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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

As always, the quality of the scripts varied greatly. There were a number of excellent scripts but there were also quite a large number of very weak ones. There were a number of rather testing questions early in the paper and this perhaps gave the impression that the paper as a whole was much more difficult than last year's. However, there were many opportunities for candidates to score well and candidates often gained good marks in several of the later questions.

Candidates were less successful with **Question 4** (irrational numbers), **Question 6** (LCM), **Question 7** (symmetry), **Question 10** (proportion) **Question 13** (planes of symmetry and bounds) and **Question 15** (Venn diagrams), but they were quite successful with **Question 18** (patterns), **Question 22** (coordinates) and **Question 24** (constructions).

Presentation was generally quite good, although there were a number of candidates who produced very little, if any, working and others who worked largely in the margins.

There was no evidence of shortage of time to complete the paper.

Comments on specific questions

Question 1

(a) Some candidates gave $\frac{2.5}{7}$ but failed to convert to an acceptable form. Others gave $\frac{3}{7}$ or $\frac{3}{14}$.

(b) There were many correct answers. The majority of candidates made the correct conversion of 370 grams into kilograms, but there were a number of careless subtractions.

Answers: **(a)** $\frac{5}{14}$; **(b)** 3.33 kg.

Question 2

It was surprising that so many candidates had difficulty with this question.

(a) Many candidates gave 7.5 as their answer, ignoring the fact that $7\frac{1}{2}$ was a percentage.

(b) Again many ignored the percentage sign and gave $\frac{15}{2}$. Some found it difficult to progress with the simplification beyond $\frac{7\frac{1}{2}}{100}$ or $\frac{15}{200}$.

Answers: **(a)** 0.075; **(b)** $\frac{3}{40}$.

Question 3

(a) This was quite well done, although many slips were made often after getting to $\frac{41}{15}$ or $3-\frac{4}{15}$.

(b) The figures 42 were often seen but the decimal point took various positions; 0.042 and 4200 were common.

Answers: **(a)** $2\frac{11}{15}$; **(b)** 420.

Question 4

This proved to be a very testing question, even some very good candidates struggled with part **(b)**.

(a) Many did not know how to approach the question; those who converted $6\frac{1}{4}$ to an improper fraction were usually successful.

(b) Many failed to simplify $\sqrt{2}\times\sqrt{8}$ and so considered it to be irrational. Others seemed to think that $\frac{22}{7}$ and π were the same thing and therefore both irrational. A full understanding of irrational numbers was quite rare.

Answers: **(a)** $2\frac{1}{2}$; **(b)** π and $2\sqrt{3}$.

Question 5

(a) This was fairly well answered, with most candidates handling the subtraction of the negative value competently.

(b) There were rather more problems here, with many candidates giving 27.2 as their answer.

Answers: **(a)** 148°C; **(b)** –27.2°C.

Question 6

(a) This proved to be a surprisingly difficult question, with many candidates showing a lack of understanding of LCM and often a confusion with HCF; 6 or 2 being seen more often that the correct answer.

(b) Many understood what was required here without connecting the problem to part **(a)**. Often they worked from 06 00 making three very long lists; this was very cumbersome, but they were occasionally successful.

Answers: **(a)** 660; **(b)** 6.11 am.

Question 7

These two parts proved to be very difficult tests for all but the strongest candidates. They often had some idea of the symmetries, but did not realise that the grid itself had to be part of the pattern.

Answers: **(a)** shading (row1, column 2), (2, 4), (3, 1); **(b)** (3, 4).

Question 8

(a) Very well answered, although a few misplaced –1.5, appearing to read it as –0.15 and a few had –0.3 and –0.29 reversed.

(b) Most candidates had no trouble doubling the number, although some left the answer as 16×10^{-4}. Others made various drastic errors, giving answers far removed from reality, 16×10^{-8}, 64×10^{-16}, 64×10^{16}…… .

Answers: **(a)** –4, –1.5, –0.3, –0.29, 0; **(b)** 1.6×10^{-3}.

Question 9

Many candidates had some success with this question.

(a) A few candidates got lost in their formulae and these were not usually deterred when the answer was a non-integer.

(b) Most candidates used the fact that triangle *ABC* was isosceles to find $A\hat{C}B$ correctly, but did not always subtract from the given 156° to obtain the required angle.

