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Unit/Paper 4MB0/1R	Examination Series: January 2017

MATHEMATICS (SYLLABUS B) 4MB0/1R

General Points

In general, this paper was well answered by the overwhelming majority of candidates. Some parts of questions did prove to be quite challenging to a few candidates and centres would be well advised to focus some time on these areas when preparing candidates for future examinations.

In particular, to enhance performance, centres should focus their candidate's attention on the following topics, ensuring that they read examination questions **very** carefully and answer the question which is set – not the question that they think is set.

- Correct use of the calculator when evaluating complex numerical calculations **(Qu 10)**
- The correct order of the resultant matrix from a matrix multiplication **(Qu 12)**
- Correctly using the square root as a function **(Qu 16)**
- Ratios **(Qu 18)**
- Probability **(Qu 20)**
- Histograms **(Qu 22)**
- Graphs of straight lines(and regions defined by inequalities) **(Qu 23)**
- Transformation geometry **(Qu 24)**
- Geometrical properties of polygons in a circle with reasons **(Qu 26)**
- Loci in 2 dimensions **(Qu 28)**
- Intersecting Chords **(Qu 29)**

In general, candidates should be encouraged to identify the number of marks available for each part of a question and allocate a proportionate amount of time to each part of the question.

It should be pointed out that the methods identified within this report and on the mark scheme may not be the only legitimate methods for correctly solving the questions. Alternative methods, whilst not explicitly identified, earn the equivalent marks. Some candidates use methods which are beyond the scope of the syllabus and, where used correctly, the corresponding marks are given.

Details of Marking Scheme and Examples of, and Report on, Candidates' Responses

Question 1

Two thirds of candidates were able to correctly use the angle properties between parallel lines and comfortably arrived at the required answer. A significant number of candidates either completed the polygon *PQRST* or simply drew the line *QS*. Very few candidates drew a line through *R* parallel to *PQ* and *TS*. A significant error identified was as a consequence of calculating $(152+122)-180$ resulting in an erroneous answer of 94°.

Question 2

Much wrong working was seen here as the majority of candidates simply did not convert correctly both given values to the same units. Failure to either multiply 5.5 by 1000 or divide 275 by1000 resulted in both marks being lost. A small minority of candidates carried out the correct division but then gave their answer as 0.05 or 5% thus losing the second mark.

Question 3

Much good work was seen in the candidates' solutions to this linear equation with over 70% of candidates scoring full marks. Of those who did get the question wrong, the vast majority simply could not remove denominators correctly.

Question 4

Whilst the majority of candidates achieved full marks on this question, of those that scored nothing many simply did not deal effectively with the 12.5% or rounded intermediate results which led to a final answer that was not sufficiently accurate.

Question 5

Over 70% of candidates gave a fully correct solution to this question. A small minority lost the final accuracy mark due to arithmetic errors, which was often caused by a failure to deal with negative quantities appropriately.

Question 6

It was noticeable in this question that many candidates struggles with negative signs and brackets correctly. Indeed, $(x-y)(w-z)$ proved to be a popular, but erroneous, answer. For an algebra question, it was slightly disappointing to see that less than 45% of candidates scored full marks.

Question 7

The majority of candidates showed that they had been well drilled in the process of differentiation with over 85% of candidates scoring at least one mark (usually for correctly differentiating x^6). Differentiating $-\frac{6}{x^3}$, however, proved more challenging with both sign errors and power errors being equally prevalent. A small minority of candidates gave the correct answer and then went on to 'oversimplify' their answer incorrectly and thus lost the second mark. The quotient rule was seen to be used on a small number of scripts. Of these candidates, most made errors resulting in no marks at

all.

Question 8

A third of candidates either did not attempt this question or seemed to think that it required the use of the sine rule. As a consequence, these candidates scored no marks at all. Of the candidates who did correctly state the area of a triangle formula, most arrived at the required answer of $\frac{7}{18}$ but about a quarter of candidates then went on to find the size of angle *A*. As a result, a final answer of 22.9° lost the final mark.

Question 9

A small minority of candidates gave the correct answer but scored zero marks. It is crucial that candidates follow instructions in questions and where working is explicitly required they should have an idea of what is required and show some working rather than simply writing down the answer of 1126. Candidates who gave intermediate results with fractions were generally more successful than those who attempted to use decimal expansions for $\frac{1}{9}$. A significant number of candidates lost marks due to incorrect cancelling within the fraction. For this type of question, candidates need to use a mix of calculator and non-calculator skills.

