Examiners' Report/
Principal Examiner Feedback

Summer 2014

Pearson Edexcel International GCSE
Further Pure Mathematics (4PM0/01)

Paper 1

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications are awarded by Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk. Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

Summer 2014
Publications Code UG038860

Principal Examiner's Report
International GCSE Further Pure Mathematics
(Paper 4PM0-01)

Report on Individual Questions

Question 1
Part (a)

Many found this a challenging start to the paper. Most labelled the 3 on the *y*-axis but many failed to label the 7 correctly with some lines not meeting the *y*- axis at all, thereby losing the mark, as the demand was clearly stated in the question.

Part (b)

Quite a few labelled the correct region, but of those who did not, the common error was to shade the triangle between y=3 $y=3$ and $y=7$ as the required region, and some labelled a triangle from $x=-3$ to $x=3.5$.

Part(c)

This part was answered correctly only by a minority of students, most of the remainder did not seem to understand the demand of the question. The minimal correct response was 2 ≤ 5 and 6 ≤ 7 and 'Yes', with one common error being to substitute for the x value of 2 correctly but not the *y* value. Another common error was to find the point of intersection of the two lines.

Question 2

Part (a)

Many students initially attempted this part of the question correctly, however there were a few who incorrectly divided by 2 first. A large number did not even attempt to find the second solution and thereby lost the final answer mark. Some students continue to fail to read rounding directions, and thus lost a mark following correct work.

Part (b)

Although a good number of students answered this part well, a significant proportion of students did not attempt to for a 3TQ and just set each of the brackets to – 2. Most students who rearranged successfully to find the 3TQ completed the question successfully finding both roots. A small number of students seemed to find $\cos\theta = -\frac{5}{6}$ difficult to deal with and they did not change it into the correct angle. It was fortuitous that an angle of 180º was not penalised, because angles were required in the region $0 \le \theta < 180^{\circ}$, and therefore it was out of range, but a very large majority of students left this angle as part of their solution.

Question 3

Part (a)

Most students managed to find the derivative correctly but there was some inventive working as the answer was given. Most made *y* the subject of the formula and then used the quotient rule with most common error being to put the two terms in the numerator in the wrong order.

Part (b)

A few used their incorrect answer to part (a) to do part (b) despite it being a given answer. There seemed to be some problems with the arithmetic and an answer of $\frac{2}{9}$ was commonly seen.

Part (c)

Most knew what to do here, using their value of $\frac{\mathrm{d}y}{\mathrm{d}x}$ with $y - y_1 = \frac{\mathrm{d}y}{\mathrm{d}x}(x - x_1)$ to achieve the method mark, but many students failed to read the question carefully with far too many forgetting to give the equation with integer coefficients. A few found the equation of the normal. Students should be reminded to read the demands of the question carefully to avoid needlessly losing marks.

Question 4
This was a very well attempted question on the paper.

Parts (a) and (b)
These was very well answered with the vast majority of students achieving –6 for the common difference and 120 for the first term.

Part (c)
Virtually every student used the correct summation formula for an arithmetic series to achieve the final answer.

Part (d)
Virtually every student set the given expression for S_n = 1200, and nearly all found the correct 3TQ leading to both correct values of 16 and 25. It is inevitable that quite a few students use a graphical calculator to solve quadratic equations, but centres should advise students that if they do use graphic calculators, they must give both roots, otherwise no credit can be given for method.

Question 5
Most stated that $\frac{\mathrm{d}V}{\mathrm{d}t}$ = 72, and a common error was to not eliminate h from the formula of the volume of a cone leading to $\frac{\mathrm{d}V}{\mathrm{d}r}=\frac{2\pi rh}{3}$. The vast majority of those who rearranged to get a formula just in terms of r were more successful than the minority of students who rearranged to get a formula in terms of h because of the added complication of the extra term required in the chain rule. Some substituted h = 12 rather than h = $4r$ before they differentiated. A few left their answer as $\frac{2}{\pi}$ rather than evaluating it. A few used the chain rule correctly but then rearranged it to $72\times4\pi\times9$, and thus the incorrect answer. Overall, this question was not well answered, showing that candidates generally find this topic demanding.

Question 6

Part (a)

This question is a good example of where students must quote a formula before they use it. There were quite a few cases where students did not quote the formula and then wrote, for example, $4x^4$ instead of $(4x^2)^2$. The presence of a correct formula would have at least allowed credit for some correct substitution. Some that did quote it correctly and then subsequently substituted in correct values, were not immune to errors in calculating the coefficients.

Part (b)

This was generally not understood with only a few correct statements of validity. Most students were confused, and were unable to deal with $4x^2$. Some students tried to find $\sqrt{-1}$ and then give up on the rest of their attempt.

Part (c)

Many students understood that they were required to multiply their expansion in part (a) by $(1+kx)$. Some students attempted to complete a binomial expansion on $(1+kx)$, and some attempted a fairly tortuous division. It is worth noting that a number of students who arrived at the correct solution then attempted to put their terms into ascending powers of x, which too many times resulted in them missing out a term in their re-ordered equation. Although they did not lose any marks for this error as examiners were able to 'isw' the second expansion those students then went on to make errors in the final part of the question.

Part (d)

On the whole, students who were able to get this far on this question answered it correctly. A minority of students left their x terms in their equation losing them all the marks for this part.