(c) There was rather less success here, an answer of 12° being seen regularly.

Answers: **(a)** 15; **(b)** 144°; **(c)** 24°.

Question 10

(a) Candidates found great difficulty with this part of the question. Some appreciated that *y* was proportional to x^2, but did not realise that halving *x* led to *y* being a quarter of its original value. Many attempted to set up equations involving *k*, but these attempts often failed because when $\frac{1}{2}x$ was squared it became $\frac{1}{2}x^2$; 5 was a very common answer.

(b) Most candidates realised that time was inversely proportional to the number of painters and part **(i)** was usually correct. Forming an expression in part **(ii)** proved to be much more difficult and various combinations of 7, 15, *t* and *n* were seen.

Answers: $2\frac{1}{2}$; **(b)(i)** 35, **(ii)** $\frac{105}{t}$.

Question 11

(a) This was well done by most, just a few misused the scale and gave 42.

(b) Again, this was quite well done, although answers of 50 were seen quite often from those giving the number of students rather than the percentage.

(c) This was less well done; the majority selected School B, but the reasoning was often muddled, with references to numbers of candidates rather than percentages. Many did not realise that parts **(a)** and **(b)** were available to be used in part **(c)**.

Answers: **(a)** 43 to 44; **(b)** 25%; **(c)** medians or other proportions compared.

Question 12

There were many correct answers to parts **(a)** and **(b)**, but many candidates gave –4 as their answer to **(c)**, no doubt reasoning that "the decimal point has to be moved four places to get from 10 to 0.001".

Answers: **(a)** 8; **(b)** $\frac{1}{3}$; **(c)** –3.

Question 13

(a) The plane of symmetry parallel to the end was rarely recognised and the answer given was almost always 5.

(b)(i) Many candidates thought that an area was required, multiplications such as 20.5 x 3.5 being seen.

(ii) There were a large number of answers of 46.

Answers: **(a)** 6; **(b)(i)** 20.5 m, **(ii)** 44 m.

Question 14

(a) Most candidates evaluated f(2) correctly, although a significant number left their answer as $\frac{-3}{1}$.

(b) Finding $\mathrm{f}^{-1}\left(\frac{1}{2}\right)$ proved to be very much more difficult. Some evaluated $\mathrm{f}\left(\frac{1}{2}\right)$, but a good number attempted to find $\mathrm{f}^{-1}(x)$, starting from $y = \frac{3}{2x-5}$. Unfortunately many made algebraic errors in their attempt to change the subject of the formula. Very few candidates opted for the somewhat easier method of solving the equation $\frac{3}{2x-5} = \frac{1}{2}$.

Answers: **(a)** –3; **(b)** $5\frac{1}{2}$.

Question 15

(a) There were very few correctly shaded regions. Most candidates shaded $(A \cup B)' \cap C$.

(b)(i) Quite well done, although some listed the elements in $S \cup T$.

(ii) Despite the highlighting of the phrase "in words", many candidates listed members. Others gave answers such as "not in *S*".

(iii) Some candidates did not understand the notation and listed elements, but there were a good number of correct answers.

Answers: **(b)(i)** 9 and 15, **(ii)** …even…, **(iii)** 8.

Question 16

(a) Good work was often spoilt by a careless slip in one element.

(b) Some candidates simply squared each term.

(c) Relatively few candidates recognised that AA^{-1} was the identity matrix and so left the $\begin{pmatrix} 7 \\ 8 \end{pmatrix}$ unchanged.

(d) There were many answers of (2, 2, –3) or $\begin{pmatrix} 2 \\ 2 \\ -3 \end{pmatrix}$, candidates appearing to believe that one figure could not constitute a matrix.

Answers: **(a)** $\begin{pmatrix} -1 & 2 \\ 3 & 3 \end{pmatrix}$; **(b)** $\begin{pmatrix} 1 & 6 \\ -2 & -3 \end{pmatrix}$; **(c)** $\begin{pmatrix} 7 \\ 8 \end{pmatrix}$; **(d)** (1).

Question 17

(a) Often correct, but a common wrong answer was 1 from candidates who did not reorder the given temperatures.

(b) Most candidates had the right idea, but many made arithmetical errors.

(c) Only the stronger candidates were able to tackle this part and of these many did not get beyond the idea of 6 x 1.5.

