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General

Marks were scored over the full range for this paper, with some outstanding performances, where candidates showed sound knowledge and skills across the whole specification. These candidates contrasted with others who had apparently little chance of success, as their work demonstrated little knowledge of the specification. Most candidates attempted all the questions, although weaker candidates often left several out. Most candidates managed the time allowed well, although there was evidence of candidates trying to do Question 8 too quickly, leading to careless errors.

Most candidates presented their work clearly, although there were those who were seemingly unable to do a simple deletion when they want to change their solution and just produced an illegible mess. Those parts of the paper found to be demanding by most candidates were Question 2(a), Question 3(c) and Question 6(c). The completion of Question 7(c) also caused problems and very few candidates successfully completed Question 8.

In contrast Question 1, Question 4 and Question 5 were done well, although many candidates misinterpreted their result in Question 4. The trigonometry in Question 6(a) and (b) was also generally done well, with candidates showing good knowledge and competence in the skills required.

Question 1

Part (a) was answered very well. Almost all candidates used the Remainder Theorem as requested, so gained both marks. A few did not heed the question and used long division which earned no marks. Another error seen occasionally was to assume, after -5 was found, that the remainder was $+5$. This was penalised.

In part (b) many were successful here too, particularly those who used long division which was the most efficient way to solve the problem. Those candidates who chose a method based on equating coefficients often made algebraic errors. Some candidates wrote $f(x) = (ax^2+bx+c)(3x-1) + c$ which led to confusion and few proved the first constant c to be zero. It seems few candidates associated the remainder from part (a) with the value of c in part (b), it often being correct in (a) but not in (b).

Question 2

In part (a) almost all candidates obtained $\mathrm{d}x/\mathrm{d}t = -1/t^2$. However, most candidates could not handle the fraction and indices correctly when finding $\mathrm{d}y/\mathrm{d}t$. The most common mistake was to state $\mathrm{d}y/\mathrm{d}t = 1-2/t^2$. Sometimes this "became" $1-1/2t^2$ but, by then, the mark had been lost. The t^2 sometimes migrated on to the numerator. Almost all candidates knew they needed to divide $\mathrm{d}y/\mathrm{d}t$ by $\mathrm{d}x/\mathrm{d}t$ to get $\mathrm{d}y/\mathrm{d}x$. Full marks were awarded for an unsimplified form of $\mathrm{d}y/\mathrm{d}x$.

A few candidates confused differentiation and integration giving the "derivatives" in terms of $\ln t$. Some candidates proceeded by first attempting to find the cartesian equation, which was valid if the result was given in terms of t. Surprisingly many of these candidates then didn't make much progress in part (c). In part (b) the majority of candidates found the equation of the normal, and not the tangent, and the relationship between the gradients was well known.

Very few found an incorrect y value at $t = 1$. Most errors were due to an incorrect $\mathrm{d}y/\mathrm{d}x$ from part (a), but some credit was given for method and 3 marks were still available. These were earned by most. Some candidates had an expression for $\mathrm{d}y/\mathrm{d}t$ in which the t's cancelled, yet it didn't apparently occur to them that an error had been made. Most candidates began by writing the cartesian equation in an unsimplified form in part (c). Many were defeated by the fraction in the denominator and so could not cope with $1/(2(1/x))$. Errors were often made when attempting to multiply through by $2x$. Some candidates chose to substitute for t in the given equation, but not all could deal with the algebra involved; $k=1$ or $k=-2$ were common wrong conclusions. Pleasingly most candidates who did attempt this question made an algebraic approach and very few just substituted $x=1$ and $y=3/2$ to find the value of *k,* which gained no credit.

Question 3

The unsimplified form of the binomial expansion in part (a) was usually correct. However in attempting to simpifly their expressions many candidates made sign or coefficient errors, with answers such as $1-x+x^2$ or $1+x+2x^2$. There were a pleasing number of correct expansions however. In part (b)(i) virtually all candidates showed they knew how to find partial fractions. Those who substituted $x = 1$ and $x = 2/3$ usually found the values of A and B correctly, with a few sign errors seen. Substitution of other values of x, or using simultaneous equations tended to be less successful.

