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Examiners' Report Summer 2008

GCE

GCE O Level Mathematics B (7361)

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Summer 2008

Contents

Mathematics B

Specification 7361

Paper 1

Introduction

There was no general indication that the examination paper was too long, with most candidates making reasonable attempts at nearly all of the questions and with a significant number of these scoring high marks. Overall, the standard of presentation and clarity of work was high. However, it should be emphasized that candidates should be encouraged include their working on the paper to show how they obtained their answers since if an incorrect answer was given without any working shown, all of the associated marks were lost. It would also be prudent of centres to encourage their candidates to answer the questions within the examination paper booklet and not, if at all possible, on any extra sheets of paper. Also, centres should emphasize to candidates who do need to use extra sheets of paper, to clearly indicate this in the answer area of the relevant question in the examination booklet.

Once again, it was pleasing to observe that many candidates showed that they have a good understanding of the basic techniques of arithmetic, algebra and geometry and were able to apply them competently. It would prudent of centres to emphasize the importance of reading a question clearly so that the candidates understand the demand of the question before attempting to answer it. Similarly, candidates should give their answers to the required accuracy as often marks are lost on otherwise completely correct work. The question paper did however highlight the following problem areas, followed by their corresponding question numbers, which should receive special attention

- Manipulation of fractional indices (4)
- Vectors (5)
- Symmetry (7)
- Complement of a set (10)
- Inequalities (11)
- Similar solids (16)
- Prime factors(17b)
- Algebraic manipulation (21)
- Using Pythagoras' Theorem (22b)
- Evaluation of a determinant (24)
- Bearings which are greater than 180^{o} (25d)
- Geometry (27)
- Calculation of perimeters and areas (28)

Of these, the questions which proved most elusive to candidates and were thus discriminators were Q4, Q5, Q7, Q11, Q16, Q17b, Q18, Q22b and Q5d.

Report on Individual Questions

Question 1

As expected, most candidates answered this question correctly. A common incorrect answer was $\frac{x^2}{2x+2}$. A number of candidates stopped at $\frac{x^2+2x-2x}{2(x+2)}$ thus collecting only the method mark.

Question 2

A common error was to use 10.3 instead of 10.5 for 10 hours 30 minutes resulting in the loss of both marks. $\frac{24}{10.5}\times 100$ was seen on a number of occasions.

Question 3

Many candidates gave £24.2 or £24.20 instead of the correct £24.19 as their answer and, of these candidates, many lost the accuracy mark, although subsequent working was ignored if the candidate had written £24.19 and went to give £24.20 in the answer line. Such candidates were awarded the accuracy mark.

Question 4

As observed in previous examinations, many candidates have difficulties with numbers with fractional indices. Common errors were setting $27^{\frac{2}{3}}-32^{\frac{2}{5}}$ as $\frac{27^2}{3}-\frac{32^2}{5}$ leading to an answer of 38.2 or to set $27^{\frac{2}{3}}-32^{\frac{2}{5}}$ as (27-32) + $\left(\frac{2}{3}-\frac{2}{5}\right)$ leading to answer of $-5\frac{4}{15}$, both of which earned no marks.

Question 5

This question proved to be one of the discriminators of the paper. Many candidates failed to realize to that coefficients of **a** and **b** were equal to zero.

Question 6

On the whole, most candidates answered this question correctly.

Question 7

This question was another discriminator. It would be advisable for centres to devote more time to teaching symmetry to their students as it was evident from many responses, that candidates were guessing the answers.

Question 8

There were many correct answers to this question. The usual error was to calculate the inverse of the gradient.

Question 9

Most candidates were successful at collecting both marks. Some candidates omitted the $\frac{1}{2}$ in $204 = \frac{1}{2} \times (x + 2x) \times 17$, losing both marks.

Question 10

It was evident from a substantial number of attempts, that many candidates do not understand what a complement of a set is and centres would be thus well advised to spend more time on this property of a set and also on basic set notation.

Question 11

A common error seen very often was that once $x < 6.5$ was obtained, the candidate's next step was to write $y = 5 - 2 \times 6.5$, losing the second method mark and thus the accuracy mark even if they did write $y > -8$ in the answer line.

