Examiners' Report/
Principal Examiner Feedback

January 2012

International GCSE
Mathematics B (4MB0)
Paper 01

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Introduction

There seemed to be a large number of questions not attempted by a significant number of candidates on this paper. The evidence suggests that this was more to do with candidate's inability to tackle a question rather than running out of time on the paper. Some questions proved to be quite challenging to a many 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 candidates' attention on the following topics:

- Statistics: mean, median and mode
- Equating coefficients of non-parallel vectors
- Algebra: factorisation of the difference of two squares
- Geometry: triangles
- Map scales: lengths and areas
- Mensuration: surface area
- Ratios: lengths, surface areas and volumes of similar solids
- Algebra: the difference between an expression and an equation
- Constructions: locus and using rulers, compasses and protractors
- Coordinate geometry: extension to areas

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 (such as the vector cross product for the area of a triangle) and, where used correctly, the corresponding marks are given.

Report on individual questions

Question 1

The concept of giving a fraction to a required number of decimal places (B1) proved to be more difficult for candidates to process than giving the same fraction as a percentage (B1). As a consequence, a third of candidates did better on part (b) than on part (a).

Question 2

The majority of candidates wrote down the correct formula, $\frac{40}{360}\times\pi\times 9^2$ (M1), for the required area and subsequently earned the second mark provided their answer rounded to the required answer of 28.3 cm^2 (A1). A minority of candidates incorrectly used the formula for the circumference of the circle and 6.28 proved to be a popular, but incorrect answer.

Question 3

Whilst the majority of candidates recognised that to find the size of the exterior angle of a regular polygon they needed to divide 360 by the number of sides (M1), a number of candidates evaluated 1800/12 to find the **interior** angle but then simply stopped. Such candidates gained no marks at all. Indeed, 150° seemed as popular an answer as the correct answer of 30° (A1).

Question 4

There were many excellent responses to factorising the trinomial quadratic with many correct answers of $(3x-4)(x+11)$ seen (M1)(A1). Some candidates however, got to this stage but then lost the final mark as they went on to solve a quadratic equation. A significant minority of candidates simply correctly quoted the quadratic formula, gave two answers of 1.33 and -11 but earned no marks at all.

Question 5

This question was not done well at all. Many candidates seemed to be confused between the unknowns x and y and the vectors **p** and **q** and many incorrect statements for x and y involved **p** and **q**. It was rare indeed to see $x=-3$ (B1) and $y=\frac{3}{2}$ (B1).

Question 6

Many differentiated the first term correctly earning the method mark (M1). However, the differentiation of the second term proved to be more problematic with many sign slips and incorrect index figures seen; notably $-\frac{2}{x^2}$ and +2 were commonly seen as incorrect attempts at differentiating this second term. As a consequence, the required answer of $6x+\frac{2}{x^2}$ (A1) was not seen as often as one would have liked.

Question 7

In part (a) there seemed to be much confusion between the mean and median. As a result a popular, but incorrect, answer of $\frac{67}{14} = 4.79$ was seen. Indeed, of those candidates who realised that the median involved the concept of the middle item, some erroneously wrote down, 7 and 6 or 6.5 as a result of finding the middle of the stated list. Realising that the list needed to be put into ascending (or descending) order (M1) enabled candidates to arrive at the required answer of 5 (A1). However, some candidates who had ordered the data were unable to finish the task and simply wrote down 4 and 6. Presumably these candidates, unable to see an actual middle term, interpreted the median as the two data items on either side of the middle of the set of data.

In part (b), the answer of 6 (B1) proved to be very popular.

Question 8

A well answered question with many gaining full marks. The majority of candidates correctly manipulated to make $\cos\theta$ the subject (M1) and correctly substituted in two numerical values for tan 40° and sin 30° and subtracted (M1 dep). Whilst this second method mark was earned for a numerical value of 0.34 or better, the final mark was lost if the candidate simply used $\cos^{-1}$ (0.34) = 70.1°. Indeed, some candidates left their answer at the stage $\cos\theta$ = 0.34, perhaps uncertain what to do next. Centres should stress to candidates the need to work to a degree of accuracy which is at least to the level required by the question. In this instance $\cos\theta$ = 0.339 would have given the required answer of 70.2°(A1).