Answers: **(a)** –1; **(b)** 0: 2; **(c)** 8.

Question 18

Candidates liked this question and there were many excellent solutions. A small number calculated the squares and subtracted in **(b)(i)**, but generally candidates used the ideas of the pattern well.

Answers: **(a)(i)** $8^2 - 7^2 = 15$, **(ii)** $n^2 - (n-1)^2 = 2n - 1$; **(b)(i)** 679, **(ii)** $x = 351$, $y = 350$.

Question 19

(a) Almost all candidates answered part **(i)** correctly, and nearly as many were successful with **(ii)** although there were a few slips, e.g. 1000 x 0.6789 = 6789.

(b) A significant number were not able to remove the brackets on the right hand side, some giving $7 - 1 - x$ and others $7 - 7x$. A number who correctly reached $2x = 23$, carelessly wrote $x = 12.5$.

Answers: **(a)(i)** $x(a - b)$, **(ii)** 678.9; **(b)** $x = 11\frac{1}{2}$.

Question 20

(a) There were many correct answers to both **(i)** and **(ii)** although some candidates clearly did not realise that $\overline{BC} = -\overline{OA}$.

(b)(i) There was less success here, with vague statements about gradients, slopes, perpendicularity etc. and even those who had a correct expression for $\overline{AC}$ sometimes had difficulty explaining the parallelism.

(ii) A good number of correct answers, but 2 was very common from candidates who assumed that triangles *OAC* and *OCD* were similar.

Answers: **(a)(i)** $-4\overline{p} + \overline{q}$, **(ii)** $-3\overline{p} + 6\overline{q}$; **(b)(i)** $\overline{AC} = 3\overline{OD}$, **(ii)** 6 units^2.

Question 21

(a) Generally well done, although some gave only one pair of angles with no further explanation. Others involved ratios of sides in their explanation of similarity.

(b) There were many incorrect uses of corresponding sides. Many, who did have a correct equation reached $11\frac{2}{3}$ but were then unsure whether this was *AB* or *BD*.

Many weaker candidates did not attempt **(ii)** and although quite a number realised that the square of the ratio of lengths was required, a good proportion of these chose the wrong pair of corresponding sides.

Answers: **(a)** $A\hat{B}C = A\hat{E}D$ and $\hat{A}$ is common; **(b)(i)** $8\frac{2}{3}$ cm, **(ii)** $\frac{9}{49}$.

Question 22

Overall this question was very well answered with only part **(e)** causing real problems, when the negative sign was often forgotten.

Answers: **(a)** $\left(-\frac{1}{2},1\right)$; **(b)** $-1\frac{1}{3}$; **(c)** $y = -\frac{4}{3}x + 3$; **(d)** 10 units; **(c)** $-\frac{3}{5}$.

Question 23

(a) Many candidates did not link the solution of simultaneous equations with the intersection point of the two lines. Some did and gained the two marks without difficulty, but those who tried to solve algebraically almost always made errors.

(b) There were a lot of correct answers but $y = x + 4$ was regularly seen.

(c) Many candidates drew the correct line although some drew $x = -1$.

(d) Those who attempted this usually gained full credit.

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

Question 24

(a) Most candidates measured the angle correctly although a number used the protractor scale incorrectly and gave the acute angle.

(b)(c) These were very well answered, most candidates giving accurate constructions with very clear arcs.

Answer: 101° - 103°.

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Paper 2

General comments

The general standard and level of response shown on this paper was similar to that of last year, but there was a wide spread of attainment. Candidates coped with the paper quite well on the whole and there was no sign that they had any difficulty in completing the paper due to length of time allowed.

The general standard of presentation was often encouraging and explanations were usually adequate or better in most of the questions. This was not always the case in **Question 5**, however, where too often numerical sizes of unidentified angles were stated with no explanation. In such cases it is not possible to give much credit to the work. The first part of that question demonstrated that there is a need to emphasise that section of the Geometry Syllabus that requires the solution of problems involving similarity and congruence, giving simple explanations.

Comments on specific questions

Question 1

(a) The majority of candidates were able to calculate the simple interest on the sum, but many did not add the initial sum to find the total in the account. A few subtracted the interest. A small number used compound interest.

(b) The calculation of the cost of telephone bills was disappointing. The personal and household finance part of the syllabus clearly requires further attention.