Question 12

There were many correct attempts at this question. There were however, a considerable number of candidates who answered part (a) correctly but did not attempt part (b). Many candidates believed that $\angle ACE$ was 90° which cost them dearly later.

Question 13

Many candidates collected full marks, however, there were a number of candidates who thought that the volume of the cylinder was involved and got nowhere. However, much unnecessary work was spent by many in calculating the vertical height of the cone as 15cm or 18.8cm.

Question 14

Parts (a) and (b) were answered correctly by most candidates but part (c) was usually elusive to most candidates except for the ablest.

Question 15

As in previous examinations, it is quite clear that most candidates do not have an understanding of the concept of a domain of a function. The algebra let a number of candidates down in part (b) but such candidates usually managed to collect the method mark which was awarded at the first step of the method.

Question 16

As expected, there still are many candidates who do not fully understand how to deal with the areas and volumes of similar shapes. Thus in part (a), a common error was to see $12 \times 5 = 60$ and even $\frac{1}{5^2} = \frac{12}{x^2}$ leading to an incorrect answer of 17.32. In part (b), erroneous methods seen were $\frac{6}{5} = 1.2$ and $\frac{6}{5^2} = 0.24$.

Question 17

There were a number of candidates who did not understand what the demand of part (a) required and they went on and *solved* the equation rather than *factorising* it, losing both marks. It was also clear that many candidates did not realise the hint given in the demand of part (b) and simply calculated $3\times 20^2+16\times 20+21$ and obtained 1541. They then stopped presumably because they thought that this was what the question required.

Question 18

This was another discriminating question. Many candidates did not even attempt the question and of those that did, many had no idea of what to do. Some managed to get as far as "5 sheep" and then forgot to add on 3 more thus losing the last 2 marks. There were, however, many who successfully answered the question.

Question 19

It was clear that many candidates had been well drilled in this type of question and thus successfully collected full marks. A common error was to write 120 = $k5$ so that k = 24 and so s = "24"$\times$3 = 72, gaining no marks. The other errors seen were setting s to be $\frac{k}{t^2}$ or $\frac{k}{t}$.

Question 20

It was pleasing to see many correct attempts at this question, however, there were candidates who did not attempt part (b). A popular erroneous method for part (b) was writing $\angle ACD=\frac{108}{2}=54$ so that $\angle CAD=180-2\times 54=72$. Other misconceptions included believing that $\angle CAE$ was 54° or worse that $\angle CAE$ was 90° – 54° = 36°.

Question 21

Many candidates demonstrated in this question that they had been well drilled in algebraic manipulation, however, the candidates whose algebraic capabilities were poor usually fell at the third step of the method which was to collect terms in c on one side of the equals sign. Of those that did managed to collect terms in c, in so doing many made a sign slip.

Question 22

Points A and C were invariably correctly plotted. Many candidates appeared to have had no idea of how to obtain the other two vertices – often ending up with rectangles or odd shaped quadrilaterals. Common errors were plotting (4,1) and (5,8) for (5,1) and (4,8) respectively. A sizeable majority simply joined A to C, believing that this was a side of the square rather than its diagonal. A number of candidates who successfully drew the square then *measured* rather than *calculated* the length of a side of the square and so gained no marks. Part (b), though, was one of the discriminators of the paper. The more able candidates, however, did successfully use Pythagoras to calculate 5 cm as the length of the square's sides.

Question 23

Many candidates managed to collect full marks for this question. Of those that did not usually collected the single mark in part (a) and the method mark in part (c) for dividing their answer to part (b) by their answer to part (b) and multiplying by 100. A common error in part (b) was to calculate the salary of one worker and add this to that of the supervisor and then subtracting the result from their (a).

Question 24

This question demonstrated that many candidates do not know how to calculate the value of a determinant. At best such candidates collected the method mark for solving a trinomial quadratic. There was also a common sign slip - such candidates usually correctly wrote down $2 - x(x - 1) = -4$ but then wrote $2 - x^2 - x = -4$. Another common error was to write $\dfrac{1}{2 - x^2 \pm x}$ for the evaluation of the determinant.