Question 9

A wide variety of responses were seen in this question. Only very good candidates achieved the required answer of 65.7% or in some cases 65.6% due to rounding. Many achieved at least the first mark for the appearance of 2.8 or $(0.7)^3$ (M1) but then did not seem to understand what was then required. Indeed, many wrote incorrectly $\frac{2.8}{4^3} \times 100$ or $\frac{2.8}{4} \times 100$ or $\frac{1.2}{4} \times 100$ = 30%. It was not uncommon to also see 64 – 2.8^3 = 42.05 or 30% of 64 = 19.2 followed by 64 – 19.2 = 44.8 then $\frac{44.8}{64} \times 100$ = 70%. A correct statement of the form $\begin{pmatrix} -9 & 7 \\ -10 & 0 \end{pmatrix} \frac{4^3 - 2.8^3}{4^3} \times 100$ (M1 dep) was seen on very few scripts indeed but the correct answer of 65.7% (A1) invariably followed. Weaker candidates did not attempt this question.

Question 10

Far more students correctly factorised $3x^2 - 9x$ (M1) than correctly factorised the denominator, $x^2 - 9$ (M1) suggesting that centres need to spend more time on the topic of factorising the difference of two squares. Further poor cancellation led fewer than expected to the required answer of $\frac{3x}{x+3}$ (A1).

Question 11

In part (a), the strict inequality of $x > 4$ proved to be problematic for some candidates with many answers of the form 4, 5, 6, 7, 8, 9, 10 seen rather than the required answer of 5, 6, 7, 8, 9, 10 (B2). One mark was lost by these candidates. In part (b), a significant number of candidates did not seem to be familiar with the terminology for the number of elements in a set and simply wrote down the elements 1, 2, 3 and 4. Others confused the meaning of A' with $x > 4$ and wrote down 5, 6, 7, 8, 9, 10 or simply the numerical value of 6. As a consequence, very few correct answers of 4 (B1) were seen.

Question 12

A large majority did not use the **ratio of the cubes** of the sides and instead ended up with the incorrect answer of 63.3cm^3. These candidates earned no marks at all. Those that did use the cubes of the lengths (B1) sometimes had them upside down resulting in $\frac{27}{125} \times 38 = 8.21$ instead of the correct $\frac{125}{27} \times 38$ = 176cm^3 (M1, A1). Some candidates seemed to be totally confused with the concept and used either $\sqrt[3]{\frac{3}{5}}$ or even $\left(\frac{3}{5}\right)^2$.The ability to work with similar figures and solids often seems to cause candidates some difficulty in understanding and is therefore a topic which needs to be reinforced by centres.

Question 13

Many candidates made good attempts at this question on surds and produced worthy solutions but some over relied on their calculator. Common errors were $\sqrt{125}$ + $\sqrt{80}$ becoming $\sqrt{205}$ or believing that $\sqrt{125}$ = $25\sqrt{5}$. Many tried to 'take the easy way out' and converted the given roots to decimals, thus forfeiting the marks. $5\sqrt{5}$ (B1) + $4\sqrt{5}$ (B1) = $9\sqrt{5}$ (B1) was seen on many scripts where surds were understood. The required answer was 9 (A1) and this mark was lost if the answer was left as $9\sqrt{5}$

Question 14

Despite this topic being regularly tested at this level over the years, many candidates interpreted the statement *y varies as the cube of x* incorrectly and there were many initial incorrect statements of the form $y = kx^3$ or $y = kx$ or $y = \frac{k}{x}$ instead of the correct statement of $y = \frac{k}{x^3}$. As a consequence, not as many candidates as was expected found the correct value, 80, of the constant (M1, A1). For those who did get as far as the value of the constant, a significant number wrote down a correct expression for the value of x to be found (M1 dep) only to lose the final mark from an incorrectly found constant or simply writing $\sqrt[3]{64} = 8$ instead of the required answer of 4 (A1). A common wrong answer seen was $x = 1$ from a value of k found to be 10/8 instead of 10×8.

Question 15

In part (a), many correct matrix solutions, $\begin{pmatrix} 17 & -7 \\ 9 & 8 \end{pmatrix}$ (B2) were seen. However, the incorrect answer of $\begin{pmatrix} 1 & 1 \\ -3 & 4 \end{pmatrix}$ proved to be very popular. Candidates simply added rather than subtracted their multiples of **A** and **B**. except for arithmetical slips, part (b) was done well with many correct solutions of the form $\begin{pmatrix} -9 & 7 \\ -10 & 0 \end{pmatrix}$ (B2), seen.

Question 16

A significant number of candidates seem not to understand the usual three letter notation for an angle ($\angle ABO$ meaning an angle measured **at *B***, with the arms of the angle being *BA* and *BO*). This was evident from many candidates' diagrams since the angle 34° was marked either at *A* or at *O* and the angle 30° was marked either at *C* or *O*.