(i) Even when the change of time units was correct, the evaluation of the number of units used was rarely rounded up to the next integer, so that answers of 147.6 cents were common.

(ii) Although many of the stronger candidates coped quite well with this part, the conversion of dollars and cents caused some problems, and many candidates took 5 cents to be the total cost of the first 400 units. A significant number found the cost of the remaining units to be a quarter of 5 cents, rather than being reduced by a quarter. These candidates were given considerable credit.

Answers: **(a)** \$920; **(b)(i)** \$1.50 or 150 cents, **(ii)** \$55.59.

Question 2

Candidates scored well on this question. The first part was usually correct. Most reached 15.84 in the next part, but many rounded it to 15.8 or added the 300 grams for the fruit. Both of these steps spoilt the accuracy in the next part, but a greater number converted 15.84 kg to 1584 g, so this part was probably less often correct than the remainder of the question. Some of those who reached 82.5 failed to go on to quote 8 biscuits remaining. Most candidates correctly divided by 201 but some lost credit by wrongly giving 4.47% as their answer. The reverse percentage was usually well done, but some found 25% of the 80 cents to obtain 60 cents, or in a few cases 100 cents.

Answers: **(a)** 120 g; **(b)(i)** 15.84 kg, **(ii)** 82 packets, 8 biscuits, **(iii)** 4.48 %; **(c)** 64 cents.

Question 3

The first part was well answered by the majority of candidates, though it was noticed that surprisingly many used the formula to solve the quadratic equation. Weaker candidates often equated each bracket to 18. Although most reached $1/u = 4/45$ in the next part, many stopped there or then went wrong. The stronger candidates had no difficulty in rearranging the formula in the next part, and the majority of the remainder gained some credit by making a correct first step.

The response to the last part was disappointing. Although many gained credit for obtaining $ar/12$, several failed to find the total income of as, and a few took the selling price from the cost price. Any correct equivalent of the answer was accepted.

Answers: **(a)** $-\frac{1}{2}$ and 6; **(b)(i)** $11\frac{1}{4}$, **(ii)** $v = \frac{fu}{u-f}$; **(c)** $\frac{a(12s-r)}{12}$.

Question 4

There were some good histograms drawn, but weaker candidates tended to use frequency in place of frequency density on the vertical axis. Many decided to use another scale, which is always likely to lose credit. Most of those who had drawn a correct histogram were able to find the modal class, but a few still gave $40 < v$ 50. The identification of the interval containing the upper quartile was less well done. Some found three quarters of 110, and so quoted $70 < v$ 110, while others gave 37.5 as their answer.

The first two probabilities were well done in most cases, but only the stronger candidates reached the last answer. Some reached half the correct value, but many more had a denominator of 625.

Answers: **(b)** $50 < v$ 55; **(c)** $60 < v$ 70; **(d)(i)** 0, **(ii)** $\frac{7}{25}$; **(e)** $\frac{72}{175}$.

Question 5

The first part was not well done, though a small number of excellent solutions were seen. Many pairs of equal angles were quoted, but few tied them together to show angles *PBC* and *PCB* equal. To score full marks reasons were expected and a conclusion drawn. Many correct values for angle *ACD* were seen, though several quoted 118 - 32 (= 86). The last parts were more demanding, but credit was given for correct steps, such as quoting angle *DCF* =70 and *COD* = twice *CFD* when correct answers were not obtained. Unfortunately too many failed to identify numerical quantities quoted and credit could not be allowed for bare numbers.

Answers: **(b)** 30°; **(c)(i)** 68°, **(ii)** 96°.

Question 6

Most candidates used Pythagoras to show the radius was 5 cm, but some bogus methods were also noted. The cosine formula was often used to show angle *AOB* = 106.3°, but many used the expected method of finding half of the angle from a right-angled triangle first. The area of the segment was quite well done, though the area of the triangle was more often found by using $\frac{1}{2}ab\sin C$ than $\frac{1}{2}$8 x 3 direct. Many good solutions to the last part were seen. Most accepted the hint of the previous part and found the area of a small segment first, but a gratifying number found other methods, the best of which was to find the area of rectangle - (circle - rectangle).

Answers: **(c)** 11.2 cm^2; **(d)** 17.5 cm^2.

