. The area of the triangle presented few problems, but many used complicated methods rather than using parts **(b)** and **(c)** to find $\frac{1}{2} AB \times BC$.

Answers: **(a)(i)** $-\frac{4}{3}$, **(ii)** $4x + 3y = 10$; **(b)(i)** 5 units, **(ii)** 10 units; **(d)** 25 units^2.

Question 3

A small number of candidates made the sensible decision to work in millions of dollars, thus making it easier for themselves and the Examiners. Some made it more difficult by not splitting up the large numbers into groups of three digits in the conventional manner.

Parts **(a)**, **(b)** and **(c)** were well done, though a few insisted first on finding 112% of $80 000 000. A small number of these then forgot to subtract $80 000 000.

Part **(c)** caused some difficulty as several candidates added the loss on Beta, rather than subtracting it, from the gain on Alpha, when finding the gain on Gamma. The resulting gain ($7 100 000) was sometimes expressed as a percentage of the overall profit ($9 600 000) rather than the cost of Gamma ($35 000 000).

Many candidates knew how to find the reverse percentage in **(d)**, but weaker candidates often used 60% of $80 000 000.

Answers: **(a)** $20 000 000, $25 000 000, $35 000 000; **(b)** $9 600 000; **(c)(i)** $5 000 000, **(ii)** 20.3%; **(d)** $50 000 000.

Question 4

This question was not well answered in general, proving to be the most difficult one on the paper.

Too many candidates made unjustified assumptions at all stages. In particular, it was common to see the assumption that *PQRS* is a square (which is to be shown in **(b)**) from the start.

(a)(i) It was expected that candidates would start by stating $AB = BC$, and then deduce $PB = QC$, having mentioned $AP = BQ$.

(ii) Many did justify the congruence in a valid way, but many relied on $PQ = QR$. Some stated all three pairs of sides and all three pairs of angles to be equal. This approach could not score full marks.

(iii) There were some well argued reasons to show the right angle based on the congruence, but there were many spurious solutions, such as "*each angle of the quadrilateral PQRS is* $\frac{360^\circ}{4}$" or relied on assuming *PQRS* to be a square.

(b) Examiners were looking for statement like "*PQ = QR (= RS = SP)*" and "*PQR = 1 right angle*", but many made non specific generalisations.

Question 5

The majority of candidates scored well in this routine algebra question, with full marks being quite common.

The evaluation and rearrangement of the formula was very well done. When solving the equation, some failed to spot $t = 0$ was a possible solution to **(b)(i)**. Having reached $(y-1)^2 = 16$ in **(b)(ii)**, some multiplied it out and solved the quadratic equation, but better candidates took square roots to reach $y - 1 = \pm 4$. A few overlooked the negative value in this case.

The quadratic equation was usually correct, but some did not give answers to the required degree of accuracy. The most common of these errors was to give –0.736 with –2.26.

Answers: **(a)(i)** 120, **(ii)** $\frac{2s - an}{n}$; **(b)(i)** 0, 2.4, **(ii)** 5, –3, **(iii)** –0.74, –2.26.

Question 6

Many of the stronger candidates scored heavily in this question, but overall the response was slightly disappointing.

(a) Several failed to use the fact that tangents to a circle have equal lengths (so $BD = CD = DE$) or assumed that the result implied that $AE = CE = 8$ cm. Credit was given to those who used trigonometry to find angle *CAD*.

(b) The majority found the first angle, using the angle sum of a triangle. Some candidates were either unable to continue or made false assumptions, such as the centre of the circle is collinear with *PX*, *QY* or *RZ*. The symmetry properties of a circle were not well understood in these cases.

Answers: **(a)(i)** 5 cm, **(ii)** 22.6°; **(b)(i)** 70°, **(ii)** 64°, **(iii)** 55°.

Question 7

This was another popular, high scoring, question that was well answered. The cosine formula was well known and the calculation of *AB* was usually correct, but more errors were noted when candidates started from cos 81° = … The calculation of the area was also well done. Although it was expected that candidates would use these two results to find the shortest distance, a significant minority used the sine formula to find either angle *A* or *B* and then used simple trigonometry. The height of the tree was usually correct, but some attempts at the last part (such as adding 15° to *BAC* (38.2°) showed a failure to understand the angle of elevation.

Answers: **(a)** 81.5 m; **(b)** 1810 m^2; **(c)** 44.5 m; **(d)** 19.3 m; **(e)** 23.4°.

Question 8

This proved to be quite testing for many candidates.

(a) The explanation was not always convincing. It was hoped that solutions would point out that the centres of circles lie in the line joining the points of contact of the circles.

(b) Some took whole circles rather than regions to be yellow or green.

(c) Some gained credit for a correct start here, but few completed the derivations of the equation correctly.

(d) This part was better done, though some failed to see how the factors led to the solutions of the equation, preferring to use the quadratic equation formula.

(e) Only the best candidates were able to complete the question.

Answers: **(b)(i)** $\pi(x + y)^2 - \pi(2x)^2$, **(ii)** $\pi(2y)^2 - \pi(x + y)^2$; **(d)(i)** $(y - x)(y - 5x)$, **(ii)** $y = x$, $y = 5x$; **(e)** $\frac{8}{25}$ or 0.32.

Question 9

Although it was not a very popular question, candidates were quite successful here. Candidates who followed the pattern given were usually able to score well. Others managed to score some marks, but not necessarily by the methods suggested. Even when the algebra in **(d)(ii)** proved too demanding, some managed to complete the last part successfully. It was pleasing to see that many managed the number work, even when the algebra work left something to be desired.

Answers: **(b)(i)** 9, **(ii)** 60, 61; **(c)(i)** $2n + 1$, **(ii)** 5100, 5101; **(d)(i)** 12, 63, 65, **(ii)** $(4n)^2$, **(iii)** 39 999, 40 001.

Section B

Question 10

Although some had difficulty in convincingly establishing the first two results in part **(a)**, the graphs were usually of a high standard. For some reason, a few plotted the first point in the wrong place, at (0.5 202) or (1 220).

Many candidates only gave one value of r for which $y = 100$. They should have noticed the question asked for value**s** and two marks were allocated.

Most drew satisfactory tangents at $r = 2$, but some made errors in reading the scales when calculating the gradient. Many gave an acceptable value for r when y is least, but only the best connected the value of y at that point to the surface area in the last part.

Answers: **(b)(i)** 105; **(c)** 2.20 to 2.27, 5.65 to 5.75; **(d)** –35 to –48; **(e)(i)** 3.6 to 3.8, **(ii)** 80π to 82π or 251 to 257.

Question 11

Most of the candidates successfully completed the tables and drew the two curves, which were correctly labelled. For some unknown reason many plotted (80, 115) at (80, 105) in otherwise correct solutions. Most knew how to read off quartiles and medians, but the reasons given for stating Maths was easier were often imprecise or wrong. A definite statement was expected (such as "*Mathematics has a high median, or higher upper quartile*"), not vague generalisations referring to unstated pass marks.

There were less correct answers to the probability questions than usual this year.

Answers: **(a)** English 30, 80, 136; Mathematics 10, 30, 60, 115, 140; **(c)(i)** 64 to 68, **(ii)** 20 to 26, **(iii)** 56 to 58 and 63 to 65; **(e)(i)** $\frac{12}{49}$, **(ii)** $\frac{193}{980}$.