Examiners' Report/ Principal Examiner Feedback

Summer 2010

GCE O Level

Mathematics Syllabus B (7361/02) Paper 2

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Mathematics Syllabus B
Specification 7361

Paper 2

Introduction

There was no evidence to suggest that candidates ran out of time in attempting to complete this paper. Indeed the responses seen reflect how well candidates are prepared particularly in algebraic techniques and trigonometry. There is still work to be done with candidates where the responses are clearly wrong but there are ways within the question of re-checking previous work and starting again.

This was particularly noticeable in Q3 (where a probability greater than one indicates an error), Q8(e) (where an incorrect sign in the quadratic equation would suggest a previous wrong statement), Q10 (where an incorrect triangle D should indicate some errors in previous working).

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 xxx'.

Report on Individual Questions

Question 1

Many correct attempts were seen to both parts of this question as candidates were familiar with the required methods. As a consequence, many answers of £ 0.72 (B1) were seen in part (a) and 3.25 kg (M1, A1) invariably followed in part (b).

Question 2

The majority of candidates successfully expanded the brackets (M1) before attempting to differentiate (M1 dep). As a consequence, many correct expressions of $13 - 10x$ (A1) followed by the required answer of 33 (A1 ft) were seen. A single sign slip in the first line was only penalised once in the question allowing such candidates a maximum of 3 marks. However, candidates who gave an incorrect first line which involved more than a sign slip lost all marks. Fortunately, this did not happen often.

Some candidates showed strong algebraic abilities by using the product rule to differentiate from the start. The vast majority of these candidates achieved full marks by arriving at the required answer.

Question 3

Part (a) was well answered with many candidates writing down $\frac{3}{4} \times \frac{4}{5} \times \frac{5}{8}$ (M1) to arrive at the required answer of $\frac{3}{8}$ (A1). Some attempts to add, however, were seen.

Many problems were created by a misunderstanding of the requirements of part (b). On many scripts, at least two was interpreted as writing down **pairs** (instead of triplets) of probabilities. This invariably produced an answer greater than one which should have led candidates to suspect their method was wrong. Only a minority of candidates wrote down at least two of the required triplets (M1) and added them together and a significant number of answers of the form $\frac{71}{160}$ were seen. Unfortunately, this led to no further marks unless their answer to part (a) was added (M1 dep) to arrive at the required answer of $\frac{131}{160}$ (A1). The complement method was allowed as a correct alternative method.

Question 4

Many correct answers of £ 2.25 (M1, A1) were seen in part (a).

In part (b), although the cost of labour = £ 6.00 (B1 ft) was readily determined and this became the denominator of required percentage, there was some confusion with the understanding of 'the cost of materials rises by $33\frac{1}{3}\%$' and many values, other than the required value of 0.75 (M1), were generated. As a consequence, fewer than expected produced the required answer of 12.5% (M1, A1). Common errors were $\frac{5.25}{6} \times 100$ leading to 87.5%, $\frac{3}{6} \times 100$ leading to 50% and a denominator of 8.25 rather than 6.

Question 5

Many correct uses of the intersecting chords theorem were seen in part (a) leading to the required answer of $2\frac{2}{3}$ (M1, A1).

Part (b) proved, however, to be very elusive except to the most able of candidates. Many tried a variety of incorrect methods which required the calculation of angles *PXD* and *PDX*. Candidates who recognised that they needed to use the tangent-secant theorem either generated the correct quadratic equation (M1, A1) to show that *PA* = 8 cm (M1, A1) and hence that the triangle is isosceles or they assumed that PA = 8 cm and used this value in a tangent-secant formula (M1, A1, M1). This second method however required the candidate to state an original hypothesis of the form: If *PXD* is isosceles, then *PX* = *PD* (A1) and to provide a conclusion of the form *PX* = *PD* or *PXD* is isosceles (A1).

Question 6

Except for the occasional arithmetical slip, many candidates used the correct method to arrive at the gradient of -1/2 (M1, A1) in part (a). This value was then invariably used correctly in part (b) to arrive at an equation of the form $y = -1/2x + 1$ (or equivalent) (M1, A1). The most common error seemed to be giving a gradient of ½.