There were many complete correct solutions to part (b)(ii) and most candidates demonstrated they knew in principle how to find the expansion. Many, though, made a mistake somewhere in their working. The most common error lay in the expansion of $(2-3x)^{-1}$. Many forgot to put 2 to the power –1 so the expansion of $(1-3x/2)^{-1}$ was often multiplied by 6 instead of $3/2$. Also some expanded $(1-3x)^{-1}$ instead of $(1-3x/2)^{-1}$. Some candidates forgot to multiply their separate expansions by their values of A and B or to add them together to complete the expansion.

The negative sign in $A=-2$ was often overlooked when combining the two expansions. Some candidates used the method of finding the two expansions and then finding the product of $(3x-1)$ and two binomial expansions. This nearly always led to errors. Candidates should realise that there is often a link between parts of a question. The use of the partial fractions led to a more sensible method with far less algebra involved.

The majority of candidates scored no marks in part (c). Answers such as $x > 2/3$, $1 < x < 2/3$ abounded and there was confusion between $2/3$ and $3/2$. Many candidates apparently just made a guess, with x not equal to 1 or $2/3$ being a common one. Many gave an inequality in which a modulus was less than a negative number.

Question 4

Part (a)(i) was answered correctly by virtually all candidates, and attachment the £ sign to the value of A was condoned.

Most candidates earned 2 marks in part (a)(ii), either for giving an answer for k to a greater accuracy than that stated in the question or, more commonly, for isolating k in an unsimplified form. Many variations on a correct expression were seen, but with most candidates giving the simplest; the 36^{th} root of $7000/\text{A}$. However, those who did use logarithms usually did it correctly.

In part (b), although most candidates could set up and solve the index equation correctly, the interpretation of the solution showed a common lack of understanding. Although most candidates correctly calculated t to be 56.89, almost all assumed the answer to be 56 and not 57, thus losing the final mark. It seemed that many thought you always round down in this type of question and didn't read the context carefully. Relatively few candidates used a trial and improvement approach, but of those who did many actually demonstrated that the required answer was indeed 57.

Question 5

It was pleasing to see complete correct solutions from a large number of candidates. Clearly implicit differentiation of equations such as this is a topic that that had been learnt well.
It was a pity that many candidates wasted time in rearranging the equation in x,y and $\mathrm{d}y/\mathrm{d}x$ to isolate $\mathrm{d}y/\mathrm{d}x$. A quicker method was to substitute $x = 1$ and $y = 3$ immediately after

differentiating. A few candidates simply wrote $8x\mathrm{d}x + 2y\mathrm{d}y = 3y\mathrm{d}x + 3x\mathrm{d}y$ or similar, which is incorrect notation and scored no marks.

The common errors were to leave the 4 in the differentiated expression, or not to differentiate the product term correctly, attaching $\mathrm{d}y/\mathrm{d}x$ to the wrong term or having just one term. The few candidates who chose to rearrange the given equation and solve it for y before differentiating generally made little further progress, although such methods would be valid if carried out correctly.

Question 6

There were many correct answers to part (a)(i). Rather than using $\cos 2x = 2\cos^2 x - 1$ directly, some answers were obtained from $\cos 2x = \cos^2 x - \sin^2 x = \cos^2 x - (1 - \cos^2 x)$. This sometimes led to sign errors. Other errors were the use of $\cos^2 x - 1$ or failure to multiply the -1 by 3.

In part (a)(ii) most candidates factorised successfully but then wasted time solving for x. The question did not ask for solutions. Those who used the quadratic formula often made mistakes.

