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Mathematics B (4MB0)
Paper 02

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General Points

Some questions proved to be quite challenging to a number of candidates and centres would be well advised to focus some time on these areas when preparing candidates for a future examination.

In particular, to enhance performance, centres should focus their candidate's attention on the following topics, ensuring that they read examination questions **VERY** carefully.

- Translating literal statements into correct equations (Question 2 (b))
- Intersecting chords theorems (Question 4)
- Mensuration (Question 6)
- Enlargements (Question 8(b))
- Estimates of a mean value and probabilities from grouped frequency data (Question 9 (a)&(c))
- Finding the value of one parameter in a vector problem (Question 10 (c))

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.

Candidates should also be reminded that if they are continuing a question on a page which does not relate to the question that they are answering, they must say "Continuing on page..."

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

Part (a) was done very well by the vast majority of candidates and much good work was continued in part (b) where the majority of candidates scored full marks. Marks tended to be lost in part (b) where the calculation was incomplete. Such candidates went as far as a first calculation either converting to pounds or finding 75% rather than performing both calculations.
A small minority of candidates did not seem to be aware that it is normal to express pounds to 2 decimal places.

Question 2

Whilst nearly half of all candidates scored full marks here, many were unable to interpret the phrase *22 more peaches than melons in the box* correctly in part (b) with a significant number of candidates identifying this statement as meaning 22*m* or even 22*p*. As a consequence, whilst these candidates made an attempt at part (c) to eliminate *m* or *p*, they were unable to find the required answers. Indeed, one incorrect method, with the second equation: $p = m - 22$ produced *m* = 61 and p = 39. A check by such candidates that the values did not fit both statements would have alerted them to an error somewhere in their working. Furthermore, answers, involving decimals, or a value of *m* or a value of *p* equal to zero should have also alerted candidates to errors in their working.

Question 3

Generally this question produced a high standard of solutions. Although a small minority found the algebra too complex, for the majority the errors, when they occurred, were usually caused by arithmetic slips leading to an incorrect trinomial and, hence, incorrect solutions. Many candidates with the wrong equation, knowing that the equation should factorise, produced factors which, when expanded, would not actually produce their trinomial expression. Careful thought at this stage would have enabled candidates to locate their error.

Question 4

In part (a), the majority of candidates successfully made use of Pythagoras' theorem. Some however did take a circuitous route via trigonometry and a small number misread the given information and did not draw a successful conclusion. As always, a few candidates failed to give their answer to the required degree of accuracy.

In part (b), although there were a number of reasonable attempts at finding FB , it is clear that many candidates lack familiarity with the secant-tangent theorem with many writing the incorrect equation $10 \times (7 + FB) = "16.248"^2$.

Most fared better in part (c) as many were able to apply the intersecting chord theorem. However those who were unable to successfully deal with part (b) were also unable to obtain the correct solution in this part of the question. Only about a third of candidates achieved full marks on this question.

Question 5

In part (a), a significant majority of candidates provided fully correct solutions. Most candidates found f(-1) first and then g(-11) but an equally successful minority first found gf(*x*) and then put *x* $= -1$. Most candidates did realise that gf means first f and then g but, as always, there were a few who got the order wrong both here and in part (c).

Most candidates knew what was expected in part (b), although there were some who left this part out completely. Errors were caused usually by careless arithmetic slips in the working. Most marks lost were as a result of not presenting their inverse function in the form of a mapping as requested in the question.

There were plenty of fully correct solutions in part (c). Errors, when they occurred, were due mainly to slips in finding fg(*x*) particularly $2(2+x) = 4+4x$, omitting the -6 or using gf or in some cases f(*x*) x g(*x*). Just over half the candidates scored a mark of 7 or more on this question.

Question 6
Quite a few candidates were reluctant to leave π in their working, even though (a) required them to and (b) wanted an exact value. In many cases it felt as though candidates had rushed at the question without giving themselves time to interpret the situation.
A majority of correct solutions were seen in part (a) although a few thought the volume was 2πrh and in a minority of cases, $\frac{4}{3}\pi r^3$ was used. Such incorrect substitutions proved costly in both parts of the question.
Only the better candidates scored well in part (b) of the question. Many were confused about the increase in depth and often equated the volume of the spheres to the total new height (16.4) volume. There was also confusion about the value of 'r'. It was treated as the same for the spheres as for the cylinder in several cases. Only about a third of candidates progressed beyond the first two marks of part (b). Indeed, a quarter of candidates scored no marks at all on this question.