In addition, many candidates made up inappropriate reasons which were not relevant or correct for this question to find other angles. Use of parallel lines and alternate angles was all too common. Some circle theorem facts were also seen such as same segment or opposite angles of a cyclic quadrilateral.

Since all that was needed in this question was base angles of an isosceles triangle being equal, angle sum of a triangle being 180° and adjacent angles on a straight line being supplementary or vertically opposite angles equal, it was surprising that more candidates did not get this question fully correct. As a consequence, fewer than expected correctly identified a correct 58° angle in triangle *BAC* (B1), a correct angle at *O* (B1), a correctly deduced base angle of the triangle *OAD* (B1) and the subsequent required angle of 102° (B1).

Question 17

There was limited success in this question with much wrong working seen. In part (a), correctly interpreting how to use the scale of a map to find the actual length of a road proved problematic with common errors seen such as $\frac{400000}{30000}$ = 1.33 or dividing 30 000 × 4 by the wrong power of 10. A completely correct method was required (M1) leading to the required answer of 1.2 km (A1).
Part (b) was also poorly answered. Candidates invariably forgot to square the given ratio and 3600 and 360 were common incorrect answers. Better candidates were able to write down $\left(\frac{100000}{30000}\right)^2 \times 1.08$ (M1) to give the required answer of 12 cm^2 (A1).

Question 18

In part (a), many candidates associated the *4 times* with *x* and gained one mark for writing down $4x$ (B1). The majority of candidates then lost their way in what to do next and very few correct answers of the form $4x + 18$ (B1) were seen. Many candidates seem to feel that an equation was required in part (a) and $4x = 18$ was a common, but incorrect, statement. Where an expression was given, $4x$ was invariably embedded incorrectly and $72x$ and $5x + 18$ were common, but incorrect, expressions. The evidence of responses suggests that centres need to reinforce the difference between an *expression* and an *equation*. The lack of correct responses to part (a) meant that either part (b) was poorly attempted or not attempted at all. The majority of candidates who did get the correct expression in part (a) invariably formed the correct equation, $2(x+18)=4x+18$ (M1), in part (b) to arrive at the required answer of $x = 9$ (A1).

Overall, a very challenging question with the majority of candidates not scoring more than one mark in total.

Question 19

Overall, the majority of candidates correctly wrote down $8-15x$ (B1) for part (a). Some candidates would have got the mark but they failed to simplify leaving their answer as $9-15x-1$. A minority of candidates still seem to have the mistaken belief that $fg(x) = f(x)g(x)$.

Part (b) was reasonably well attempted with many candidates correctly rearranging a linear equation in *x* and *y* (M1). An arithmetical slip, (quite commonly seen), was allowed for method and so not as many who knew what they were doing wrote down the correct statement, $x \mapsto \frac{8-x}{15}$ (A1). Indeed, a frequently seen incorrect solution either had a numerator of $x-8$ or $x+8$.

Candidates scored well in part (c) and $\frac{1}{3}$ (B1) was frequently seen. A minority of candidates seemed to think however that $fg(x) = 3$ was the same as fg(3) and, as a result, -37 was a popular, but incorrect, answer.

Question 20

The most challenging question on the paper with very few candidates scoring full marks. Indeed, it was rare to see a response which earned more than two marks. Writing down 96 (M1), the area of the six faces of the cube, was as far as many candidates progressed. Whilst some candidates worked with volumes and earned no marks at all, others were able to at least realise that the area of a circle or the surface area of a hemisphere was required and either $\pi \times (1.5)^2$ or $\frac{1}{2} \times 4\pi x (1.5)^2$ was seen (M1). Putting together all of the necessary elements (M1 dep) , however, proved to be too much for all but a few very able candidates and the required answer of 103 m^2 (A1) was rarely seen.

Question 21

Despite the fact that 5 out of 9 of the second stage probabilities were given on the tree, all with denominators of 13, many candidates failed to get the four required entries in part (a) correct (B1, B1). Mostly, the idea of non-replacement seems to have caused some misunderstanding and incorrect denominators of 14 were frequently seen.

In part (b) there were many correct answers of $\frac{3}{14} \times \frac{2}{13} = \frac{3}{91}$ (M1, A1) seen. However, the most common incorrect error was believing the required probability was $\frac{3}{14} + \frac{2}{13} = \frac{67}{182}$.