Question 25

Interestingly most candidates plotted the motion of ship B correctly but a number plotted A's incorrectly with a bearing of 030^{o} drawn. Part (d) proved to be a major discriminator of the paper. It was evident that most candidates do not understand bearings which are greater than 180^{o} and Centres would be advised to spend more time on them with their students. A common error was the erroneous assumption that the bearing of B from A was $180^{o} + 60^{o} = 240^{o}$.

Question 26

Part (a) was answered correctly by nearly all of the candidates. Most candidates drew the pie chart correctly, however, there were a number of candidates who left sectors unlabelled or only labeled with percentages.

Question 27

Most candidates collected the mark for part (a), but for the weaker candidates, parts (b) and (c) proved elusive, particularly part (b) with the result that such candidates collected nothing for part (b) but sometimes did obtain the 2 marks for part (c). A common error was $\angle OBA = \angle ABC / 2 = 17^{o}$ and since ΔOAB is isosceles, then $\angle BAO = 17^{o}$ in part (b) and then since the diagram in the question paper appeared to be symmetric, $\angle BAO = \angle BCO = 17^{o}$ in part (c). Other claimed that $\angle BAO = \angle BCO = 17^{o}$ claiming "angles in the same segment" as their incorrect reasoning. Once again, it should be stressed to candidates not assume geometrical or trigonometrical properties unless they are stated in the question or are required to be proved in the question.

Question 28

There were many fully correct attempts at Q28. In part (a), weaker candidates assumed that all that was required was the length of the arc *AB*, such candidates only gained 1 mark for their attempt. Of those that did attempt to find the length of the line *AB,* too many thought that $AB^2 = 15^2 + 15^2$. It was interesting to observe that the Cosine Rule was often used to calculate the length of *AB*. Similarly in part (b), weaker candidates assumed it was just the area of the sector *OAB* that was required. Where the correct method was seen for part (b), often the final answer was spoilt by premature approximation or incorrect rounding.

Paper 2

Introduction

It is pleasing to see that candidates continue to show good algebraic techniques and many candidates achieved full marks on such questions. To ensure completely correct solutions on algebraic questions, candidates should be encouraged to check their working wherever possible.

Some candidates are clearly not comfortable in handling vector ratios and, in preparation for the examination, more practice is required on this type of question.

The question involving number of elements in sets created more problems than expected amongst candidates. In such questions, candidates should be encouraged to check their working as fractions and values much too large to be consistent with the information given, should indicate to the candidate that something is wrong.

Questions of a complex literal nature do cause problems for many candidates and the last part of the probability question was such an example. Although it was pleasing to see many correct answers to earlier parts of the question, all but a few understood what was required from the demand *at most one of the two sweets will be yellow*. A similar problem arose on the last part of Q9 as candidates again had difficulty in understanding what was required.

Transformation questions are generally done well but the question on this paper was not tackled well at all. The position, size and orientation of the final shape drawn, *D*, should have been an indicator to the candidate whether or not their previous working had been correct. The transformation back to the original shape, *A*, could only be a ‘standard’ reflection or a simple rotation. Diagrams which clearly did not lead towards one of these transformations should have initiated the candidate to check their previous wrong working.

The trigonometry question was handled well by the majority of candidates with much good working seen. However, candidates should be reminded that they should not make incorrect assumptions about diagrams which are shown in the question.

Report on Individual Questions

Question 1

Much correct working was seen in this question as the majority of candidates seem well drilled in the technique of solving simultaneous equations. The most popular method was balancing the two equations (M1) and then making the correct decision to either add or subtract (M1 dep). The majority of those who showed correct method went on to arrive at the required answers of $x = 1/2$ (A1) and $y = 2/3$ (A1). Some candidates worked in decimals which, providing the required answers were achieved, caused no problems. However, premature approximations invariably led to at least one accuracy mark being lost.

Question 2

In part (a), finding the actual time taken to travel from Lisbon to Coimbra proved to be problematic for a significant number of candidates with 2.3 hours or 3.5 hours being popular incorrect values used. For those who did divide 2.5 into 205 km, (M1) a high proportion arrived at the required answer of 82 km/h (A1).