Question 7
The vast majority of candidates differentiated correctly in parts (a) and (b) with only a very small proportion making any errors.
In part (c), a few candidates solved for a zero velocity but most did, correctly, equate their velocity and acceleration. Aside from a few careless errors, most correctly solved their equations. However many final marks were lost by candidates ignoring one or both conditions- either retaining the negative solution or only giving their answer to 2 significant figures. Whilst a third of candidates scored full marks for this question, just over a quarter of candidates lost this final mark.

Question 8
In part (a), the vast majority of candidates plotted and labelled triangle *A* correctly. However, many candidates slipped up in part (b). The most common error was to take a centre of enlargement at the origin. There was also use of a negative scale factor and a few who just made it twice the size of A and put it somewhere. As a consequence, these three marks were lost on many scripts. Marks were recovered however in part (c) where their triangle *C* was correctly followed through from their (often incorrect) triangle *B*. Those candidates plotting an incorrect C were often as a result of an inaccurately drawn $y = -x$ or using the y-axis as their mirror line. In part (d), the majority did pre-multiply their 2 x 3 matrix by T and those who had the correct triangle *C* usually obtained *D* correctly. A very small number did post multiply which shows a lack of practice.
A lot of correct transformations here. An early error in (b) followed by correct working in (c) & (d) usually lead to the expected reflection in part (e). As a consequence of many incorrect triangle answers to part (b), less than 50% of candidates scored more than 5 out of a possible 11 marks for this question.

Question 9
In part (a), the calculation often reflected a misunderstanding of midpoint values. The group width was often used as a multiplier leading to a popular, but erroneous, answer of 18.2 minutes. Candidates who selected the correct midpoints invariably achieved the correct answer although final answers of 58.2 were common. As a consequence, the final mark was lost. It was pleasing to see that there were many good attempts at the histogram in part (b). For those who made a good attempt, the only mark that tended to be lost was on the final bar where several candidates showed the 80 – 90 block with a double width. Part (c) was only reasonably well attempted by the better candidates who understood what frequency density is all about. Many left this out completely or simply added 90 instead of 72 in their numerator. About 20% of candidates attempted this part of the question with some success. 11% of candidates scored full marks for the complete question.

Question 10

Part (a) was generally well done with most errors occurring due to a misunderstanding of the given ratios. Part (b) was also reasonably well done with the majority of candidates either fully correct or correctly followed through from their answers to (a). However ratio was still a problem for some and the denominator '*m* + 1' appeared frequently. A small minority seemed to be under the impression that *m* or 1/*m* was a vector.

Part (c) proved to be quite challenging. Very few candidates spotted the similar triangle approach which was a shame because the ratio approach seemed to create many problems. A number of candidates decided to equate *PQ* to *AC* or *AB* rather than *kAC* or *kAB*. As a consequence, many incorrect answers of *m* = 1 were seen. Most candidates who correctly used one of the ratio approaches did succeed in obtaining the correct solution. After part (b), the majority of candidates only managed to pick up the follow through mark in part (d).

In the final part of the question, part (e), many candidates realised that they needed to use their *m* but too many failed to square the scale factor when trying to find the area. Despite the challenges of this question, some 13% of candidates did achieve full marks.

Question 11

Part (a) was mostly well done with the most common error being in the final table entry. Progressive approximation of -0.446 leading to -0.45 and then -0.5 meant that this mark was lost.

Candidates are invariably well drilled in curve sketching and part (b) was generally well done. Part (c) however was a little disappointing with too many candidates either giving the *x*-coordinate of the minimum or an answer of 5.5 instead of -5.5.

In part (c), the majority of candidates did draw the tangent and attempt to divide their *y*-step by their *x*-step, but quite a few answers were outside an acceptable range. Only a limited number of candidates attempted this question by calculus and, as a consequence, earned no marks here.

Part (e) proved to be quite challenging for the majority of candidates and many seem to simply draw the line $y=-4$ earning no marks at all. The better candidates were able to form the correct equation of $y=\frac{x}{4}-1$ and draw the correct line. Such candidates invariably scored all four marks here.

Failure in part (e) usually meant that a candidate had little or no success in part (f). Some did manage to rearrange to obtain -6, and many then went on to write $y=-6$. Final statements were often confused, but sometimes with enough clarity to be convincing and earned the final mark. A minority of candidates attempted to plot the function $y=\frac{x^3}{6}+\frac{5}{x^2}-2$ but either made mistakes or simply did not seem to know how to interpret their resultant graph.

Just over 80% of candidates scored at least 5 marks on this question but only 6% achieved full marks.

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