Question 7

The response to this question was rather disappointing. Very many candidates wrongly assumed that *AN* is either 30 or 60 cm. Most were able to gain some credit for using correct methods to find the following two angles. The calculation of the volume was usually well done, though some took the height of the pyramid to be 80 cm. The surface area caused more problems, especially in finding the height of a sloping triangular face, which was too often assumed to be 40 cm. A few failed to use four triangles and four rectangles, and rather more added a square base (or even two or three squares) to a correct answer. Although most candidates knew what was expected in the last part, and were prepared to finish by rounding up their value to the next integer, confusion with units led to wrong answers, which were often absurdly large.

Answers: **(a)(i)** 58.3 cm, **(ii)** 43.3°, **(iii)** 133.3°; **(b)(i)** 336 000 cm^3, **(ii)** 25 200 cm^2; **(c)** 6.

Question 8

This question was well answered, with many scoring full marks. Most found correct expressions for the times in the first part and started to form a reasonable equation. Sometimes the signs were wrong so only partial credit was earned, even when a further error led to given answer. The solution of the quadratic equation, almost always by formula, was well done, though the final correction sometimes spoilt otherwise correct values. The use of the positive root in the last part usually understood. Some candidates felt, not unreasonably, that an integer answer was needed. In this case either 42 or 43 were accepted if no wrong working was seen.

Answers: **(a)(i)** $\frac{800}{x}$, **(ii)** $\frac{800}{x-5}$, **(iii)** $\frac{900}{x+5}$; **(c)** 18.9 and –23.9; **(d)** 42.4.

Question 9

There was a good response to this question, with many high scores. The height of the tank was usually correct. Not all of the expressions for the area were convincing, given that the answer was quoted. Most found the correct value for *p*. Candidates of all standards plotted accurately and drew good curves, usually using the given scales. Although the question asked for the values of *x* when *A* = 65, many candidates only gave one answer. The tangents were usually good and values of the gradient acceptable. The last part was less well done. Many just quoted the least area (about 52), but of those who gave the value of *x*, the majority did obtain a value in the required range. The stronger went on to find the value expected for the height of the tank in this case.

Answers: **(a)** $36/x^2$; **(b)(i)** 82; **(c)(iii)**(a) 2.40 to 2.46 and 6.52 to 6.60, (b) 7.25 to 7.75, (c) 4.00 to 4.40; 1.85 to 2.25.

Question 10

Although the majority of candidates correctly reached 64 ÷ 200 hours, attempts to convert this to minutes and seconds were poor, 19.2 minutes often becoming 19 minutes 2 seconds. The cosine formula was usually correctly used, but it was disappointing to see how many did not realise that the largest angle is opposite the longest side. Thus many calculated all three angles, wasting time. Too many only found one angle of triangle *TXZ*, while some others confused the angles of the triangle and bearings. Thus *ZXT* = 22° appeared frequently. The sine formula was well known and accurately applied to their triangles. The angle of depression did cause some problems. Many unit errors were seen, leading to an answer of 89.6° usually, while some found the angle made with the vertical.

Answers: **(a)(i)** 19 minutes 12 seconds, **(ii)** 73.0°; **(b)(i)** 68°, 64°, 48°, **(ii)** 17.6 km; **(c)** 8.4°.

Question 11

This was a popular question which was quite well answered on the whole. Although some failed to state the centre of the rotation correctly, the first three parts caused few problems. The combination of transformations was less well done. Some omitted this part and a few reversed the order of the transformations, but many saw that all they needed to do was to reflect triangle *C* in the given line.

There was a good response to the use of the matrix that defined the transformation. Many of those who plotted the image on their diagram recognised the shear, but did not always quote the correct shear factor. The matrix of the inverse transformation was more demanding, but there was a fair response from the stronger candidates.

Answers: **(b)** Triangle with vertices (– 2, 7), (0, 7) and (0, 8); **(c)(i)** 90° clockwise, **(ii)** (1, 4); **(d)** Triangle with vertices (–2, 3), (–2, 5) and (–3, 5); **(e)(i)** (3, –1), (3, 1) and (4, 0), **(ii)** Shear, with factor –1, *y* axis invariant, **(iii)** $\begin{pmatrix} 1 & 0 \\ 1 & 1 \end{pmatrix}$.