In part (b), the correct fraction, 125/75 (M1) was seen on many scripts. Correctly handling this fraction proved to be elusive to many with fewer than expected number of candidates appreciating that this fraction is equivalent to one hour 40 minutes. Indeed, a common assumption was that 1.67 hours = 2 hours and 7 minutes followed by an answer of 15:27. Many candidates converted to a premature decimal and, as a consequence, 15 00 hours (A1) was not seen as often as expected.

In the final part of the question, part (c), weaker candidates simply multiplied by 40 and 18 600 was a common incorrect answer for these candidates. Converting 40 minutes to either a fraction or a decimal of an hour and multiplying by 465 (M1) earned method and again, except for premature approximation decimals, many correct answers of 310 km (A1) were seen.

Question 3

Candidates seem well drilled in the correct technique of using the factor theorem and many correct answers of $k = -9$ (M1, A1) were seen in part (a).

In part (b), those candidates who obtained the correct value of k in part (a) invariably went on to find the correct quadratic of $5x^2 - 4x - 1$ (M1, A1). This quadratic trinomial still needed to be factorised and many were able to do this successfully (M1) to arrive at the required answer of $(x + 2)(5x + 1)(x - 1)$ (A1). Those candidates who had arrived at an incorrect value of k in part (a) could achieve the second M mark only. Some candidates seemed to be confused between factorisation and quadratic equation solving and a significant number of answers of the form $(x + 2)(x + \frac{1}{5})(x - 1)$ were seen. Such expressions earned, at most, the first M and A mark for this part of the question.

Question 4

Part (a) was well answered with many correct expressions, $6x^3 - 15x^2 + 14x - 35$ (B1) seen.

Many candidates showed that they can successfully differentiate a function and many correct statements of the form $18x^2 - 30x + 14$ (M1, A1) were seen in part (b). Some weaker candidates simply differentiated $(2x - 5)$ and $(3x^2 - 7)$ separately to arrive at $2 \, . \, 6x = 12x$. Such candidates earned no marks.

In part (c), many correct answers were seen as confident and capable candidates reduced the quadratic equation to $18x^2 - 30x - 12 = 0$ (o.e.) (M1, A1). Many correct answers of $x = 2$ and $x = -1/3$ followed from correct factorisation (M1, A1).

Question 5

In part (a), despite many correct answers of (i) $-\underline{c} + \frac{3}{4}\underline{a}$ (B1) and (ii) $\underline{a} + \frac{4}{5}\underline{c}$ (B1) seen, there were a significant number of candidates who used the given ratios incorrectly. As a consequence, answers of the form $-\underline{c} + \frac{2}{3}\underline{a}$ and $\underline{a} + \frac{3}{4}\underline{c}$

were not uncommon. Incorrect interpretation of the given ratios in this way invariably meant that such candidates achieved, at most, the method mark in part (b).

For those candidates who used the given ratios correctly, part (b) proved to be straightforward and many correct answers of $\frac{3}{2}\underline{a} - \underline{c}$ (M1, A1) were seen. Some able candidates lost the A mark because they failed to simplify the expression, invariably leaving their answer as $\frac{6}{4}\underline{a} - \underline{c}$.

In part (c), the most able candidates, who correctly interpreted the given ratios, showed much good vector work (M1) and simplified correctly to $\frac{11}{5}\underline{c}$. Drawing the correct conclusion from this simplified vector earned accuracy (A1). The majority of candidates however earned no marks for this part of the question either because of incorrect ratios or sign errors in vectors used.

Question 6

Except for part (c), this question was reasonably well answered. In part (a), two acceptable methods were seen. The first of these (and the most popular) was the correct use of the intersecting chords property of circles (M1) enabling a candidate to arrive at the required answer of 6 cm. An alternative, but equally acceptable method, was seen on a number of scripts where *OX* and *OD* were identified as 9.1 cm and 10.9 cm respectively. A correct Pythagorean statement earned method (M1) and the required answer invariably followed. A significant number of candidates assumed part (b) in part (a). This earned no marks.