Question 22

There were many fully correct solutions to the simultaneous equations. Confident students used either the method of balancing equations (M1) and then eliminating (M1) or rearranging one equation and then substituting. Those who used the method of elimination were often more successful than those who used substitution (the latter often resulting in either a sign slip or forgetting to multiply throughout correctly). Work was well set out and the required answers of $\frac{7}{8}$(A1) and $-\frac{5}{8}$(A1) were frequently seen. Unusually, there were a significant number of candidates who wrote the answers the wrong way round on the answer lines. However, full marks were given if the correct answers were seen in the body of the script. Some weaker candidates tried to equate $3x + y = 2x - 2y$.

Question 23

Part (a) was well answered with many scripts showing the correct working $\frac{5}{30} \times 360$ (M1) followed by the required answer of 60° (A1).

Constructing the pie chart from the given data in part (b) proved to be more challenging. A significant number of scripts were blank suggesting that the candidate either had no protractor or no experience of drawing a pie chart. Consequently, a well-drawn pie chart for full marks was not seen as often as one would have expected. Some candidates seemed to have difficulty in using a protractor accurately and whereas one accurately drawn sector earned a mark (B1), full marks proved elusive to these candidates.

Question 24

Whilst here were a significant number of correct answers from able candidates, the majority of weaker candidates either did not tackle the question at all (perhaps lacking the required drawing implements) or were confused between *the locus of points which are equidistant from two lines* and *the locus of points equidistant from two points*. As a consequence, a lot of marks were lost by these weaker candidates. This is perhaps a topic that centres would be well advised to focus on with their weaker candidates as the number of different constructions that can be tested is limited and the marks available, if achieved, would make a significant difference to the total marks available to a candidate. As it was, able candidates often showed the correct bisector of angle *BCA* (M1, A1) and were able to draw an arc of a circle of radius 5 cm, centre *A* (M1, A1). Interpreting the required area in part (c) (B1), proved challenging; as many shaded the correct region as shaded the region which was **more** than 5 cm from *A*.

Question 25

Again, a very challenging question for candidates. Few seemed to know where to start and it was only the ablest who correctly identified, using the tan function (M1), the angle 26.6° (A1) in part (a). Drawing a simple diagram would have helped some candidates in part (b), as few candidates managed to identify at least one area that would have helped to find the required area (M1). Although complete and correct solutions for part (b) were quite rare, some methods (notably vector cross product) went beyond the scheme. Such methods earned comparable method and accuracy marks where appropriate. A common incorrect method was to believe that the required area was $\frac{1}{2}\times 3\times 3\times \sin 45°$.

Question 26

The majority of candidates drew one straight line to represent part of the journey correctly on the graph (B1). Unfortunately, the second mark (B1) proved to be more elusive. The primary cause of this seemed to be the incorrect interpretation of *the car then travels at this speed for 20 seconds* as a significant number seemed to think that this meant that the car started to slow down from the point (20, 25).

In part (b) as many candidates correctly interpreted what is meant by acceleration as correctly interpreted what is meant by the rate of slowing down. Curiously however, not many candidates wrote down **both** correct answers of (i) 5 m/s^2 (B1) (ii) (-)2.5 m/s^2 (B1). As a consequence, the mean mark across all candidates for this part of the question was less than 1.

Part (c) was poorly answered with 875 m a very popular incorrect answer from 25×35. Very few candidates seemed to have appreciated that the area under the curve represented the distance travelled. Where method was earned, either through a correctly substituted area of a trapezium formula or writing down two correct triangular areas and one correct rectangular area (M1), the final mark was very often lost through poor arithmetic and 687.5 m (A1) proved to be seen on only a minority of scripts.

Question 27

In part (a), for those candidates who recognised that the cosine rule was required in part (a) generally managed the first mark (M1) for a correctly substituted cosine formula. However, as the answer was given, a further step was required before full marks could be given. Simply quoting a correctly substituted formula followed by AC = 4.77 was only sufficient for one mark. A further interim statement would have enabled many more candidates to earn all three marks here.

Of those candidates who used the cosine rule in part (a) many seemed to correctly use the sine rule in part (b) (M1, M1) and arrive at the required answer of 35.7° (A1). Using the cosine rule again did not seem to impede many candidates arriving at the answer.

What was a concern though was the significant number of candidates who do not know how to interpret the three letter notation for an angle. On a significant number of scripts, 68° appeared as $\angle BAD$ in some working and on some diagrams. In part (b), $\angle BCA$ was required, but some candidates found $\angle BAC$ (76.3°) instead. There was a similar issue to this in question 16. Centres need to focus on correct understanding of angle notation to improve the performance of their candidates.

In part (c) candidates were able to recover from an incorrect answer to part (b) by stating a a correct trigonometrical equation to find *CD* (M1). Although a correct answer of 4.06 cm (A1 ft) was required, answers were allowed which followed through from an incorrect answer to part (b).

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