Part (c) saw many fully correct answers (B4), however a significant number of candidates placed all signs the wrong way round or were confused by the lettering. Strict inequalities were awarded marks where the inequalities were correct.

Question 7

Using the symmetry of the trapezium proved to be a step too far for some candidates in part (a) and either the part was left blank or there were many statements of the required answer following much incorrect working. Indeed, some candidates went as far as to state that the square root of 8.32 was 2. For the successful candidates a Pythagoras method (M1) was expected following 1.2 seen (B1) and then drawing the required conclusion (A1). A variety of alternative methods were seen which included much trigonometrical work arriving at the required solution. It would be helpful if centres reinforced the ‘rule of thumb’ that the number of lines of working should roughly correspond to the number of marks available.

Part (b) was generally well done with many candidates finding at least four correct surface areas (M1). Some candidates however fell short of any more marks because they either found only five surface areas or, as was commonly seen, identified too many identical rectangles. 4 x 8 x 2 = 64 cm^2 was a common error which was then added to two correctly determined trapezium areas. Six correct areas added (M1 dep) invariably led to the required answer of 108.8 cm^2.

In part (c) a lot of good working and correct answers of 51.2 cm^3 (M1, A1) were seen however, a significant minority of candidates seemed to be confused and simply multiplied their answer to part (b) by 8 thus earning no marks for this part of the question.

Only the more able candidates seemed to know what to do with this part and, as a consequence, the scoring was low. A reasonable number realised that they needed to do something with the number 20 (M1) but few progressed further to divide their answer to part (c) by 20 x 0.8 (M1) to arrive at the required answer of 3.2 cm (A1). Indeed many, realising that a volume was being used to find a length, erroneously took square or cube roots of values previously found.

Question 8

Candidates who understood that the mean time to process a passport was time divided by the number of persons processed during that time fared well in this question. Too many candidates however either got the algebraic fractions the wrong way round or simply multiplied each expression in *x* by 60. Such candidates lost at least 7 marks on this question. As a consequence, not as many correct statements, $\frac{60}{x}$ (B1) and $\frac{60}{x+120}$ (B1) were seen in parts (a) and (b). However, part (c) was well done and many correct answers of 9/20 (B1) were seen even though incorrect statements had been made in the previous two parts of the question.

Many candidates recognized that a difference (M1) was required in part (d) but a correct equation (A1) proved elusive to many following previously incorrect work. In part (e), where candidates had previously given an equation involving denominators in *x*, removing these denominators correctly (M1) was the first step. Indeed much correct algebra was seen here as successful candidates reduced a correctly obtained quadratic equation, $9x^2 + 1080x - 144\,000 = 0$ (A1ft) to the required conclusion (A1). However, some candidates who had the difference of two correct algebraic fractions the wrong way round in part (d), curiously reached the correct conclusion in part (e). Many of the candidates who did this, and lost marks as a consequence, should have realised that there was something wrong with their working and re-tracing their steps to part (d) would have resulted in gaining marks rather than losing them.

Irrespective of previous working, many candidates successfully attempted part (f) and determined that the only possible solution was $x = 80$ (M1, A1, A1). Indeed, in the case of some candidates, this was the only part of the question attempted. Substituting their answer to part (f) into their answer to part (b) earned method (M1) for the final part of the question. Many, however, either as a consequence of an incorrect part (b) or failing to convert to seconds, did not arrive at the required answer of 18 seconds (A1).

Question 9

Candidates are well drilled in trigonometrical methods and many good attempts were seen in this question. Indeed, although not on the syllabus, many correct uses of the sine and cosine rule were seen and marks were awarded accordingly. Parts (a) and (b) were generally well done with many candidates arriving at the required answers of 12 cm (M1, A1) and 28.1° (M1, A1). Some candidates made more work for themselves in part (a) by using trionometrical methods twice by finding an angle first and then the required side. Again, the ‘rule of thumb’ is that generally, one mark is awarded for one statement. So, a two mark question should require only two lines of working.

Part (c) proved to be difficult and, in some cases, no working was offered as candidates were unable to see that the side *CB* is common to both triangle *BEC* **AND** triangle *OBN* (where *N* is on *OC* and *NB* is parallel to *CE*).