Question 10

The actual substitution and calculator processing proved to be challenging for many candidates. Whilst there seemed to be no problem with the numerator, the substitution and calculation of $\sqrt{q}-r$ proved problematic. Candidates who arrived at the incorrect answer either evaluated $\sqrt{q-r}$ or correctly substituted the required values but rounded their interim calculator values to arrive at an approximate solution to the required answer. It was unfortunate for some candidates who did not read the final instruction in part (a) and gave their answer as $\frac{1}{64}$ which lost the second mark. In part (b), curiously, some candidates were able to give the required answer from an incorrect answer given in part (a). Even though this was a follow through mark, the majority of candidates either did not have 4 significant figures in their answer to part (a) or gave an answer 0f 0.0156 for part (b). Less than 30% of candidates scored full marks on this question.

Question 11

The most common error was missing 1 from the list of factors of 24 (part (b)). Other significant errors included misunderstanding complement, intersection or union of sets, including elements not contained in the universal set and failing to realise that part (c) explicitly referenced the results in parts (a) and (b).

Question 12

This matrix multiplication question proved to be very challenging with over half of candidates not achieving any marks. In past questions, candidates were expected to multiply together two 2×2 matrices or a 2×2 matrix by a 2×1 matrix. The resultant matrix for the first of these would be a 2×2 matrix and in the case of the second, a 2×1 matrix. However,

in this question, the candidate was expected to arrive at a **single** element (1×1 matrix) in part (a) and a 2×2 matrix in part (b). The majority of errors were created by candidates who did not appreciate that in valid matrix multiplications, the order of the resultant matrix is given by the number of rows in the first matrix by the number of columns in the second matrix.

Common errors seen were an answer of (11) or $\begin{pmatrix}8\\3\end{pmatrix}$ for both parts of the question.

Question 13

Most candidates made some progress with this question by managing to find the more complex algebraic common factor. Of these candidates, many failed to spot the numerical common factor and simply wrote down their final answer as $\frac{6x^2}{4y}$ thus losing two out of the three possible marks.

Question 14

Just over half the candidates gained full marks in part (a). A small minority of candidates failed to appreciate that the list needed to be ordered before selecting the middle value. Also a small but significant number of candidates, quoted the position of the required value rather than the value itself. Candidates fared better in part (b) with nearly 80% of candidates knowing the definition of the mode. However, a significant minority of candidates confused the mode with the mean and spent invaluable time evaluating the incorrect value.

Question 15

An inability to correctly remove the brackets in the expression $4x-5(y+3)$ proved the downfall of a third of candidates who either gave this as $4x-5y+15$ or $4x-5y-3$. These candidates earned no marks for this question. Indeed, manipulating negative signs was also problematic in **Question 6** and is an area that centres should focus on with future candidates.

Question 16

This was one of the most challenging questions on the paper with two-thirds of candidates either not making any attempt at the question or simply giving an incorrect responses because they did not seem to have the required understanding of the effect of a square root as a function. Indeed, there were many blanks in part (a) but some candidates were able to recover at least one mark in part (b), especially if they started by squaring both sides of the given equation.

Question 17

Candidates almost universally knew and attempted a standard methodology to solve this simultaneous equations question. Most candidates used either the elimination or substitution method. Those who used the substitution method were more prone to making minor slips which prevented them gaining full marks. Two-thirds of candidates scored full marks on this question.

Question 18

There were a significant number of blank responses to this question. Indeed, many candidates did not seem to appreciate that there was a need to express the two given ratios, $a:b=5:8$ and $b:c=6:25$, as equivalent ratios (eg $a:b=15:24$) with the values for *b* in both ratio statements

being the same. Those who did have a viable methodology generally ended up with either the correct answer or an equivalent ratio with all terms doubled.

Question 19

This standard trigonometry question which was generally well answered with over 70% of candidates showing a correct method. A significant number of candidates used more complex techniques than required, although many managed this with no errors some made mistakes due to the extra work they created. It was however disappointing to see a fair number of candidates lose marks due to not rounding to the required level of accuracy. Some candidates even showed truncated results rather than correctly rounded results (8.48 was a popular truncated answer to part(a)). Candidates who over rounded all their results generally faired worst in this respect.

Question 20

Only around half of candidates used the correct property that $\sum P = 1$ to arrive at the required answer of 0.15 in part (a). In part (b), two-thirds of candidates scored no marks and this was invariably down to using equally likely outcomes rather than the probabilities given in the table in part (a). Of those who did achieve one mark for this part of the question, such candidates found two of the required **three** compound probabilities. 20% of candidates achieved full marks on this part of the question.