<u>Question 7</u>

Parts (a), (b) and (c)

Virtually every student scored the first 6 marks in this question. Most knew to differentiate displacement in part (a) and their velocity in part (b). In part (c) just a few multiplied the velocity by t to give the distance. Many students lost the B mark in part (c) because they either forgot to include the *c,* the constant of integration, or included it but did not use the given information to establish that it was in fact = 0 anyway.

Part (d)

Some equated the wrong expressions in part (d), $-10+t^2=8-10t+\frac{1}{3}t^3$ being the most common erroneous equation. Virtually every student who equated the two cubic expressions went on to solve the quadratic equation correctly. Once again, students need to use graphical calculators with caution, as there were two roots to this 3TQ, and giving just one slightly erroneous value lost all method marks, as there was no method to assess. Some students gave both values of t as a final answer thus losing the final accuracy mark.

Question 8

This was another topic found challenging by the majority of students.

Part (a)
This part was generally answered successfully with the vast majority of students knowing that sum of roots = $-\frac{b}{a}$ and the product of roots $=\frac{c}{a}$. There were a few errors in signs but since credit was given for an unsimplified $\alpha^2+\beta^2$, few students lost marks, although they paid the price for being unable to deal with these negatives in parts (b) and (c).

Part (b)
In this part it was evident some students simply did not know what to do. Many could not eliminate *α* or *β* and had *p*'s appearing in their equations, leading to numerous errors in working, especially when students did not take the most direct route to solve their equation. Those few students who were successful found either *α* or *β* using the first method in the mark scheme. A very limited number of students attempted the alternative method using the quadratic formula, but this was rarely a successful option.

Part (c)
Many students were able to identify the correct sum and product of roots using their values of *p* and their $\alpha^2+\beta^2$ from part (a). Students who correctly found the 2 values of *p* in part (b) generally went on to achieve the correct expression, although a limited number forgot the need for an equation by omitting = 0.

Question 9

Part (a)

Students generally found this part harder than parts (b) and (c). Many who used the ratio formula stopped at $4p = 3q$ not realising that they had in fact virtually arrived at the correct solution, or they quoted the formula incorrectly. The two most successful methods were to use Pythagoras' Theorem and use $AD = 3\sqrt{5}$ and $DB = 4\sqrt{5}$, or to use similar triangles (the simplest method) and arrive at the required ratio simply by comparing y values.

Part (b)

Those students who gained full marks in this section (and the rest of the question) invariably drew a clear correct diagram. Virtually every student found a correct gradient of $-\frac{1}{2}$ and inverted it correctly to give the gradient of the normal of 2. Some students used the point (2 , 5) rather than (8 , 8) but on the whole there were many correct equations of the straight line.

Parts (c) and (d)

In nearly every case, those who got part (b) correct achieved a correct value for e of 9, and at least one correct co-ordinate in part (d). Those who got part (c) incorrect could however, follow through for one mark in part (d). Some tried to use Pythagoras' Theorem to set up equations to find the coordinates of F but they were rarely able to solve them.

Part (e)

Many worked out correct lengths in part (e) with a common error being to forget about the $\frac{1}{2}$ in the formula so that 70 was a common answer. Those who used their coordinates in determinant (cross product) method were usually more successful than those who used Pythagoras' Theorem as they did not have to manipulate the surds.

Question 10

Part (a)
It was surprising to note how many students did not know the formula for the volume of a pyramid. Some used $\frac{1}{2}$ instead of $\frac{1}{3}$, and there were many $V = \frac{1}{3}\pi r^2 h$ (given with a final answer of *h* = 9)! It is worth noting that a number of students did not read the question correctly and did not appreciate that 9 cm is the height only of the pyramid. Many mistakenly took the total height of the shape to be 9 cm and as such misunderstood the height of the pyramid to be 6 and used this in all subsequent workings after part (a). Quite a few students found the surface area of the cuboid to equate to their volume of the pyramid.

Part (b) and (c)
Most students were able to use Pythagoras Theorem correctly find the length of the diagonal *EC* and go onto subsequently find the length *EA*. Most students were also able to find the correct value of 7.07 cm for the length of the diagonal EH. Some left the answer as $5\sqrt{2}$ losing the accuracy mark. A very small number of students did not divide their *EC* by 2 and attempted to use Pythagoras Theorem in a non-right angle triangle.

Part (d)

It is also worth noting in this part of the question that students need to round work as directed, but then use full calculator accuracy, or revert back to surds when using those values in later calculations. In this particular part, many students lost the final mark because they used a rounded value of 9.55 cm for the length *EA* and achieved an answer of 70.5º, when the correct answer was 70.4º. Some students needlessly used complicated methods (sine rule, cosine rule) with varying degrees of success, when a simple right angle triangle was all that was required following through their *AE* and the height of the pyramid.

Part (e)

This was generally the most demanding part of the question, mainly because unsuccessful students were attempting to work with the incorrect angle/triangle. Many simply added the answer to part (d) to angle *DEI*, achieving a maximum of 2 marks in this part, and many attempted to find angle *AEI.*

On a general note, centres should encourage their students to draw simple triangles with the angles and lengths they are seeking to find. Those students who used correct clear sketches were nearly fully successful in every case, whereas those who did not use any diagrams were far less so.

Grade Boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:
http://www.edexcel.com/iwantto/Pages/grade-boundaries.aspx

Pearson Education Limited. Registered company number 872828
with its registered office at Edinburgh Gate, Harlow, Essex CM20 2JE