Using $ON = 12 - 5 = 7$ (M1) was an essential first step in arriving at the required result and candidates who recognised this, invariably used Pythagoras correctly (M1) in order to show *CE* = 9.75 cm (A1). A noticeable number of candidates assumed that *CE* = 9.75 cm and used this to find *CB* = 10.95 cm. They then used this value to show *CE* = 9.75 cm. Such circular arguments earned no marks at all.

Incorrect, incomplete or no method shown at all for part (c) did not stop many candidates getting full marks for part (d). In some cases much trigonometrical working was shown (M1) to arrive successfully at the required answer of 54.3° (A1). Unfortunately, the more working that was shown, the more likely rounding errors would appear and some very able candidates lost the final mark due to accuracy here.

A lot of candidates showed good method for part (e) as many correct trigonometrical methods were used to find angle *OBD* = 15.9° (M1, A1). Adding this value to the answer previously found in part (b), (M1 dep) saw many correct answers of 44.0° (A1). Although 44° is not to the required degree of accuracy, this answer was not penalised.

Question 10

This question tested the ability of many candidates and, although there were a number of follow through marks, many marks were lost through incorrectly plotted points. Candidates should be made aware that, when there is an extended question of this type, the demand for a single transformation (as in part (f)), should indicate that there is a simple transformation (reflection, rotation, enlargement, translation) from one diagram to the other.

On many scripts, the candidate's triangle D could not be transformed onto triangle A using a simple single transformation. Candidates who find themselves in this situation would be best advised to recheck previously drawn diagrams.

Part (a) (B1) was invariably drawn correctly and there were many good attempts at (b) (B3). Some candidates, however, made a fundamental error by trying to work the coordinates of triangle B using matrix products. Such candidates should be advised that this only works where the centre of the enlargement is the origin. Despite an incorrect triangle B, many were able to produce triangle C (B2 ft) from this triangle. Some triangle Cs seen were as a result of a reflection rather than a rotation. Although many scripts showed the correct line drawn of $y = x$ (B1) for part (d), there were still a significant number of scripts which had the line $y = -x$ drawn.

Part (e) was better attempted than parts (b) and (c) and many triangle Ds followed (B3 ft) correctly from the candidates correct (or incorrect) triangle C. Indeed, the use of matrices was fine here and much good work was seen. In part (f), a correct placement of triangle D was a requirement for any marks and only a few able candidates were able to give the required answer of a reflection (M1) in the *x* axis (A1). Much matrix work was seen in part (g) for the two marks (B2) available. Candidates at this level are expected to know the standard reflection and rotation matrices.

Question 11

In part (a) (i), most candidates knew that they needed to evaluate f(3) (M1) but many simply left the answer of zero rather than concluding that $(x - 3)$ is a factor (M1 dep). Part (a) (ii) was generally well done with many candidates correctly showing a division method (M1) to arrive at the quadratic $2x^2 + x - 1$ (A1). This, in turn, was factorised well (M1) and many correct answers of the form $(x - 3)(2x - 1)(x + 1)$ (A1) were seen. Parts (c) and (d) were generally well done with correct values of -3, -7 and -15.5 (B3) in the table and a correctly drawn graph (B3). The most common error with the graph was plotting the point (0, -0.5) rather than the required point of (0, 0.5). Candidates were able to show how well drilled they are in algebraic manipulation and much correct working (M1, A1) was seen in part (d). A significant number of candidates however slipped up on the final part of the question as the demand was to write down the exact values of *x* and not necessarily the ones from their graph. The values of 3 and -1 (B1) were straightforward but the third value of 0.5 (B1) proved to be more elusive as many values were given from the candidates' graphs. A frequently seen incorrect answer was 0.3.

Statistics

Overall Subject Grade Boundaries

Grade	Max. Mark	A	B	C	D	E	U
Overall subject grade boundaries	100	82	64	46	41	28	0

Paper 1

Grade	Max. Mark	A	B	C	D	E	U
Paper 1 grade boundaries	100	86	68	51	41	31	0

Paper 2

Grade	Max. Mark	A	B	C	D	E	U
Paper 2 grade boundaries	100	80	62	44	35	26	0

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