In part (b), a correct Pythagorean statement with *AF* the subject (M1) led many candidates to the correct conclusion (A1).

Whilst many candidates seemed to be confident in the use of the internal intersecting chords property, the use of the external intersecting chords property proved to be more problematic. Full marks in part (c) therefore proved to be elusive to many but the most able of candidates. Indeed, the most popular incorrect statement was $FE \cdot FA = FD \cdot FX$ resulting in an incorrect answer of 5.4 cm for *FE*. The correct statement, with values substituted (M1), led very few candidates to the required answer of 17.4 cm. As in part (a), some candidates successfully arrived at the required answer by evaluating $\angle XAE$ (M1) and then using trigonometry on $\Delta\, OAE$ to find *AE*.

Part (d) proved to be more popular and many scripts showed *OX* as 9.1 cm (M1). A correct trigonometrical statement (M1 dep) led a significant number of candidates to the required answer of 31.2° (A1).

Question 7

In part (a), there was a requirement and four marks available to enter numerical values and expressions in terms of x into 7 sections on the diagram. The value 8 (B1) in $(A \cup B \cup C)'$ proved to be the most popular mark achieved. A miss-interpretation of the statement *12 went on the boat trip and the coach trip but not the helicopter trip* by many candidates resulting in an incorrect entry of $12 - x$ onto the diagram. This error was compounded on many scripts and the remaining values and expressions were invariably incorrect. For those candidates who did interpret the statements correctly entered 12, 2 and 4 (B1) on the diagram and followed this with entries of $14 - x$, $18 - x$ and $4 - x$ into the remaining segments (B1, B1).

Candidates were able to recover method in part (b) by writing down a correct equation, equal to 56, from their diagram (M1). A correct value of 3 (A1) was only awarded following a correct equation.

In part (c), answers of 47 (B1 ft), 9 (B1 ft) and 8 (B1) were expected but candidates were able to achieve the first two marks provided that the values written down followed through from their x and their diagram.

Question 8

Many correctly labelled diagrams (B3) were seen in part (a) as the majority of candidates appreciated that this was a *without replacement* problem.

Again, in part (b) (i), much correct working was seen (M1) resulting in the required answer of 1/15 (A1). In part (ii), successful candidates gathered together the required probabilities – 6 pairs (or 3 pairs if the complement was to be used) (M1, M1 dep) and many scripts showed the required answer of 31/45 (o.e.) (A1). Poor evaluation of fractions or fractions used from an incorrect diagram earned method only.

The wording in part (iii) proved to be difficult for the majority of candidates with many simply assuming that it was equivalent to the probability of one yellow sweet and, as a consequence, 16/45 proved to be a very popular, but incorrect, answer. Only a small minority of candidates recognised that the probability required was all but the probability of two yellow sweets (M1) and few answers of 44/45 (A1) were seen.

Question 9

Parts (a) and (b) required candidates to read values off the graph which was given and these two parts were generally done very well with many correct answers given in the range 63 → 65 m (B1) for part (a) and 32 → 34 m (M1, A1) for part (b).

Part (c) required candidates to complete the table, giving answers to one decimal place. Many correct table entries of 6.7, 36.7 and 90.7 were seen (B3). A one mark penalty was given where a candidate had either given 6.6, 36.6 90.6 or had given values to 2 decimal places.

In part (d) the candidate was required to draw the graph from their table values (B3). This was done very well by the majority of candidates and very few penalties were imposed. One error, which did seem to reoccur, was plotting at 96.7 rather than 90.7.

Many correct answers in the acceptable range 97 → 99 km/h (M1, A1) were seen in part (e) as candidates seemed well able to read values off their drawn graph correctly.

In part (f) however, many candidates did not seem to understand what was required of them and either avoided answering the question or read the speeds on wet and dry roads at 27 m and then subtracted these two values. As a consequence, few correct answers in the range 93 → 97 km/h (M1, A1) were seen.

Question 10

This question was not generally well done with most errors centring around incorrect attempts to part (c). Indeed, an incorrect answer to this part of the question meant few other marks were available to the candidate.

