# Examiners' Report

# Principal Examiner Feedback

January 2018

Pearson Edexcel International GCSE

in Further Pure Mathematics (4PM0)

Paper 02

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## PE Report on 4PM0 January 2018

### Introduction

Candidates found paper 1 somewhat more difficult than paper 2. The reasons for this are not immediately apparent though many experienced problems with the first three questions on paper 1. This was surprising in the case of questions 1 and 2 as these tested topics which are also on the various GCSE/iGCSE specifications. Question 3 was a topic that always causes all but the best candidates problems. The recent timetable alteration, which gives a gap of over a week rather than a couple of days between the two papers, may have contributed as candidates had extra time for further revision and could concentrate on the topics which had not been tested on paper 1.

Candidates are becoming more confident in working with radians although some still prefer degrees and fail to change their answers into radians. Rounding seems to be less of an issue too although there are still cases of candidates either failing to round at all or truncating instead of rounding. Inequalities gave problems with either the incorrect inequality used through including (or excluding) 0 or reversing the inequality sign.

### Paper 2

### Question 1

Part (a) was a seemingly straightforward task but many slipped up on this. Errors included incorrect formula, most often $r^2\theta$, sometimes $\frac{1}{2}r\theta$, sometimes $\pi$ in the formula. Some candidates worked in degrees which was only acceptable if the method was completed by changing the answer to radians. Part (b) could be worked with an angle in radians or degrees so many candidates could achieve 2 marks here.

### Question 2

Most got part (a) correct with a few missing out brackets and getting $\frac{n}{2}(10+3n-1)$. In part(b) many did not use their answer from part (a) and started again but the main confusion was over the number of terms in the series with answers such as $\frac{20}{2}(32+62)$, $\frac{10}{2}(64+30)$ or $\frac{20}{2}(64+57)$ being seen.

### Question 3

Very few candidates achieved more than one mark here as they failed to realise that when a region is revolved about the $y$-axis, integration wrt $y$ is required. The majority also failed to take account of the cylinder that was missing from the volume of required. Many candidates found the coordinates of the points of intersection of the curve with the $x$-axis and used these as limits. However, nearly all responses used a correct volume formula including π, albeit for a volume of revolution about the $x$-axis, so scoring no marks here.

**Question 4**

In part(a) most used the discriminant but some only gave the positive answer or used incorrect inequalities and many gave the inside region as their answer. Some found the critical values but gave no regions. Most did part(b) correctly with the usual errors being to miss out $\pm 6$ or 0 or to only give positive values.

**Question 5**

This question was generally well attempted with most candidates obtaining some credit from the first three marks as they could apply the product rule efficiently and many continued to pick up credit for the second derivative. A few used the product rule correctly for the first derivative but then failed to use it again for the second. Very few attempted the alternative method for the last two marks; most substituted $y$ and their derivatives into $y'' - 2y' + y$.

**Question 6**

This question was found to be easier than other vector questions set in recent years. Most did part (a) correctly with a few giving **a** – **b** or **a** + **b**. Part(b) was found to be quite hard with answers such as $\frac{3}{4}\mathbf{a} + \frac{1}{2}\overrightarrow{AB}$ appearing . Part (c)(i) was usually correct on follow through while part (c)(ii)was found to be easier than part(b). Many did not know what to do having reached the end of part (c).

**Question 7**

Part (i) had a wide spectrum of responses from efficient and compact correct solutions to much work worth little (or no) credit. Often candidates changed the left hand side as powers of 2 but changed to powers of 4 on the right hand side. Most correct answers came from the method outlined on the mark scheme with powers of 2. A few attempted powers of 4 throughout but most of these came unstuck on the way.

Part (ii) was perhaps perceived as more demanding than (i). However more candidates made progress here and often felt more comfortable with this in comparison with (i). Most scored at least one of the opening 3 method marks. There were a significant number of responses that scored 5 or more marks. The log base 4 and log base $x$ quadratics were represented in a similar proportion of responses each. Many achieved the answer 4 and a lot achieved 2.52 or better, scoring 6 or 7 marks respectively

**Question 8**

Most knew what to do in part (a) but often used an incorrect formula such as $V = \frac{1}{3}\pi r^2 h$.

Some clearly tried to work back from the given answer, gaining no marks. Most did part (b) well with the usual errors being to only give a value for $r$ and not $S$, or to give $S$ as 277 or

277.5. Most calculated the second derivative for part(c) but many did not give a valid conclusion such as "$\frac{d^2S}{dx^2} > 0$ means that $S$ is a minimum".

**Question 9**

Most candidates used the factorisation route in part (a), with a high success rate. A few tried the factor theorem and the majority of those were unsuccessful. Those who felt they had failed with this part of the question rarely attempted any further work.

Part (b) was generally very well done. The vast majority used the main approach in the mark scheme. As a result, many candidates picked up 10/10 for (a) and (b) although some, having found a correct equation for the tangent forgot to check that it passed through $(-2, 0)$.

Part (c) was a big discriminator. Very few who attempted meaningful work used the splitting the area method, most attempted line – curve approach which, when they began correctly, often led to 4/4. Only a minority of those who split the area could cope correctly with the signs required for the separate parts. Many candidates simply ignored the effect the line would have on the region and didn't consider it in their solution.

**Question 10**

Many only scored the first 6 marks in this question as finding the values of $m$ and $n$ was beyond most candidates. Parts (a) and (b) were rarely wrong.

In part (c) of those who reached the equation connecting $m$ and $n$ and then knew to use Pythagoras' Theorem often found that the algebra become too difficult and many finished up with a 3 term quadratic with irrational roots.

Most who attempted part (d) got the correct length for $AB$ but then tried to fiddle the length of $RQ$ to be the same. Fewer found the gradients of the two lines. Very few gave $AB$ and $RQ$ as vectors and so could do both parts together. Many omitted part (e) as they had no values for $m$ and $n$, The more common method here was to use the "determinant" method but often with only four columns instead of five. Very few used the "area of a parallelogram" method.

**Question 11**

Candidates were confident and accurate in their working for parts (a) to (c). They showed methods clearly and worked accurately to gain all the marks available in most cases. Candidates also seemed confident in their use of surds but inevitably some had incorrect expressions which they followed with the given answer.

In part (d), few candidates were able to identify the correct angle required. Despite much work done, which displayed their obvious confidence with trigonometry and Pythagoras' Theorem, selecting the correct angle prevented them from gaining marks. Those who were able to identify the angle were able to find the lengths required first before finding the solution. A few recognised the symmetry of the shape to simplify their work to get the correct angle.