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Registered address: AQA, Devas Street, Manchester M15 6EX *Dr Michael Cresswell Director General.*

General

Most of the candidates attempted all of the questions and in the order in which they were set. The quality of the mathematics varied considerably. There were some very well presented and concise correct solutions, in contrast to some other solutions that, although correct, were unnecessarily long in the working presented. This appeared to result in a time penalty for some candidates who seemed to spend an unnecessarily long amount of time in some of the earlier questions and thus appeared to be a little rushed towards the end of the examination.

There were some candidates who appeared ill-prepared for the examination; either they were not committed to trying to achieve well, or they had not adequately covered some of the topics. In contrast, many candidates demonstrated a thorough knowledge of the specification, gaining high marks on all questions. Some candidates across the whole grade range lost marks through not presenting sufficient working to make it clear where their answers had come from.

Question 1

This question, surprisingly, was not done well. Part (a) was intended as a straight forward partial fractions question, although some candidates did not see it that way. Many apparently guessed at the value of k, 3 being a common wrong answer. Some candidates replaced the k with the conventional A and B, and then demonstrated that $A = B$. Many of these, having arrived correctly at $6A = 3$, then deduced that $A = 2$. This 2, or other values, often became $\frac{1}{2}$ in part (b) without any supporting evidence and so lost further marks. Very few candidates in this situation seemed to have checked for a mistake, despite the $\frac{1}{2}$ being given in part (b).

In part (b), most candidates picked up a mark for recognising a log integral, although the coefficients were often incorrect, particularly the sign in integrating the $\frac{1}{3-x}$ term. However, most candidates could evaluate their log expression correctly using the laws of logs.

Question 2

Most candidates scored well on this question although there were some unnecessarily long solutions.

In part (a)(i), most candidates substituted $x = \frac{1}{2}$, correctly into the polynomial, but many lost a mark by not demonstrating that the result came to zero by showing the required arithmetic and/or by not interpreting the result as demonstrating that $(2x - 1)$ is a factor. For part (a)(ii), many candidates did an algebraic long division or multiplied out the given expression and equated the coefficients. Both techniques lead to the correct answer, but the value of q could be written down by inspection and the value of p should follow in a couple of lines of working. This is where many candidates spent an unnecessarily long time in their working. Most candidates answered part (a)(iii) correctly, although, surprisingly, the common error was to just omit the 4 when factorising the numerator.

Part (b) was attempted via a variety of methods. The most concise of these was to divide $2x^2$ by $x^2 + 2x - 15$ and interpret the remainder. Many candidates who took the more conventional partial fractions approach had not realised that $A = 2$ was immediate and so they set up simultaneous equations in three unknowns, often making a mistake in their solution.

Those who substituted suitable values of x were usually more successful. Some candidates wrote the right-hand side as $\frac{B}{x+5}+\frac{C}{x-3}$ with some then going on to find the values of B and C correctly and recombining their fractions to get the required form. However, this is an unnecessarily long route to the solution, and mistakes were often made along the way, not least in the opening line when candidates were attempting to multiply through by the denominator.

Question 3

Part (a) was generally done well by candidates, with very few errors seen in the binomial coefficients. Part (b) was similarly started well, and candidates either realised that they were to use their result from part (a) or simply started again. Errors were commonly made in evaluating the coefficient of the x^2 term, often omitting to square $\frac{3}{2}$. Some candidates were also careless with the sign. Some candidates attempted to write down a result for part (b) with no working shown, so if they were incorrect they usually scored no marks.

The responses to part (c) were more varied: some candidates showed little knowledge of how to manipulate the expression, while those who knew that they were aiming to get a multiple of the result from part (b) often failed to obtain the required multiple of $\frac{1}{2}$, many obtaining $\frac{1}{4}$, 2 or 4 instead.

Question 4

This question fell into two clear parts: most candidates gained full, or nearly full, marks on part (a), but most were only able to score the first mark in part (b). In part (a)(i), most wrote down the value of A correctly. In part (a)(ii), most candidates obtained an expression for k from which it could be evaluated and so gained the marks. Those who did not give an explicit expression for k lost a mark, and those who just verified that $20k^{60} \approx 2000$ scored no marks. Similarly, candidates were mostly correct in part (a)(iii), but a few made an error in $2008 - 1885$, and some did not round to the nearest 1000.

In part (b), many candidates showed that they had understood the question by setting up the correct equation, but few of those were then able to solve it correctly. The common problem was that, having written down an equation of the form $ak^t = bm^t$, candidates wrote the corresponding log equation as $t\log(ak) = t\log(bm)$ and so, confused by their t apparently cancelling, abandoned their answer. Those who wrote the log equation correctly usually went on to complete the question correctly. The other common mistake was a misunderstanding of the question in which the expression for Q was equated to the result from part (a)(iii); this scored no marks.