In part (a), many candidates recognized that the angle of rotation was 90° but a significant number of these seemed to be confused between clockwise and anti-clockwise and fewer than expected gave the correct answer of 90° clockwise (B1).

The word *enlargement* was given in the demand of the question for part (b) so repeating this word did not, in itself, gain anything for the candidate. The phrases required were *scale factor of 2* (M1) and *centre P* or *centre (3, 6)* (M1).

In part (c), a significant number of candidates did not achieve full marks because they either used the wrong centre of enlargement, performed an enlargement of ½ instead of -½, or produced an image which was a reduced reflected image of *B*. The centre of enlargement and one correctly plotted vertex of *C* was enough for method (M1) but fewer than expected achieved full accuracy (A2).

Despite many incorrect answers to part (c), many recovered in part (d) to correctly reflect their previously plotted *C* (B2 ft) and many were able to define this transformation correctly as a reflection (M1) in the line $y = x$ (A1) for part (e).

Clearly, incorrect diagrams meant that answers to part (f) proved to be elusive to many candidates and few correct answers of reflection (M1) in the x-axis or the line $y = 0$ (A1) were to be seen.

Much algebraic working was seen in part (g) as many candidates tried to determine the 2 x 2 matrix, **T**. A few able candidates recognised that the matrix was one of the 'standard' matrices for reflection and were able to write down the correct matrix (B2). Centres should be mindful that any request for determining such a matrix would lead to one of the standard matrices and candidates should be suitably prepared to deal with such questions. Indeed, the demand for part (g) should have triggered that the transformation from *D* to *A* was a standard reflection in one of four lines **or** one of four rotations about the origin. Where neither of these types of transformation was evident from the candidate's diagram, the candidate should have been mindful to return to earlier parts of the question to correct wrong working.

Question 11

Part (a) was well done with the majority of candidates successfully applying Pythagoras (M1) to arrive at the required answer of 11.3 cm (A1). Despite constant reminders about correctly rounding to the required degree of accuracy, there were still some candidates who left their answer as 11.31 cm. As a consequence, these candidates lost the accuracy mark.

Incorrect assumptions about the diagram proved to be problematic for a number of candidates in part (b) and much wrong working was seen. Some weaker candidates assumed that $\angle BEC = 90°$ and simply stated that $BE = 8 \cos 31°$. Others made the assumption that $\angle BED = 90°$ and wrote down the incorrect equation $BE = 11.3 \cos 76°$. In this second case, credit was given for identifying that $\angle EBD = 76°$. Identifying that $\angle EBD = 76°$ or $\angle BDE = 28°$ (B1) was essential to find the required length, *BE*. Two steps, involving trigonometrical statements and the found angle (M1, M1 dep) were then required to find this length as 5.47 cm (A1). As a consequence of premature rounding, some candidates lost the accuracy mark, writing down 5.46 cm instead.

Many candidates who were unable to determine *BE* correctly in part (b) recovered in parts (c) and (d) and many correct answers of 17° (M1, A1) and $CF = 2.45$ cm (M1, A1) were seen.

Despite previous incorrect working and rounding errors, much correct method was seen in part (e). A variety of methods were used requiring the candidate to firstly find either *BF* or *FE* (M1). The correct use of an area formula generally followed (M1 dep). An answer in the acceptable range $7.75 \rightarrow 7.83$ cm^2 (A1) however proved to be somewhat more elusive as a consequence of previous work.

Again, part (f) also showed much correct working with many candidates finding the area of ΔBEC or ΔDEC correctly (M1). This was invariably followed by subtracting either their answer to part (e) or the area of ΔDFC (M1 dep) to arrive at the required answer, in the range, $3.42 \rightarrow 3.52$ cm^2 (A1).

Statistics

Overall Subject Grade Boundaries

Grade	Max. Mark	A	B	C	D	E	U
Overall subject grade boundaries	100	80	64	48	43	29	0

Paper 1

Grade	Max. Mark	A	B	C	D	E	U
Paper 1 grade boundaries	100	80	63	46	37	28	0

Paper 2

Grade	Max. Mark	A	B	C	D	E	U
Paper 2 grade boundaries	100	80	64	49	39	30	0

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