Examiners' Report/ Principal Examiner Feedback

Summer 2010

GCE

Further Pure Mathematics FP3 (6669)

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Introduction

Generally the paper was found to be very accessible with marks available to candidates across the whole ability range. Particular observations from examiners did identify poor presentation in some cases as well as handwriting that was difficult to read. Equally, many candidates presented their work carefully and it was possible to follow their line of thought.

Report on individual questions

Question 1

This proved to be a good starter question for the vast majority of candidates. The most common cause for a loss of marks was to leave $\pm$ with both of their values of '*a*' and '*b*' despite being told they were both positive. Most used the correct formula although there were a significant number of occurrences of $a^2 = b^2(1-e^2)$.

Question 2

The majority of candidates knew that completing the square was the required first step and that 'arctan' was the required form. There were some attempts using various substitutions such as $x+2=3\sinh u$ but in cases like these candidates made little progress. Generally this question was answered well with many fully correct solutions.

Question 3

In part (a) the majority of candidates could successfully substitute for sinh*x* into the right hand side and obtain the exponential form of cosh2*x*. Those who started from the left hand side were also usually successful. A significant number of candidates proved the result using hyperbolic identities and could gain no marks. This was presumably where they failed to read the question.

In (b) those candidates who used the result from (a) to form a quadratic in sinh*x* usually gained all or most of the marks. There were occasional errors in factorising but generally those who went on to use the logarithmic form of sinh*x* did well. Candidates who attempted to find *x* by resorting to the exponential form of sinh*x* rather than use the result in the formula book, usually lost one mark by leaving $\pm$ in their answers. There were some attempts seen at this part of the question purely in terms of exponentials rather than using the clue from (a). Such attempts rarely made any progress as candidates were unable to deal with the resulting quartic in e^x.

Question 4

In (a) most candidates knew to integrate by parts but the most frequent error was to differentiate $\left(a-x\right)^n$ as $n\left(a-x\right)^{n-1}$ rather than $-n\left(a-x\right)^{n-1}$. There was also some unclear work as the resulting sign errors were attempted to be accounted for. It was difficult at times to tell if the candidate had achieved the printed result legitimately. Candidates are always advised to write down enough working when they are asked to prove a result and in this case, it would have helped if the candidates had shown the working involved as the limits were substituted.
Part (b) of the question was not answered well. Many candidates failed to apply the reduction formula correctly in finding I_2. A common incorrect application was $I_2 = na^{n-1} - n(n-1)I_1$ and even those applying the result correctly struggled to establish what I_0 was.

Question 5

There were so many different approaches to both parts of this question. There were some correct, elegant and concise solutions and also some poorly presented and difficult to follow attempts that took 2 or 3 pages. The most common approach was to differentiate the given relationship although there were many attempts at some manipulation first, such as $\sqrt{y} = ar\cosh 3x$ or $\cosh\left(\sqrt{y}\right) = 3x$ and then to use implicit differentiation. These approaches were also largely successful. A small minority chose to convert arcosh3x to its logarithmic form before differentiating. The manipulation required defeated most but some persevered and commendably emerged with the required result.

In part (b) the neatest solution was to differentiate the result in (a) implicitly and candidates could often reach the result in a line or two. The main other approaches involved either the product or quotient rule and were often completed successfully too.

Question 6

Parts (a) and (b) of this question caused few problems.
In part (c) there were many correct solutions and generally, candidates could obtain the correct characteristic equation and deal with the resulting algebra, to show that there were only two eigenvalues.

Part (d) was less well answered and it appeared that giving the Cartesian form of the line caused some confusion. Most candidates knew that they had to multiply something by the matrix but were not sure what. Those who used the parametric form of the line usually proceeded to the correct answer, although there were a significant number who left the transformed line in parametric form.

Question 7

The first two parts of this question were standard demands and in (a) the majority could obtain a normal vector (with the odd slip) and proceed to the equation of the plane. In (b) the majority of candidates used the method in the marksheme although there were some acceptable attempts at showing that the given point was on the line and in the plane.

Part (c) proved to be the hardest part of the paper for most candidates. There were many ways of finding the distance required including scalar products, vector products, trigonometry and similar triangles but a correct strategy defeated many candidates. A good diagram here might have helped clarify their thoughts. Some candidates often quoted inappropriate formulae such as the perpendicular distance between two skew lines.

Question 8

Part (a) was standard work and many could at least get to a correct form of the tangent although a significant number were unable to legitimately obtain the printed answer. Most used the chain rule to find the gradient but there were a few instances of implicit and explicit differentiation.

Completely correct answers to part (b) were relatively rare. However, many candidates could at least make a start and obtained the equation of l_2 and sometimes the coordinates of the intersection of the two lines. The most successful and elegant solutions came from candidates eliminating t and proceeding to obtain the correct locus for Q.

Grade Boundary Statistics

The table below give the lowest raw marks for the award of the stated uniform marks (UMS).

Module		Grade	A*	A	B	C	D	E
		Uniform marks	90	80	70	60	50	40
AS	6663 Core Mathematics C1			59	52	45	38	31
AS	6664 Core Mathematics C2			62	54	46	38	30
AS	6667 Further Pure Mathematics FP1			62	55	48	41	34
AS	6677 Mechanics M1			61	53	45	37	29
AS	6683 Statistics S1			55	48	41	35	29
AS	6689 Decision Maths D1			61	55	49	43	38
A2	6665 Core Mathematics C3		68	62	55	48	41	34
A2	6666 Core Mathematics C4		67	60	52	44	37	30
A2	6668 Further Pure Mathematics FP2		67	60	53	46	39	33
A2	6669 Further Pure Mathematics FP3		68	62	55	48	41	34
A2	6678 Mechanics M2		68	61	54	47	40	34
A2	6679 Mechanics M3		69	63	56	50	44	38
A2	6680 Mechanics M4		67	60	52	44	36	29
A2	6681 Mechanics M5		60	52	44	37	30	23
A2	6684 Statistics S2		68	62	54	46	38	31
A2	6691 Statistics S3		68	62	53	44	36	28
A2	6686 Statistics S4		68	62	54	46	38	30
A2	6690 Decision Maths D2		68	61	52	44	36	28

Grade A*

Grade A* is awarded at A level, but not AS to candidates cashing in from this Summer.

- For candidates cashing in for GCE Mathematics (9371), grade A* will be awarded to candidates who obtain an A grade overall (480 UMS or more) *and* 180 UMS or more on the total of their C3 (6665) and C4 (6666) units.
- For candidates cashing in for GCE Further Mathematics (9372), grade A* will be awarded to candidates who obtain an A grade overall (480 UMS or more) *and* 270 UMS or more on the total of their best three A2 units.
- For candidates cashing in for GCE Pure Mathematics (9373), grade A* will be awarded to candidates who obtain an A grade overall (480 UMS or more) *and* 270 UMS or more on the total of their A2 units.
- For candidates cashing in for GCE Further Mathematics (Additional) (9374), grade A* will be awarded to candidates who obtain an A grade overall (480 UMS or more) *and* 270 UMS or more on the total of their best three A2 units.

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