Question 5

Most candidates were correct in part (a)(i), with very few arithmetic errors seen. Similarly, the differentiation required for part (a)(ii) was usually done correctly, with the common error being $\frac{\mathrm{d}}{\mathrm{d}t}\left(\frac{1}{t^2}\right) = -\frac{1}{t}$. Most candidates used the chain rule correctly, although some poor algebra was seen in inverting $\frac{\mathrm{d}x}{\mathrm{d}t}$, with $\frac{1}{2-2t^{-3}} = \frac{1}{2} - \frac{1}{2t^{-3}}$ being seen quite often; if candidates had not made it clear that this is what they believed the reciprocal to be, they were denied the chain rule method mark. However, most candidates scored the mark for finding a tangent, although a few found an equation for the normal.

Those who chose to find c in $y = mx + c$ instead of using $(y+3) = m_T(x-5)$ were prone to error. Part (b) was much less successful for most candidates. Despite the required form of the answer being given, few candidates chose to find $(x+y)$ and $(x-y)$ in terms of t and apply the result to the given equation. Of those that did do this, there were many errors in the squaring and multiplication. Some candidates tried to find t in terms of x and y , often getting lost algebraically in their attempt and abandoning it; some did manage to complete this method successfully, but it was time consuming. Others simply did not attempt this part of the question.

Question 6

Many candidates showed that they are competent with implicit differentiation and scored full marks here or at least some of the marks. The most common error was for candidates not to differentiate the 4 on the right-hand side, leaving it as 4, having got the left-hand side correct. The derivative of $2y^2$ was usually correct, but errors such as an extra x or y or a coefficient error crept into the derivative of $3xy$.

Question 7

There was a full range of marks seen in response to this question. Some candidates were able to complete the whole question successfully, including finding all four solutions to the particularly demanding part (a)(ii). Other candidates just scored 1 or 2 marks, from part (a)(i) and/or a correct identity in part (b)(i). Most candidates knew what to do for part (a)(i) and got the value of R correct, although a few got $\sqrt{80}$. Many, however, had $\tan\alpha = \dfrac{6}{8}$. Most also knew that they were to use the expression from part (a)(i) in part (a)(ii), although a few attempted to manipulate the given expression with double angle formulae and usually abandoned the attempt. Of those using the expected approach, most scored 2 marks, some getting a third solution as well but not many finding all four. An error which was sometimes seen was to replace $2x + 53.1$ with $\theta + 106.2$.

Part (b) was generally more successful, with most candidates scoring a mark for at least one of the identities for $\sin 2x$ or $\cos 2x$ correct and many going on to use these convincingly in obtaining the requested result. Others made errors in signs and coefficients and fudged the result rather than looking for their errors. Some candidates, however, did seek an error and attempted to overwrite their work rather than starting again, often making it difficult to read what they had actually intended as their answer.

Most candidates who attempted part (b)(ii) scored at least 2 marks — the starting equation and the solution $x = 45$ — but many also obtained all four solutions. Those candidates who ignored the hence and again expanded the left-hand side were largely unable to complete the question successfully, although some did succeed via this route.

Question 8

Some candidates gave a very concise and correct solution to this differential equation. Most candidates made some attempt to separate the variables and integrate, although it was not always clear that they had done this, with a stray x sometimes remaining on the left hand side. There were many errors in the integration, the common ones being $\ln y$, resulting from poor algebra in separation, and a coefficient error in the integral of $\cos 3x$, the 3 itself often being dropped and the integral given as $\sin x$.

Most candidates did include an arbitrary constant and tried to find it using the given conditions, although a few just substituted these into their solution without a $+ C$, or directly into the differential equation, and just produced nonsense.

Question 9

This question also separated clearly into two parts, with most candidates scoring well in part (a) and part (b)(i) but few making substantial progress in part (b)(ii).

Part (a)(i) was usually correct but with the occasional sign error or the position vectors the wrong way round. In part (a)(ii), some candidates chose to give one of the position vectors as their direction vector.

There were several approaches to part (b)(i), most of which were acceptable, the important thing here being to give a convincing argument that the given point does lie on the line. This was best done by finding the value of μ from one component equation and showing that it satisfies the others.

Candidates whose working was unclear, with $\mu = -3$ appearing somewhere within it, usually only scored 1 mark. Candidates should always state which vectors they are working with in terms of letters, such as $\overrightarrow{AB}$, rather than giving numerical values which might not be recognisable. This was particularly the case in part (b)(ii), where it often was not clear what candidates were trying to do as they had not identified the vectors with which they were working. However, it was apparent that, of those who did make a recognisable start, some tried to work with vector $\overrightarrow{OQ}$ instead of $\overrightarrow{PQ}$ and then often went on to take the scalar product with the wrong vector. Some candidates tried to work with a vector $\begin{bmatrix} x \\ y \\ z \end{bmatrix}$, again often without saying what it represented, and, although a few eventually expressed x, y and z in terms of λ, by then many had made a mistake and it became difficult to follow how they had got to their incorrect result. The use of the parametric equation of the line to solve a problem of this nature appeared not to be well known.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the **Results statistics** page of the AQA Website.