Question 21

9^3 proved to be a popular, but erroneous, answer to part (a) and whilst such candidates did not seem to appreciate that their answer to part (a) would be helpful in part (b), a significant number of candidates with incorrect answers in part(a), recovered in part (b) and much correct working was seen in this second part of the question.

Question 22

This question, based on histograms, was poorly answered with over half of candidates failing to score any marks at all. Indeed, all that was required for the first missing table entry was a comparison of the heights of the two bars given in the histogram. The second table entry mark was a follow through mark using the data given in the first sentence in the question: …*for a period of 60 days*. In part (b), many diagrams were either left blank or had bars drawn at incorrect heights. In the latter case, candidates were showing a lack of understanding of histograms by failing to take into account the width of the missing bars.

Question 23

Surprisingly, a large number of candidates either did not attempt this question or drew incorrect lines on their diagram. Of the remaining candidates, the four available marks were in equal proportion amongst these candidates with less than 14% of candidates scoring all marks. Drawing and labelling lines with given equations is a fundamental concept for candidates tackling this subject and centres should be mindful of ensuring that their candidates are well-drilled in the correct technique.

Question 24

This question proved to be quite challenging for a significant number of candidates and many simply did not answer the question or started with triangle *B* in the first quadrant. In both of these cases, no marks were achieved for this question. Of those who correctly reflected triangle *A*, the majority often managed the translation to locate triangle *C* correctly to achieve at least two marks. However many fewer candidates successfully rotated triangle *C* with the most popular, but erroneous, attempt at triangle *D* being a reflection of triangle *C*. Many candidates did not attempt part (d). Of those who did, a small number were trying to find a translation rather than a multiplicative answer. As a consequence, only 18% of candidates achieved a mark of four or more on this question.

Question 25

In a question set on proportionality, it is essential that the candidate correctly interprets the statement given. A significant minority misread or misunderstood the question and attempted to answer it based on inverse proportionality or even direct or square proportionality. Such candidates gained no marks. A significant number of candidates clearly misunderstood the demand in part (a), and provided the solution for the first part of the question in part (b). Retrospective marking is not generally available (and this was the case here) and such candidates, whilst showing all, and correct, working in part (b), were unable to score marks that they would have achieved in part (a). Just over a third of candidates scored full marks on this question.

Question 26

This geometry question proved to be quite challenging to candidates with many making incorrect assumptions about the diagram or failing to give correct reasons. Indeed, whilst some were able to give the required answer of 96° for $\angle ADC$, one-third were unable to give the correct reason. The correct reason should have been *opposite angles of a cyclic quadrilateral*. Part (b) often showed erroneous use of parallel lines with *FAB* being assumed parallel to *DC*. As a consequence, 44° proved to be a popular, but erroneous, answer. Only a very small minority of candidates (25%) were able to correctly use the alternate segment theorem to arrive at the correct answer of 58°. The marks for part (c) were dependent on a correct answer for part (b) and **two** valid reasons. These two marks proved to be elusive to all but 9% of candidates.

Question 27

A fair number of candidates scored no marks here either as a consequence of not attempting the question or failing to remove denominators correctly. Of the remainder, the majority of candidates did arrive at a correct quadratic with 50% of candidates scoring all five marks for the question. Of those candidates who were successful in their method for solving a quadratic, there were as many attempts at using factorisation as there were of using the quadratic formula. Candidates should be advised that where the required answers are not required to 3 SF, the correct quadratic will **always** factorise.

Question 28

Loci in 2 dimensions using normal geometrical instruments did not seem to be a popular topic for this cohort of candidates. Nearly half of the candidates either left the question blank, provided the incorrect constructions or did not use the required geometrical instruments in their attempt at constructions. A quarter of candidates did provide the correct constructions to the level of accuracy required but only a third of these candidates identified and labelled the required region in part (d).

Question 29

The vast majority of candidates recognised that Pythagoras' theorem was required in part (a) and many full marks were seen here. Parts (b) and (c) however proved to be more challenging as many candidates miss-quoted the use of the intersecting chords theorem. In part (b), a popular, but erroneous, use of the theorem was often seen in the form $6 \times 6 = 8 \times QD$. Similarly, in part (c), the equation $6 \times 6 = 10 \times QE$ was seen more often than the correct equation.