Candidates generally demonstrated that they had both the knowledge and appropriate skill to answer part (b)(i) successfully and there was a pleasing number of correct solutions. The most common error was to write $\tan\alpha = 7/3$ instead of $3/7$.

In part (b)(ii) not all candidates read the request to give answers correct to the nearest $0.1°$. These candidates were only penalised once. A common incorrect answer was 171.5 from $180 - 8.5$ instead of $180 - 31.7 - 23.2$. Clearly there was confusion when dealing with the obtuse angle. Some candidates changed $\sin(\theta + \alpha)$ to $\sin(\theta - \alpha)$, so could not complete successfully.

In part (c)(i) most candidates did not realise the need to use exact values and they used a calculator to find angle β and then its cosine. This gained no credit. Those who drew a diagram faired better as they often went on to use Pythagoras` theorem in an appropriate form, which showed where the value of $1/3$ came from.

Marks could only be earned in part (c)(ii) if $\sin 2\beta = 2\sin\beta\cos\beta$ was seen. Some candidates used calculators once more and did not give an exact answer. Some did realise that 0.44444 was $4/9$ but didn't gain any credit unless the double angle sine formula had been used. Many candidates made the mistake of apparently thinking $\sin 2\beta$ was $2\sin\beta$.

Question 7

Most candidates found the distance between A and B correctly in part (a), though some stopped once they had found the vector $\boldsymbol{AB}$ and so gained no credit. A few worked out $(4 + 3)^2 + (0 - 2)^2 + (1 + 5)^2$. In part (b) the majority obtained the correct value for λ but not all realised that, for a complete proof, all equations must be checked. Those who didn't give the value of λ explicitly could still gain full credit from a vector equation with the components of point B on the right hand side. Other rearrangements were penalised one mark.

The intended, and simplest, method in part (c) was to find the coordinates of C and then find the length BC. Most candidates showed they knew how to find the point of intersection of two lines with many finding μ and/or λ correctly, although some made errors. Many did check they had found the intersection point by demonstrating a consistent solution, although this wasn't required. Surprisingly most of those who discovered they had made a mistake in solving the simultaneous equations didn't go back and look for it. Many candidates stopped having found the coordinates of C, apparently not connecting the request for the distance AB from part (a) with this part of the question. There were various approaches made by those who did continue.

Those who found the distances BC and AC usually completed the question correctly and efficiently. Other candidates chose to calculate angles, and sometimes there was a great deal of working often containing errors, and so no valid conclusion could be reached. Some candidates found the angles between OA, OB and OC rather than attempting to find angles in the triangle ABC. However, a few candidates did demonstrate the isosceles triangle successfully by finding two of the angles correctly, although this was a time consuming method. Those few who chose the method which did not involve finding C i.e. using the direction vectors of the given lines, were rarely successful.

Question 8

Not all candidates appeared to have time to attempt this question and often solutions appeared rushed rather than thought out. However many of those who did attempt the question solved the differential equation in part (a) correctly. Most candidates separated the variables correctly using conventional notation, but then there were often errors in the integration. Common ones included the omission of a constant, incorrect integration of both x and $\cos 2t$ or use of degrees instead of radians when evaluating the constant. Some candidates just substituted the given conditions straight into the differential equation, producing nonsense.

In part (b)(i) some candidates substituted $\pi/4$ into $\mathrm{d}x/\mathrm{d}t$ instead of their solution from part (a). Another error was to substitute $13\pi/4$ for t. There were, however, some correct solutions showing understanding and most candidates who attempted this did show they intended to work with $\sin 26$, even if they were trying to use it in an incorrect expression or with their calculator in degrees. Most gave answers to the accuracy required by the question.

In part (b)(ii) those who had successfully solved the differential equation in part (a) usually earned the method mark here. However correct answers were rare, as many candidates arrived correctly at a negative value for $2t$, and just ignored the negative sign, rather than considering the next positive solution. Another common error lay in using the wrong calculator mode once more.

Mark Ranges and Award of Grades

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